

A Comparative Analysis of Farming System and Agrarian System: Some Theoretical Considerations

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INTRODUCTION

This paper aims to highlight some similarities and differences between two approaches which are more and more commonly regarded as among the most promising in development research. One is popular among scholars, researchers and development workers of English speaking countries, and is known as the Farming System Approach. The other is more particularly used by French researchers and development workers. It is grounded on the concept of Agrarian Systems. While it would be useful to follow the historical development of those two approaches in their respective socio-political contexts which have conditioned their emergence, and to find out in which conditions they have reached the sphere of development, these tasks are left to more competent people. Although those approaches have been familiar to scientists and researchers for many years, their implementation in the field of rural development in the less developed countries is only in its first step.

Therefore, concepts and methodologies are still somewhat flexible; uncertainty among those who implement one approach is common as well as arguments among supporters of the two approaches.

This is one more reason for attempting to clarify the situation at a time when a close collaboration between development workers of different countries is more and more needed and remains quite difficult.

Though they seem to speak the same conceptual language they often misunderstand each other. As our Franco-Nepalese Cooperation Programme is facing such difficulties, my purpose here is to report some ideas resulting from two years of work amidst a research project on himalayan agrarian system¹ as well as 9 months of informal collaboration with Nepalese institutions where the concept of farming system is well known.²

The following lines are purely personal considerations based for the part concerning the Farming Systems on :

* Dr. Bergeret, an agriculturist, worked in Nepal during 1980s under Franco-Nepalese Cooperation Programme (FNCP).

- 1) A consortium for International Development Study, Farming Systems Research and Development, Guidelines for Developing countries:

W.W. Shaner
P.F. Philipp
W.R. Schmehl

West View Press/Boulder, Colorado, 1982.

- 2) A methodology for on-farm cropping systems research:

H.G. Zandstra
E.C. Price
S.A. Litsinger
R.A. Morris

The International Rice Research Institute (IRRI). Confusion between the two approaches often occurs because comparable research methods or even methodologies are implemented which rely on different concepts and aim at different strategies.

CONCEPTS AND STRATEGIES

The Farming Systems (FS) Approach

The F.S. Approach is based on the following premises:

- In most developing countries the objectives of National Policies are to help less favoured groups and to increase agricultural production.
- Those are two complementary aspects with several consequences in the field of development: they contribute to the self-sufficiency of the country, to the supply of the industry with local raw materials, to the improvement of external trade, to the maintenance of social peace and to the prevention of excessive out-migration from rural areas to urban ones.
- The national or regional policies, as well as the institutions dealing with development aim at reaching the farmers in order to increase their production. Simultaneous efforts in research, extension and development of various facilities (roads, credit etc.) focus on this goal.
- This goal is seldom reached because most farmers do not adopt modern technologies for several non-exclusive reasons:

The F.S. approach aims at studying the relationships among the management variables, the environment variables, and within both types. In that respect the Farming System is defined as: the complex arrangement of soil, water resources, crops, livestock, manpower and other resources of a particular environment, which are utilized by the family according to its own preferences, capabilities, and available techniques.

A F.S. contains several sub-systems, the limits and definitions of which can change from an author to other, but among which one often considers: i) the cropping

system³ and ii) the livestock system. Then the F.S. Approach consists in studying the sub-systems themselves as well as their interrelations.

Upto now one must admit that it is the cropping system which has been the most operational concept in the field of research towards development for every experimentation on livestock requires more time and means for less immediate and dramatic results.

Thus the F.S. approach has exceptionally been used in the field of Animal Husbandry Research.

The International Livestock Centre for Africa must be quoted as an institution specialized in the research on livestock system. So must the works on the relationships between agriculture and livestock in semi arid Africa:

Ref = Mc Cown
 R.L Ghaaland
 C. Dehaan

The interaction between cultivation and livestock production in semi arid Africa. In A.E. Hall, G.H. Cannel and H.W. Lanton (eds). Agriculture in semi arid environments. Ecology studies, Vol. 34. Springer Verlag, Berlin, Heidelberg, New York.

Though all those basic definitions meet a general consensus among the researchers who use the F.S. Approach, their application in precise Research and Development actions can be substantially different. So that one can speak of diverting tendencies.

The F.S. concept is sometimes taken in its broad sense, sometimes in its limited sense. The Cimmyt⁴ has developed a F.S. Approach in a limited sense since it only deals with F.S. which are expected to have broad scope for the improvement of wheat or maize cultivation.

Other researchers have developed a broader conception of F.S. and would not define any priority sector unless it is identified by the research itself.

As for the relative importance that should be given to the Management and Environment variables as well as to the fixation of their common limit great differences of appreciation can be found: the supporters of an "interventionist" approach will limit the number of environment parameters arguing that variables such as credit policy, availability of various facilities on a site, market organization, etc. can be altered by the joint pressure from farmers and the development workers on the government. The supporters of a more *Submissive* approach include such variables in the environment parameters, on which the farmers have no influence. They will focus on the management variables in order to optimize them under the constraint of a great number of environment

parameters among which one can find all the off-farm resources (credit, infrastructure, etc)

Other differences must be quoted as those between an *upstream* approach (some would say a technocratic one) and a *downstream* one. The *upstream* approach describes concrete situations of F.S. using sophisticated simulation models. These models depict the consequences that significant modifications of the environment could have on the F.S. (such models have been used in impact studies for large hydraulic projects). Among others, one can quote Hart's works (1979)⁵ who describes an F.S. in Central America as the aggregate of sub-systems among which he has identified the relationships, and sometimes quantified these relationships.

Hart's Model (1979)

Money	Agro eco-system type (1)
Materials	Agro eco-system type (2)
Energy	Agro eco-system type (N)
Information	
Socio-economic	
Sub-system	

Farming System (relationships have not been drawn)
 Agro eco-system = Cropping System + Livestock System

The *downstream* approach aims at the identification of bottlenecks in the prevalent systems and at their modification by short run limited actions. Both approaches must be considered as complementary.

As can be seen from the above examples the F.S. Approach is not a homogeneous theoretic corpus. The diversity of the institutions which use this approach and of the countries in which it is used are the sources of widely different conceptions.

It would be useful to undertake a census of the institutions using such an approach and of the countries where it is used to build a typology of the different tendencies as described above. The socio-political features which prevailed during the creation of the institutions as well as the political and socio-economical background of these countries interact in determining which type of research is implemented.

Nevertheless the basic share of common premises among these approaches is not questionable. And those common premises distinguish this approach from the Agrarian System Approach.

Agrarian System (A.S.) Approach

No attempt will be made to synthetize all the different aspects of the A.S. Approach which is subject to questions and arguments among those who use it. I shall stick to those elements which have been essential in the design of our works and investigations in our Research Project in Nepal.

The agronomists and other researchers of our team having worked in Nepal have made the rural development process the subject itself of their research. One premise of their work lies in the idea that rural development and more specifically the development of agriculture is affected by two factors: a) the *local conditions* of production; and b) the *surrounding conditions* of production.

So we are led to study the A.S. level as the intersection of these two levels of conditions. Let me be more specific. An agrarian system can be defined as "the arrangement in a *specific place* of the productions and techniques implemented by a *community* in order to meet its needs. The A.S. expresses the interaction between a bio-ecological system represented by the natural environment and a socio-cultural system through practices belonging to the pool of techniques available to the farmers.⁶"

So the purpose of the A. S. approach is to study the rural development process through its manifestations among communities in their environment. This makes a substantial difference with the F.S. Approach, for attention is simultaneously paid to the local and the surrounding conditions inside the A.S. and this opens new perspectives.

About the diffusion and the adoption of innovations

The A.S. Approach enables us to take into account:

- collective constraints to the diffusion of an innovation (e.g., cattle grazing as an obstacle to crop intensification).
- the particular conditions of a system in which an innovation will get some chance to be adopted (e.g., it is only after some collective constraints have disappeared and after individualism in agriculture has become the rule that certain types of systems become gradually market oriented and open to "modern techniques").

About the Origin of Modern Technlques

The A.S. Approach enables us to show which types of A.S. and inside them which types of farmers really benefit form modern techniques. In other words, who is left apart from the development process.

More Generally About the Impact of Development Policies Generated at the Central Level

The A.S. Approach enables us to show political divisions, economic dominations in the rural communities and thus to link those social structures with the ones which are different but sometimes "corresponding" of the central level where policy decisions are taken.

Besides, it enables us to follow from one end to the other, the complicated succession of elements linking institutional changes with technical changes, which is a fundamental topic in the field of rural development. Therefore, such arguments as those generated among the supporters of the F.S. Approach, can be solved easily:

- The distinction between Management and Environment as well as the uncertainty about their common limit lose relevance. The problem is not to decide *ex-ante* what one can change but to identify what needs to be changed (whether local or surrounding factors) in order to achieve given objectives.
- The strategy which aims at serving both the national long run objectives of the government and the short run interest of the farmers is paradoxical. Once you no longer consider the government as a monolithic block but you identify different socio-political groups sometimes corresponding with local ones the paradox is resolved.

One of the main interests of the F.S. Approach is its immediate orientation towards action. Agronomic trials and socio-economic studies aim at adapting the techniques available from more fundamental research in experimental farms so that as many farmers as possible adopt them.

The A.S. Approach aims at identifying which types of A.S. and inside them, which types of farmers are ready to adopt such modern techniques.

Then comes action which is related to the priorities identified by the development workers on the basis of A.S. Research results. Three main broad priorities can be considered which are somewhat exclusive.

- 1) Discover and experiment with new techniques in the research site itself in order to supplement current technological packages unsuccessfully extended through the area (if any).
- 2) Identify in which geographic area extension efforts should focus with respect to available techniques.
- 3) Determine which types of institution are more likely to support development actions specifically addressing the targeted communities.

Such are some differences of concepts and strategies between the two approaches. They are implemented through comparable methodologies which is a source of misunderstanding

METHODOLOGY

The F.S. Approach

Based on the above underlined concepts the F.S. Approach is systematic, multidisciplinary, problem and site oriented and participative. It is action-research aiming to transform production systems through the diffusion of modern techniques. This research has proved effective and operational in the field of cropping systems mainly, and follows a precise methodology.

The Cropping System (C.S.) research (as well as F. S. research in theory) usually follows four distinct phases:

- site selection and description:
- identification of innovations (new cropping systems in the case of C.S. Research).
- test of these innovations.
- extension of these innovations outside the sites.

Site Selection and Description

A research site can be selected if: it is representative of a widespread type of environment; it has great potentials for crop intensification; and its characteristics are favourable to the research management (accessibility, absence of political problems).

The site description must include:

- an identification of the types of lands according to water management (irrigated land, dry land) and quality of soil. Eighty percent of the area of the site should be covered by three or four types of lands.
- an identification of the crops, the cropping patterns and the cropping systems. The cropping patterns are classified according to the types of lands and the cropping systems can be described: whether through the cropping patterns they include, or through more sophisticated indicators assessing their performance (yields, crop intensity etc.).
- a description of the main factors determining those cropping patterns, whether it can be physical factors (climatic etc.) or factors linked with the F.S. resources (internal resources as manpower, cultivated area, number of animals etc. or external resources as infrastructure, proximity of markets, systems of tenure etc.).
- a description of farming systems types on the site.

Identification of Innovations (C.S.)

A cropping system can be considered as adapted to a site (or to a F.S.) if it fulfills the following conditions:

- biological adaptability, vis-a-vis the natural environment. Its performances should reach a reasonable level.
- technical adaptability vis-a-vis the internal and external resources of the farms. The cropping system should be operational.

economical adaptability. The return to inputs (cash, manpower, etc.) should be significantly higher than returns obtained through traditional cropping systems. Such cropping systems are identified through farmers' field trials. Their performance is compared to that of traditional cropping systems. The cropping systems are improved by incorporating sectoral technical innovations which are tested in so-called component technology trials. In the component technology trials sectoral innovations (improved varieties, various doses of fertilizers, improved practices for weeding etc.) are often tested on the same fields as the cropping patterns trials. Such trials are called *superimposed trials*.

In some few cases the *Component Technology Trials* are managed by the researchers themselves on separate fields. Such trials are called *Researcher Managed Trials*. The *Component Technology Trials* provide feedback to the research stations where the sectoral technical innovations are produced.

Test of Innovations

The new cropping systems are then tested in order to see if they fit into the pattern of adaptability criteria, as mentioned above. All measurements and results must fulfill the requirements of statistical validity.

All the inputs as well as the returns are monetarily evaluated because all the chosen sites are market oriented enough to justify the use of financial performance criteria. Cross return computation as well as marginal cost/benefit ratio are used to assess the performances of the tested cropping patterns.

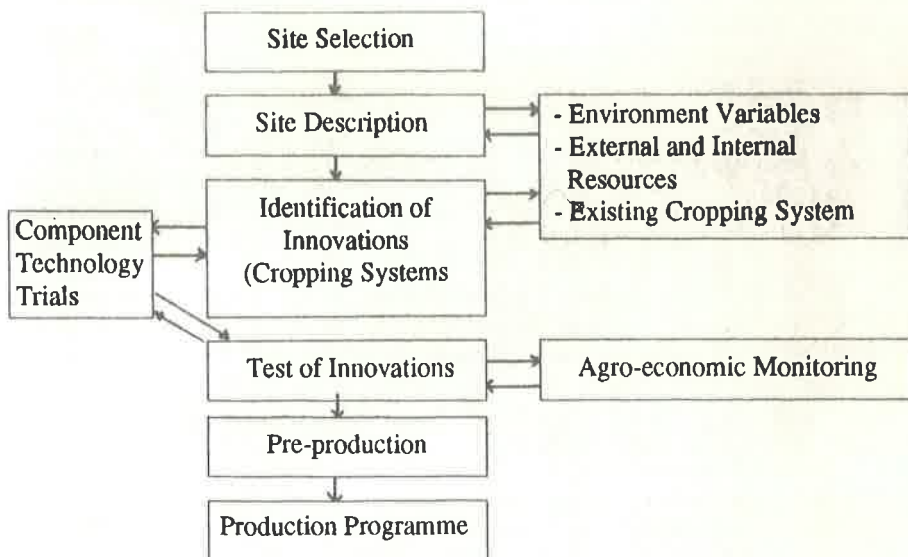
Extensions of Innovations Outside the Site:

The successful cropping systems as identified on the research sites are then tested on larger areas with similar environmental conditions. This step is called preproduction phase. During the preproduction phase, the researchers must take particular care because the practices identified on the research site must absolutely be applied.

The assessment of performance is simply based on yield assuming that the total value of the inputs engaged is the same as on the research site.

At least those cropping systems which have been successful during the preproduction phase are extended to large areas with similar environments.

The national extension and credit institutions then become the main agents for extending the successful cropping systems through production programmes. The following diagram summarises those different steps (From, A methodology for on-farm cropping systems research op cit.).



The Agrarian Systems Approach

If we consider the F.S. methodology as briefly described above we understand why there can be some confusion between the two approaches.

As the F.S. approach, the A.S. approach is systemic and multidisciplinary, and it requires a detailed description of the environment. It is also participative with trials implemented on farmers fields as well as socio-economic studies.

Nevertheless, when looking more in detail those similarities appear as superficial although they suffice to our will of closer collaboration with our colleagues from English speaking countries. The essential differences we have mentioned when dealing with concepts and strategies are left unchanged. They naturally induce differences in methodologies.

Primary Data

One difference is related to the collection of primary data, mainly in the field of socio-economics. The researchers of English speaking countries, who are very much concerned with efficiency and rapidity often use interviews as a data collection method which can be based on questionnaires.

Those interviews can be conducted in one passage or in several passages. They can be formal or occasional. They are expected to provide necessary information such as: cultivated area per type of crop, labor requirements, earnings and expenditures of farmers, /sometimes data on crop production (yields etc.) when time is lacking for them to be measured or when their measurements are not included in the research design.

As far as Nepal is concerned (and we suspect it is so in many other countries) we are convinced that such information obtained through such methods cannot be considered as reliable.

Whatever the reasons can be (questions based on criteria or physical units completely unknown by the farmers, reluctance of the farmers who often under-estimate their wealth, questions useful to the researchers but absolutely lacking interest for the farmers etc.). Our experience of the concrete conditions of any field research in the hills of Nepal indicates us that it is necessary to rely on observation of farmers behaviour rather than on interviews of farmers.

Thus, the primary data collection within our project in Nepal is mainly based on observations and measurements rather than on interviews although this method is compulsory for certain information such as historical features or when it is necessary to know about a farmer's personal advice | or memory.

Analysis and Processing of Primary Data

A second difference concerns the analysis of primary data. The supporters of the F.S. approach (and more generally most researchers from English speaking countries as well as several French scientists) think that the only means to come up with valid conclusions is to use statistical tools. Therefore, the results of on-farm trials are analysed through statistical methods (analysis of variance, regressions, correlations etc.). We certainly do not question the validity of such a method but we prefer to adopt a modest position in that respect.

Assuming that the extreme heterogeneity of the environment (physical or human) prevents us from controlling a factor (let alone a set of factors) we feel it is impossible to systematically apply *ex-ante* a type of experiment where one or several factors would vary as all other factors would remain constant, which is the type of experiment required for statistical analysis.

We prefer to begin with some trials which are designed *just to see*. Those trials are not statistically analyzed, but are expected to allow the formulation of hypothesis about the mechanisms of production (for instance about the main factors affecting the crop yields).

A more rigorous verification of those hypotheses only comes in a second step, when one is more likely to identify relevant factors to be experimented and analysed. For example in Salme, a set of agronomic trials had been designed "just to see" the impact of chemical fertilizers on the yields of maize. From these trials it has been suspected that organic matter was the main factor affecting the yields. A second set of trials was then designed which allowed to build a statistical correlation between yields and organic matter ⁷.

Basically we feel that when sticking to an *ex-ante* statistical approach in such an heterogeneous environment as it is prevailing in the hills of Nepal. i.e.. in building correlations, there are non-neglectable risks of mistakes that can be to some extent

limited by a research on causes. This leads us to a central methodological point dealing with the analysis of diversity.

Dealing with Diversity

The F.S. approach methodology deals with diversity in a very pragmatic way. Diversity is considered as a potential source of error. Therefore, the research is designed in such a way as to avoid the effects of diversity.

Thus, the site selection must concern a sufficiently widespread type of environment likely to catch the attention of policy makers. The site itself must be representative of this type of environment. The site is then described as a juxtaposition of homogeneous zones called types of land.

The diversity among the farming systems is again very quickly and pragmatically dealt with since the various farming systems are immediately classified in types according to criteria defined *ex-ante* such as socio-economic ones (manpower, cultivated area, size of cattle herd, types of crops etc.). All those different steps, included in the phase of site description should only take a few months.

Then comes the main bulk of research work (i.e., experiments on cropping patterns) which is designed according to the main types (mostly according to the types of land or cropping patterns. One has hardly seen an experiment designed according to the F.S. types).

Adapted cropping patterns once identified on the site are extended within environments which had been described as similar by the preliminary survey. This pragmatic way of dealing with diversity seems somewhat superficial, and anyway inadequate to the hill conditions.

It is striking to observe that the most crucial and difficult phase of the whole research undergone by CSP is the extension phase (preproduction and production programs). In the hills, this phase could hardly be successfully implemented and one can hardly find a production program in the hills of Nepal.

As striking is the fact that such programs exist and come up with quite good results in Terai, e.g., a far more homogeneous place where the diversity of concrete situation is not so great. We deeply feel that the limited success of CSP in the hills is partly due to an inadequate way of dealing with diversity.

Our research project on agrarian system has based its methodology on the analysis of diversity.

The methodology aims to: describe the diversity, explain it, i.e., find out mechanisms of differentiation and understand its historical development and develop predictions about its evolution.

It is based on the constitution of an exhaustive document fixing the boundaries of the research effort. This document contains a description of the research object and of

its 'diversity through simple criteria defined *ex-ante* on the basis of available knowledge⁸.

Those criteria then permit to build a sample from the exhaustive document. This sample is not expected to be statistically representative of the content of the exhaustive document but must include the main types through which the diversity manifests itself. This sample is thus elaborated on the basis of some hypothesis about the basis of diversity. The following steps consists in studying the sample for a verification of the hypothesis. The result of such investigations is often the emergence of a dynamic typology which can fit inside the *ex-ante* defined types or not. This dynamic typology is only valid within the boundaries of the research fixed by the exhaustive document. An important research topic in that respect concerns the generalisation of such results outside the boundaries of the research, i.e., the generalisation of a dynamic typology in a unknown or little known environment.

How can we decide upon the validity of the criteria used in the dynamic typology, outside the boundaries of the research ? Are there any indicators of such validity or must the entire research process be re-implemented ? The answers to such questions certainly depend on concrete cases. Two examples will illustrate that methodology.

The first one concerns a typology of Agrarian Systems elaborated in two districts of the hills of Nepal⁹. In that case the exhaustive document is given by a map of the two districts with the names of the villages, the main rivers and trails, and some indications on altitude.

The hypothesis that altitude, ethnicity, village situation vis-a-vis rivers and transport facilities are important factors explaining the diversity of Agrarian systems. A sample of about 20 villages is then designed according to altitude, ethnicity, distance to roads and position vis-a-vis the rivers.

Then a succession of field tours to study those 20 villages allowed to find out mechanisms of functioning and of differentiation of the agrarian systems as well as extra criteria characterizing the diversity (criteria concerning practices, soil quality, orientation of slopes).

From those 'data, a dynamic typology emerges as well as a description of possible evolution for each type. The second example is provided by JP and B. Pierret Risoud¹⁰ in Salme, a village in the hills of Nepal. The object of research concerns the various farming systems in the village. The exhaustive document consists in a set of data collected from each and every household. An exhaustive census gives for each household the number and age of people, the cultivated area (cadastral survey), and the number of livestock.

The available knowledge on Salme agrarian system (previous research) leads to some hypothesis about the functioning of the farms. Some criteria are expected to be relevant to explain the diversity of farms (ratio as cultivated area/number of people to feed, or cultivated area/number of livestock., etc.)¹¹.

From those criteria a sample is built, including main types of farms in Salme. The activity of these farms is then monitored for one year from which a dynamic typology should be made available whether it confirms or denies the previous typology. Therefore, a knowledge about social differentiation in Salme should emerge.

A precise and dynamic analysis of diversity is the only way to answer the questions concerning the development process whatever they can be: in which conditions is a technical innovation likely to be adopted by the farmers, what are the specific needs of specific types of farmers as regard to development action, what can be the impact of national development strategies on the local communities. Those questions are related with the main question about the links between surrounding and local factors affecting agricultural production.

The understanding of the actual functioning of agriculture in its diversity is a necessary preliminary step before implementing any development action in order to be fully aware of its impact. It is one condition allowing to actually assess who is benefitting and who is suffering (because there are always some) from development actions.

It is not surprising that CSP encounters more success in Terai than in the hills since it aims to extend new *cropping patterns* which are constituted by technical innovations that have been elaborated in research farms exclusively located in Terai (improved varieties, fertilization techniques, etc.). For instance, the organic matter which is a main factor affecting the yields of crops in the hills is not taken into account in the agronomic trials.

CONCLUSION

This paper leaves several questions open concerning the comparison between F.S. and A.S. approaches. It shows that the differences of concepts and strategies as well as differences of methods can justify the distinction between an *English Speaking Countries School* and a *French School* in the field of rural development.

Nothing would be more dangerous than underestimating those differences which finally concern the place that a research on development occupies vis-a-vis the political power of nations.

It seems to us quite necessary to define precisely which groups are benefitting from a development action or to design a development action according to target groups. One should not remain vague pretending to serve both the government and the farmers' interests without further precision. It is a very sensitive question where the role of researchers and development workers vis-a-vis the government and the farmers would gain on being more clear.

However, there is no point starting a confrontation between the two approaches. What is needed is a mutual enrichment. The supporters of the F.S. approach have a lot to teach us in the field of realism, pragmatism, and efficiency. We could have a lot to tell them about the need to keep regarding the research and development actions in their actual socio-political context.

FOOTNOTES

1. "Programme Versant" INRA/CNRS.
2. Mainly the cropping system program (DOA, ICP).
3. The researchers specialized on cropping systems have defined:
 - The cropping system as the arrangement of all the components necessary for the production of all the crops on a farm.
 - The cropping pattern as the arrangement of all the components necessary for the production of a succession of crops on a field for one year.
4. Centro Internacional de Mejoramiento del Maiz Y Trigo.
5. R.D. Hart, Agro ecosistemas conceptos basicos. CATIE Turrialba, Costa Rica., 1979.
6. Element pour une problematique de recherche sur les Systems Agraires et le developement. Report of the constitutive assembly of the Department on Agrarian Systems and Development - Toulouse, November 1979. In P. fourest, A. MAUMELAT Intensification du Systeme Agraire et Differentiation Sociale a BUMTANG Thesis ENSSAA - Dijon, June 1983.
7. B. and J.P. Pierret - Risoud. Thesis to be published.
8. Examples are given below.
9. P. Bergeret: "Pression demographique et evolution de systemes Agraires au Nepal", Memoire ENSSAA - 1981.
10. Doctorate Thesis to be published.
11. J.P. and B. Pierret-Risoud: Thesis to be published.