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## THE COLOMBIAN AGRICULTURAL STATISTICS SYSTEM, UNDER A NEW CONCEPTUALIZATION

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### ABSTRACT

Agricultural statistics developed by the Colombian State in the last fifty years are presented in this article. During this fifty-year period the production of agricultural indicators has not been fairly distributed: indicators have been developed at national and regional scale rather than at a county scale. This is probably caused by the misunderstanding of the statistical research methodologies limitations and advantages, the lack of continuity in the statistical systems' concepts which, due to diverse causes, has not been carried out; a slow leading process in National Statistical's technical aspects and the absence of statistics in culture. Nowadays Colombia is an optimal place for an efficient complete high-quality Agricultural Statistical System to be build because of a new vision of information and statistical systems in agricultural indicators users and developers, the experience achieved by the Departamento Administrativo Nacional de Estadísticas (DANE) in conceptualization and design through the implementation of over eighty-five long-term continuous statistical researches, and the application of communication technologies, data base innovations and geographic information through the use of spatial data, geostatistical analysis and satellite images to keep track of natural as well as man-made land cover.

Key Words: agricultural indicators, Colombian agriculture Statistical System, national agriculture census, show statistics, administrative registry and statistical culture.

## **INTRODUCTION**

The administrative management in various areas is closely linked to the territory on which it develops, since this is the common reference for all human activities. It comes to the different administrations is a need for comprehensive and updated knowledge. According to the 1991 National Constitution for the state administration and political representation, the country was divided for administrative departments, districts, municipalities and indigenous territories. It is in this geographical area to develop regional statistics in general and agriculture in particular.

Countries of the world has recognized the importance of agricultural statistics as a means to understand the structure and evolution of the sector, indispensable basis for the development, design, implement and evaluate plans, programs and projects that establish the necessary policies to promote agricultural development. In Colombia, as is characteristic of any developing country, agriculture is a source of essential development in the national economy, despite the declining share in national GDP (2000-2009 historical average of 8%). Furthermore, 24 percent of Colombia's population lives in rural areas and agriculture employs about 20 percent of national employment and represents over 60% of employment in rural areas.

Because of the importance of the agricultural sector and rural national economy, it is evident that a clear understanding thorough, by relevant statistical information, reliable and timely information, to plan and schedule, with some basis its development. These information needs vary if it is in the national or municipal level, the technical efforts, institutional and financial have been made mainly by the institutions at the national order. (DANE and MADR), who have somehow tried to generate the municipal level, with relative success.

At one time, the generation of agricultural information has been addressed by different methodological choices, prioritizing the needs of national and departmental information, however it has always been a pending task information generation at the municipal level by several factors, among them is highlights financial factor.

Among the alternative methodologies to supply regional agricultural information are the national agricultural census. – 1st National Agricultural Census in 1960, CNA I , 2nd National Agriculture Census conducted in 1970, CNA II and 3rd in the absence of national agricultural census, the Colombian government has been making various efforts in statistical research, from municipal consensus (no objective statistical method) probability samples, (ENA- ENDA) and agricultural products census. However, The 3rd

National Agricultural Census, The census is a imperative need for the development of the Agricultural Statistics of Colombia and territorial statistical. This statistical operation is the keystone of the system. From it that is the statistics program is local, national, continued efficiency and integrity of agriculture. National Administrative Statistics Department -DANE- has been working on the strategic plan for agricultural statistics – PENDES- , where provided for complementarity and completeness of the agricultural statistical system and this in the context of National Statistical System –SEN- and inside of DANE regarding the statistical operations in the economic, social and environmental. The structuring of Agricultural and Rural Statistical System -SEA- involves national and international experience and takes into account the experience information systems of MADR and the agricultural production unions, the recommendations of Food and Agriculture Organization of the United Nations -FAO-, World Agricultural Census 2005 - 2016 and the fundamental principles of official statistics of the United Nations.

## 2. BACKGROUND.

In 1951, the National Office Control –CONTRALORIA- attempted to conduct the first national agricultural census, but due to technical and public policy that failed. In 1960 was made by DANE, the first National Agricultural Census and during the years 64 to 69 national surveys were conducted on different aspects of interest to the agriculture. In 1970 -71 was made, the second National Agricultural Census by DANE, but during the decade were not carried out national surveys on issues of importance, so the continuity was observed between 1964 - 1969 was lost.

In parallel, since 1971 the Ministry of Agriculture in order to meet its internal needs of organized information in statistics office, it from 1972 published annual estimates of harvested area, production, cattle inventory, area in pasture, harvest forecasts, among other indicators. The method used in collecting the data is “subjective”, using the criteria and ministry staff experience in their respective jurisdictions. This work often leads to meetings with a concurrence of local authorities, important farmers and other officials of the Ministry, through analysis, adopted figures (originally was municipality and now is department) for period certain.

The use of subjective procedures in the estimation of harvested areas and yields obtained, has limitations because of the impossibility of quantifying the annual statistical errors, so the figures do not allow a consistent analysis, however is the only continuous source of data at this level political and administrative, also efforts have been made to improve their statistical quality, by introducing conceptual aspects that govern the administrative records.

Given the urgent need for the information required for the adoption of policies, decisions and plans for national economic development and territorial, in 1982 the National Council for Economic and Social –CONPES- approved the implementation of the 3rd National Agricultural Census - III CNA- , a fact that should have been done approximately in 1986.

However, the high costs that the transaction involved, the lack of financial resources, inability to obtain external financing, the possible delay in obtaining results and the fact that the DANE, an organization that was run was scheduled completion of the National Census of Population and Housing, made to seek alternatives, due to the above, led to the adoption of the sampling methodology Agricultural Areas.

This methodology has been successfully applied not only in United States, but in several Latin American countries, it should be tested in Colombia. Between 1983 and 1986 pilots testing were implemented in five departments, so: In November 1983, in Caldas, in February-March 1984 in Tolima, in September 1984 in Magdalena, in November 1985 in four municipalities in southern Cauca, and in February, March and April 1986 in the Valle del Cauca. Given the successful results obtained in the pilots testing and the fact that it was a scientific advantageous conditions of Colombia MARD to the end in 1988, made the First National Agricultural Survey –PENAGRO- which covered 23 departments and allowed the collection of information about the structure of agriculture; data were collected about socio-economic as well as data on areas planted, watered and harvested and the production obtained for transient crop in two periods taken as a reference, areas planted, watered and productive age and the production obtained for permanent crops, the number of cows milked and milk production. These surveys formed at the time what was known as the Agricultural Statistics System for Sampling –SEAM-

Thus, this statistical operation allowed in the short term, get the information that otherwise could be achieved through the implementation of III CNA, and through this sample design was thought to establish a statistical system that would permit continuous regularly obtain information about all topics of interest concerning this important sector of the economy, with indicators at both national and departmental levels.

Since the holding of the First National Agricultural Survey –PENAGRO- in 1988 to 1995, there was no information of sector using scientific methods due to suppression of SEAM in 1990, so the user public and private organizations were forced to supply themselves with information for specific purposes. This has determined that there are several variable data for the same investigation, different levels of geographical breakdown or territorial for the same reference period. Given these circumstances, in June 1993, Ministry of Agriculture and livestock, now the Ministry of Agriculture and Rural Development, -MADR- and National Administrative Statistics Department, DANE, signed an agreement of cooperation and technical coordination for the establishment of the National Agricultural Statistical System and Fisheries of Colombia.

During the period 1995 to 2005, DANE-MADR-, conducted ten National Agricultural Survey –ENA-, censuses were advanced in conjunction with agricultural production economic union, National Census of potato with Colombian Federation of Potato producers –FEDEPAPA- , National census of industrial poultry farming with National Federation of Poultry Farmers –FENAVI-, National Census of Pig Industry tech with Colombian Association of Pig Farmers –ASOPORCICULTORES- National Census of Rice with National Federation of Rice farmers, National Census of Vegetables and Fruit with

Horticultural Association of Colombia –ASOHOFrucol- , Departmental Livestock Census in Department of Huila with Livestock Farmers Federation of Colombia – FEDEGAN-, National Survey of Forest Plantations, with National Association of Reforestation -ACOFOR- in 1999, Census department of forest plantations with Autonomous Regional Corporations –Cars- in Departments of Antioquia and Magdalena, among other researches.

In 2005, DANE carried out, National Census of Population and Housing, where not only collected data from population and housing but also economic and agricultural units, this has been the only agricultural research associated with the national census of population and housing since the last agricultural census in 1970. Likewise, this new concept applied to this statistical operation per decade, is a big event in national statistics, by integrating large population and housing research with economic and agricultural statistics, integration allowed to build a national statistical frame of the agricultural sector from the housing – Rural Home – (with some restrictions) and facilitate the design of statistical operation integrated a comprehensive understanding of the agricultural sector. From 2006 and until 2009, MARD continued to carry out the national agricultural surveys that DANE had been doing through the Corporation Colombia International (CCI), in 2010 an agreement was signed between MARD - DANE -CCI- for unit institutional efforts for the ENA 2010. For 2011 it is expected that this research back to DANE and restarted statistical research on the conceptualization of Agricultural Statistical System. –SEA-, conceptualization presented by DIRPEN in 2009.

Currently private sector has excellent systems of information by economics union. For Coffee Sector the Coffee Information System –SICA-, For Oil Palm Statistical Information System Oil Palm Sector –SISPA- in Cane Sugar –CENICAÑA- has an advanced information system for sugarcane which revolves around agriculture site specific –AEPS- This system consists of 10 tools related to area, production and yields crops by variety, fertilization, Hydrometeorology, climate, agro-ecological and economic. For panela-cane, FEDEPANELA has created a technology platform called Panela Information System –SIPA-. Through this platform, enter the information related to all beneficiaries (Entrepreneurs and Rural Groups) in a sequential and validated. The information entered refers to the characterization of panela units and panela-cane producers.

-SEA- is defined as an integrated system of agricultural statistics, released by government agencies or private actors performing their public tasks, fundamental to the process of defining public policies, the optimal resource allocation, monitoring and evaluation of government management, as well as being necessary to promote transparency and accountability of governments.

This information should be produced with quality, timely and easily accessible, complying with the fundamental principles of official statistics of United Nations and Code of Good Practices, for which international benchmarks are reviewed, documenting each process and sub-process (meta-information system - Accelerated data), methodologies are made public, attending to the strategic needs of users(farmers, policy

makers, evaluators of policy compliance, researchers) gradually covers the demand, and takes into account the needs of modeling indicators, imbalances between supply and demand statistics strategic and eliminating every the shortcomings identified.

-SEA- collects technical proposals made by the MADR in 2001, regarding territorial agricultural statistics

This proposal, considered that information plays a key role in strengthening decentralization strategies in various sectors of governance. The transfer of responsibilities to local authorities has been accompanied by strong pressures for development and institutional strengthening of local and regional authorities. One of the critical points which need to strengthen the capacity of these entities is the planning and monitoring of public policies. There are clear weaknesses and gaps that are in management disaggregated below national and regional levels. This leads to necessity of creating an information system that allows a better understanding of reality needs, local diagnostics and indicators. For this, the MARD proposes the construction of a rural land information system that provides information bases and methodological developments for use by local authorities, with the following characteristics:

1. Create a system of territorial indicators seeks to channel the support of national entities responsible for generating information to local authorities, departmental and regional. It proposes three components of this system of territorial information: system of territorial indicators, survey systems regional and local, and rural consensus.
2. Territorial Indicators System begins of construction of indicators at the territorial level, which is a task that has been being conducted by various publics and privates entities.
3. The regional and local survey systems aims incentive to local authorities to undertake in depth studies for their respective areas of jurisdiction, capitalizing population census and sectorial statistics frame. Throught acces of entities to sampling frames and technical support.
4. The third component of land information is conformed by Consensus Agricultural Assessment System being developed by the Ministry of Agriculture and Rural Development from the 70.

The MADR in 1993 proposed the development of the Agricultural Sector Information System of Colombia -SISAC- where it was contemplated the third CNA, a set of intercensus investigations, between them sampling areas, production and performance departamental and municipal, -MAPREDE and MAPREMU- the first annualy and the

second every five years, but under this proposed scheme estimates municipal research continued through the development of statistical models for estimating small areas or municipal, statistical developments supported by the decadal national census data, the quinquennial large sample municipal and departmental annual surveys.

In 2007 the Dane proposed National Agricultural Statistical System –SENADER- which main objective to modernize and strengthen national statistical organization, through the implementation of data collection tools and statistics for the agricultural sector and rural social development national and regional for the purpose of comprehensive management support institutional planning and policy formulation, monitoring, evaluation and control institutional management and decision making on the same scale.

The specific objectives of SENADER are:

- Generate statistical culture in the rural sector from participation and socialization of the actors involved in the basic information and missionary activity of DANE
- Analyze and set objectives from the identification of problems caused by the failure of timely and relevant information.
- Define strategies, prioritize actions and projects aiming to generate basic information to strengthen the agricultural sector in the country
- Organize and optimize use of resources, human, physical, financial and information used by actors in the agricultural sector involvement.
- Design and implement a modern information system and practical that takes into account the information needs of the various sector actors.
- Evaluating and track the actions generated by the information system in place.

This system included four major components:

Productive activities, support activities, social rural development policy and institutional. This is a conceptualization advanced, comprehensive and complete picture of Colombian agricultural statistical system.

According to José Eddy Torres-2007, public surveys of area, production and performance should focus on agricultural and pastoral areas not covered by the information systems of the unions of agricultural production (according to estimates from this study corresponds to 54% of cultivated area in Colombia) that can provide that information to one articulated system of public agricultural information. It also is recommended as a source of agricultural information administrative records of parafiscals funds to expand the coverage of union information.

This study also suggests that at the municipal level to develop local agricultural information systems to integrate and feed back to departmental systems and the national

system, around two goals: its land use plans-POT and its processes of socio-economic formulation and updating stratification and estimation of rural farm households UAF.

### 3. AGRICULTURAL AND RURAL LAND INFORMATION NEEDS

According to the results of a national survey of information users in the agricultural sector by MARD in 1993 indicate strongly territorial information needs, national and departmental levels considered critical information at the municipal.

87% of respondents, demand a high priority, information on area, production and yield, 65% , markets and prices, 50% the land use and other structural variables, 42% production costs, 33% credit, marketing and inventory. The rest of the required information referred to in its order: livestock and pastures, environment, import and export, social and demographic characteristics, employment, fishing and technology, among others.

Differentiating the demand among the public and private, in the first of these retains the overall structure of priorities of information requested, while the second stands out, imports and exports, claimed by 44% of respondents.

With respect to the demand for information regarding the degree of disaggregation of the same, 64% of respondents want information at the municipal level, 15% of respondents requested to be departmental and only 5% require information nationally. For almost all items of information are requested to be municipal disaggregation.

In the public sector demand for municipal information is 69%, 22% regional, and 21% departmental levels. In the case of area, production and yield, 74% of respondents considered to be disaggregated at the municipal level, 14% at the departmental level and only 1% at nationally level. The private sector, 60% require that such information is provided at the municipal level and 20% at the departmental and regional levels. As for presentation, 56% of the informants, requests the raw data about area, production and yields, and the remaining 44% preferred the information analyzed.

Regarding the frequency of information, 42% requested information to be every six months, 33% wants to be per annum and a 13% request wants it to be monthly. Analyzing separately the public and private sectors, within the public sector to 44% wants semiannual information, 32% annual information, 25% per annum and 20% monthly. In General, the case of area, production and yield 65% want information semi-annual and 16% want information per year. 69% for the public sector, the information semiannual is more priority than for the private sector, in which only 36% of cases requires it in this way: For prices and volumes 35% want information semiannual and 26% monthly. For use of the land: 64% want information annual and 22% semiannual, livestock and

pastures: 56% want monthly and 27% annually. For credit, marketing and inventory: 51% want information every six months and 17% monthly.

A second study conducted by the MADR in 2001, makes a new approach to the demand for agricultural information, according to this research productive economic activity requires significant inputs of information to improve the competitiveness of the sector in general. The information for this user group is directly linked to expectations of economic efficiency and profitability, thus the possibility of achieving greater efficiencies in cost reduction; In general, this new approach favors the exchange of information, that is to say, the flow, before the single production. This implies the idea of forming a demand, supply, ones transaction conditions and some intermediaries.

Today demand indicators in the agricultural and rural sector has increased considerably and new products are in demand in relation to economic components, social and environmental, climate change is impacting the Colombian agricultural and socioeconomic system requires continuous monitoring of the impacts, adaptation, mitigation and sustainability of agricultural production systems, welfare topics of the peasant population, standard of living of rural families, the presence of female head of household in the development of farming and rural, income, savings and agricultural and rural investment, rural wealth, are topics of particular importance that –SEA- must resolves.

#### 4. STATISTICAL SYSTEM OF AGRICULTURAL AND RURAL COLOMBIA –SEA- DANE.

SEA is proposed by DANE is based on the basic criterion of the possibility of overcoming many problems of statistical territorial development, have been found so far, improving communication and coordination between producers and users of agricultural information and rural, recognizing the needs of statistical information for decision making in the agrifood, rural economic development information needs from a gender perspective, competitive and sustainable agricultural development, environment, develop and implement statistical programs that meet those needs in. The origin of the problem lies in the fact that not enough effort has been made continuously, interdisciplinary, interinstitutional and territorial to develop and operates a regional agricultural statistical system, apart from the severe limitations of financial resources.

One agricultural and rural statistical system has to include those responsible for decision making, analysts, industry experts, agricultural and rural statistics, domestic users, regional and local, as integrated whole and not as independent groups and unrelated activities. Each activity must operate in complementary interaction with other activities, so as to harmonize, coordinate and link. It should be:

- Effective and efficient in providing timely, relevant, flexible, accurate, accessible and consistent to those responsible for decisions on agricultural, rural, environmental and food;
- Able to adapt structurally and conceptually to changing conditions, thereby avoiding becoming obsolete concepts and definitions.
- Able to generate rural, environmental and territorial information, besides ensuring the national information
- Compatible with human capabilities, financial and institutional country, as these will grow and develop over time.

Under this conception, -SEA- requires the structure of two subsystems for implementation and the generation of territorial and national statistics.

The first subsystem refers to the analysis focusing on the interpretation and analysis of data from the statistical operations and other sources, in light of existing knowledge and the dissemination of results to those responsible for decision making both at local level municipal and national levels.

The fulfillment of this phase in addition to providing a guide to data analysis will provide in detail the variables under investigation and coverage. Possible to structure the research to be done to meet the new requirements and user demand.

The second subsystem is constituted by the Production of National Statistics and territorial deals with the production of indicators, by observing and measuring the different variables under investigation related to rural socioeconomic activity, agriculture, fisheries, forestry and environmental.

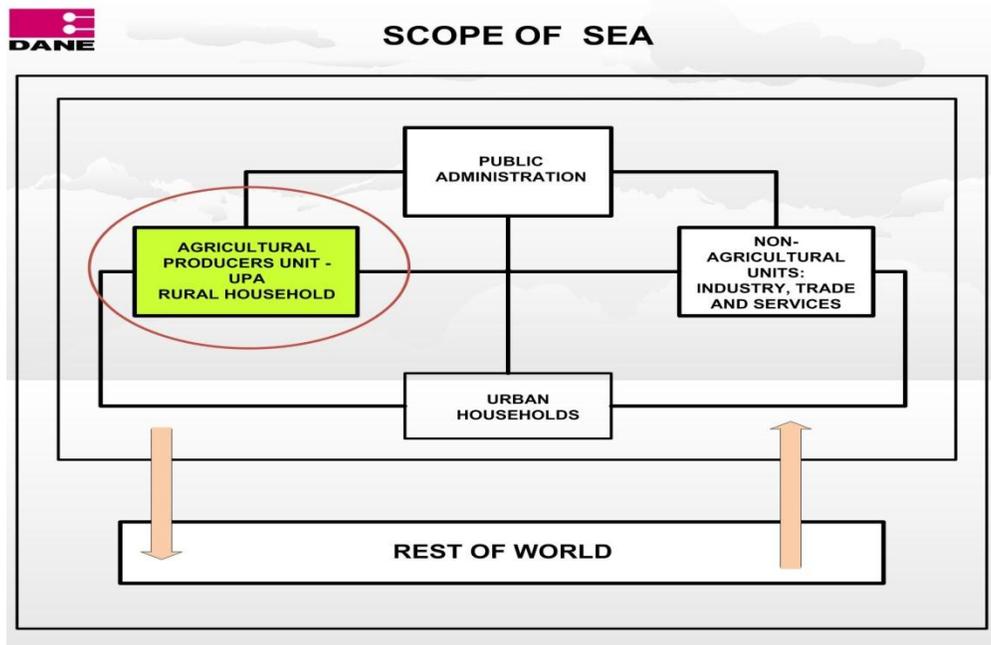
#### 4.1 ANALYSIS SUBSYSTEM OF SEA

The area of farming, rural, social and environmental encompass the complex interactions of physical processes (soils, meteorological, biological) economic and social factors in the production, distribution and use of agricultural and rural. Given the conditions of time and availability of soil and water resources, these processes are running public administrations, households and production units, thus establishing the processes and agents.

Established processes and actors involved, is necessary to determine the causal relationships between different phenomena to be investigated. In this context, and based on the work done by FAO, USDA, BM, EUROSTAT in international level, and the works carried out by MADR and DANE in domestic level can establish different types of analysis, identifying different subject categories (agricultural producers, land, crops, livestock, technology, management, environment, production costs, marketing, profitability, welfare and environmental) indicators and variables that would be required to meet these demands for information.

This subsystem will guide and consolidate the agricultural and rural statistical production, national and territorial, so this subsystem will use all the methods and conceptual developments of data analysis for the optimal development of the system ((Models: predictive, prescriptive, casual, formal, simple math, complex math; logarithmic and semilogarithmic, supply and demand models, simple correlation, standard deviation, coefficient of variation trend rate of growth of demand for a product, supply and demand analysis, construction of indicators and composite indexes, economic and environmental accounts, simulation analysis, mathematical programming, multivariate analysis, analysis of environmental risks, climate change, among others). The figure below shows the area of analysis of SEA and its relation to SEN.

Figure No. 1. Scope of Sea



Source: DANE, SEA.

## 4.2 THE STATISTICAL PRODUCTION SUBSYSTEM OF SEA

It is understood as an integrated set of research that provide information on various indicators that explain the behavior and evolution of agricultural and environmental.

This system is defined in a program that includes the characterization and behavior of the phenomenon of study special and detailed description of the data that are compiled, the nature of the methods used and statistical operations that to be undertaken together with a schedule tab, processing and dissemination of quantitative information.

The statistical operations should be scheduled in advance, meeting the requirements of users and establishing a priority, given the resource constraints, to maximize the use of the same and achieve economy and efficiency in these.

The preparation and execution of the program will require the evaluation of human resources, infrastructure and organization necessary, included training needs. Moreover, it is necessary to determine the relationships among the aspects to be investigated with a view to the integration, consistency and complementarity of the information obtained.

The program should be considered as an important step in the achievement of statistical development and not just as an inventory of activities and needs. Must not be lost sight of the dynamic nature of the program, especially because its implementation will reflect itself deficiencies and problems that require change, therefore, be crucial permanent surveillance efforts in its organization, execution, to respond to the needs of users.

The objectives proposed with the implementation of production subsystem can be summarized in the following:

- Provide reliable, timely and geographically disaggregated, in order to measure the dynamics of agriculture and its contribution to national economy, domestic consumption, agribusiness, as well as for export (tradable and non tradable). Similarly, providing information for rural sector development, agriculture and the development of a social agriculture and environmental sustainable.
- Provide a basis for the development of national and territorial.
- Coordinate and consolidate rural statistics, agricultural, social and agri-environment to avoid duplication and therefore, the dispersion and loss of resources.

- Progressively improve the methods and techniques of statistical research applied to the rural sector, agriculture, aquaculture, fisheries and forestry
- Strengthen regional statistical systems.
- Empower and train the technical staff of various institutions that make up the system, conducting statistical research
- To accept the recommendations of international organizations so that national figures can be compared with counterparts in other countries.
- Accept the recommendations of international organizations in order that national figures can be compared with counterparts in other countries.
- Comply with the fundamental principles of official statistics of UNITED NATIONS

To achieve the objectives is raises the formulation and implementation of various investigations, them born from the combination of different subject categories (Number and size of agricultural production units –UPA-, ownership regime of land, rural demographics, farming, fisheries and forestry, agricultural practices, water resource management, employment, costs of production, consumption, prices and profitability, technology, agriculture and environmental management) rural incomes, standard of living of rural families with the research units.

Needless to say given the, variety of subject categories that are needed to analyze the agricultural sector, rural and many of them as inputs for socio-economic for analysis in other areas, these researches can be classified into two groups:

- Which correspond to execute the Colombian agricultural statistical system, through various implementing agencies.
- Those general, in addition to serve the agricultural sector analysis, are required in the study of other socioeconomic sectors.

Whether in a group as in the other, its must make a careful study of the methodology, scope and coverage of the investigations that have been made to determine if all required indicators are considered and methodologies are compatible with the concept of Agricultural rural and territorial Statistical System.

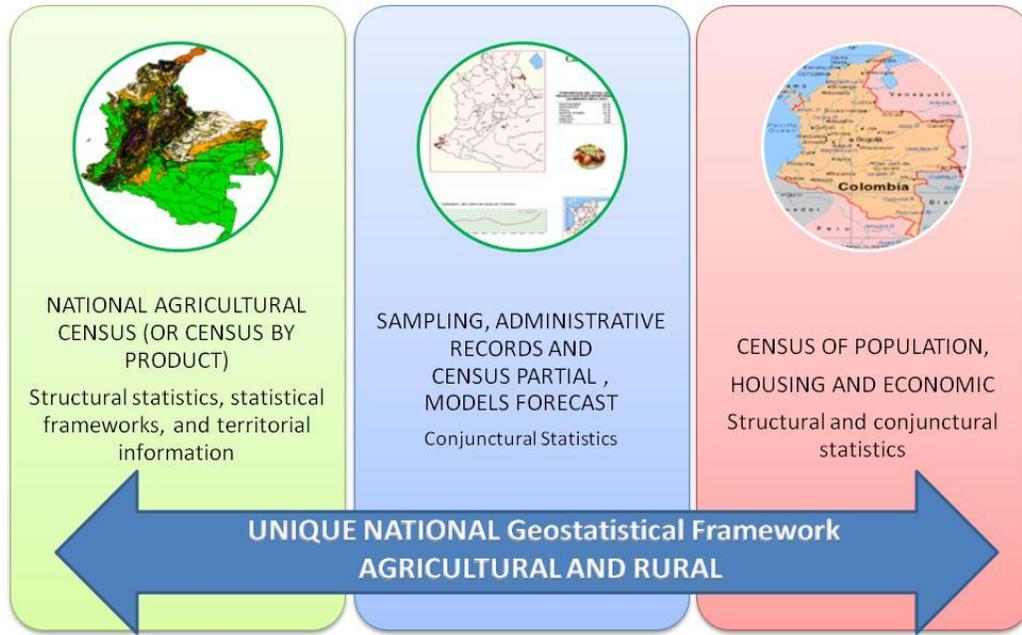
#### 4.3 CONSOLIDATION OF DECENNIAL PLAN OF AGRICULTURAL AND RURAL STATISTICAL SYSTEM

It is in the plan for structuring statistical operations where it appears as the cornerstone of –SEA-, Third National Agriculture and Rural Census, proposed to take place decadal. This statistical operation is the basis for the definition of territorial statistics program, continuous and deep in the agricultural sector and rural. It is from this research that is obtained best statistical framework for the sector and the opportunity to shape the agricultural and rural statistical system territorial.

The Third National Agriculture Census -CAN-, also allows the construction of rural Colombian registry defined in Act1429 of 2010. The CNA generates a rural record of the companies agricultural and agribusiness production units associated agricultural rural households, the census also allows the construction of rural Colombian registry defined in Act 1429 of 2010, therefore is the basis of records and information systems that would be created in the development of land policy. Regarding the environmental component, the database of a national agricultural census are essential for establishing natural hazards, vulnerability and risk of farming, damage assessment and rehabilitation of areas affected by natural disasters (rainy season, droughts, fires, landslides, earthquakes, health events).

It is important according to the above that the SEA is integrated into the SEN, where it makes present public and private sector in the production of agricultural information, fisheries, forestry, socioeconomic, environmental, rural and users as plaintiffs of it. Colombia according to the recommendations of the FAO and the United Nations has been working in the integrity of statistics operations inside of DANE. From the point of scientific, technical, technological and operational, redounding in resource economics, technical efficiency and integrated analysis of agriculture and rural sector. Therefore, the effort to unite in the immediate past, the national census of population and housing statistical framework for agricultural and rural agricultural census in the future is a step in the right direction of the system, as shown in Figure No. 2.

Figure No. 2 SEA for long term statistical research methodologies



Source: DANE, SEA.

Into SEA, DANE proposes a system of agricultural statistics and rural long-term, stable ensuring the permanence of national indicators, departmental and municipal, bearing in mind that the base is the Third National Agricultural Census or failing the national census by product and overall national population census, housing and economic development. The census is the basis of regional statistics; it is from this research model that can integrate land information needs (municipality, department and country) establish the different methodologies and strategy in time for the system implementation. The following is a proposal Preliminary Decennial Integrated Plan of SEA an accounting approach following the scheme of the system of national accounts considered by - SEN such as statistical strategy.

The focus of agricultural resource accounting is to identify and quantify their flow from the production of seeds, soil preparation, planting, breeding, management and extraction and harvesting environment, through successive stages of development, waste management and return of these to the economic sector for its transformation. Also, given the statistical operations should take into account the changing needs of users, the socioeconomic reality of the country, development plan and agricultural policies (Policies: land, rural development, supply chains, science and technology sector's competitiveness, agricultural health and food safety, agricultural insurance, credit and prices, housing and food security, rural household welfare, environment, foreign trade).

DECENNIAL PLAN PRELIMINARY INTEGRATED OF COLOMBIAN AGRICULTURE STATISTICS SYSTEM												
No.	MODULE, INFORMATION UNIT AND INSTRUMENT OF RESEARCH	MEASUREMENT PERIOD										
		0	1	2	3	4	5	6	7	8	9	10
<b>1</b>	<b>AGRICULTURAL PRODUCERS INFORMATION MODULE: UPA</b>											
<b>1,1</b>	<b>NATIONAL AGRICULTURAL CENSUS</b>	X										X
1,2	NATIONAL AGRICULTURAL SURVEY											
	diseases, production systems, sale prices; Evaluation (Postharvest) forecast (Pre-harvest), objective methods of measurement, pre and post-harvest losses	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
1,3	SURVEY OF FORESTRY		X	X	X	X	X	X	X	X	X	
1,4	SURVEY OF LIVESTOCK						X					
1,5	SURVEY OF SLAUGHTER CATTLE	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
1,6	SURVEY OF AQUACULTURE, INLAND FISHERIES AND MARITIME		X	X	X	X	X	X	X	X	X	
1,7	SURVEY OF HANDLING OR MANAGEMENT OF UPA: Large, medium and small farms (production costs)		X	X	X	X	X	X	X	X	X	
1,8	SURVEY WORK (LABOR)		X	X	X	X	X	X	X	X	X	
1,9	SURVEY OF PROFITABILITY OF UPA		X	X		X		X			X	
1.10.	SURVEY OF AGRICULTURAL SERVICE ESTABLISHMENTS						X					
1,11	SURVEY OF SOILS: DEGRADATION, USE OF MINERAL, FERTILIZERS, PESTICIDES, WASTE, OTHER.		X	X		X		X			X	
1,12	INDICATORS OF THE ENVIRONMENT: CLIMATE CHANGE		X	X	X	X	X	X	X	X	X	X
1,13	OTHER SPECIAL AGRICULTURAL SURVEY Ad-hoc		X	X	X	X	X	X	X	X	X	X
1,14	MAPREMU (Municipal Survey on structure of agriculture)						X					
<b>2</b>	<b>ADMINISTRATIVE MODULE REGISTRATION INFORMATION: ESTABLISHMENT AGROINDUSTRIAL</b>											
2,1	Agriculture: cotton, rice irrigation, sugar cane, oil palm, banana exports, export flowers, records of agricultural and forestry parafiscal funds.		XXXX									
2,2	Livestock: Milk Industry, poultry tech, tech hog, shrimp farming, inland fisheries and sea (Maritime industry) and administrative records of the funds parafiscal livestock.		XXXX									
2,3	Other (technological innovation, quality certification, environmental management and sustainable social, and opinion, etc.).	X	X	X	X	X	X	X	X	X	X	X
<b>3</b>	<b>MODULE INFORMATION TRADE: INTERMEDIARY</b>											
3,1	For major / minor, Producer / Consumer: Methodology and current product basket	X	X	X	X	X	X	X	X	X	X	X
3,2	Wholesale / retail trade; prices, transportation stocks.	X	X	X	X	X	X	X	X	X	X	X
3,3	Market intelligence.	X	X	X	X	X	X	X	X	X	X	X
3,4	Market News	X	X	X	X	X	X	X	X	X	X	X
3,5	Exports / imports	X	X	X	X	X	X	X	X	X	X	X
<b>4</b>	<b>HOME INFORMATION MODULE: RURAL HOUSEHOLD</b>											
4,1	FOOD CONSUMPTION SURVEY (nutrition)	X	X	X	X	X	X	X	X	X	X	X
4,2	SURVEY OF INCOME AND EXPENSES			X		X		X			X	

Source: DANE, SEA.

## 5. METHODOLOGICAL ALTERNATIVES

From the national agricultural census or agricultural censuses by product (or national population census, housing and economic), there are a wide range of methodologies for the production of regional statistics, as shown in Figure No. 4 can not design a national census on the SEA without thinking long term and geographically. The design should combine these two essential elements of the system, for reasons of efficiency, completeness, comprehensiveness, relevance, adaptability and quality statistics.

In principle in the field of objective statistics, the ideal is to start the system from the national agricultural census and research performed by using administrative records intercensal statistical, (INDEC, IBGE, INEGI, INE, USDA, EUROSTAT), samples of elements, cluster sampling, (FAO-1982 - 1996), censuses products, (DANE, INDEC, 2010), sampling of small areas (Rao JNK, 2001), Optimal spatial sampling, (Arbia Giuseppe, 2001), national forest inventories and biodiversity (Gschwantner Thomas, 2009; Loetsch F, Haller KE, 1964; Rondeux J, 2001); Statistical models for estimating and forecasting (Genovese, 2001; USDA-1987-2010, IBGE, 1996-2010), agricultural crops objectives forecast (FEDECAFE, INDEC, IBGE, USDA, INEGI, Eurostat, 2010), inventories of greenhouse gases (IPPC-IDEAM) or a combination of the above methods. Always departmental and national levels will be united with the municipal level, where there are the sources of system information (the farmer and agricultural activities). The topics and methodologies listed above can be structured territorially, harmonized.

In the field of statistics are not objective, consensus is the only municipal research in agriculture that has often been in the production of territorial indicators at this level, The MADR has been making major efforts to become a municipal administrative record, this method relied on geographic information systems and under the conceptualization of a statistical investigation is a suitable method for the provision of territorial indicators. An example of this is the administrative record in growing cotton, under the administration of the Corporation Colombia International –CCI- This record was designed by DANE in conjunction with the MADR in 2000 (and with the support of CONALGODON, local guilds and producers) and was continued by the CCI under an agreement with the MADR from 2005. Currently this methodology is structured from the registration form, production and industrialization of cotton each season, and geographic information support to the plot land level, georeferenced by the respective element of cotton producers guilds.

The record has a quality control system, using a probability sample at the level of unionization for testing plots land and planted areas. The operation of the registry is monitored through the chain of cotton, textiles and clothing. The program of agricultural production chains currently operating (32) working under a compliance plan,

monitoring and evaluation of short term (quarterly, semiannual and annual), in this process are structured scenarios for evaluating the statistics sub-sectorials, which are fundamental to evaluate the performance of the indicators of productivity, profitability and optimization. This is an optimal scenario that the MADR is using to strengthen the Information System of Colombian agricultural sector, -SISAC-, where representatives of the links are in the chain, primary, secondary and tertiary and under full cooperation inside it. In the private sector guilds have been developing the production censuses and administrative complex with high standards of quality and statistical breakdown at the municipal level (Asocaña - Cenicaña, FEDECAFE, parafiscal funds of agricultural) , Given the interest guild development of farming, these investigations identify, measure and monitor the performance of the agricultural activity at the farm level - - Farm and in some cases plot level (Cenicaña – Asocaña, Fedecafé, Fedepalma). In this segment there is great potential for generating territorial agricultural statistics.

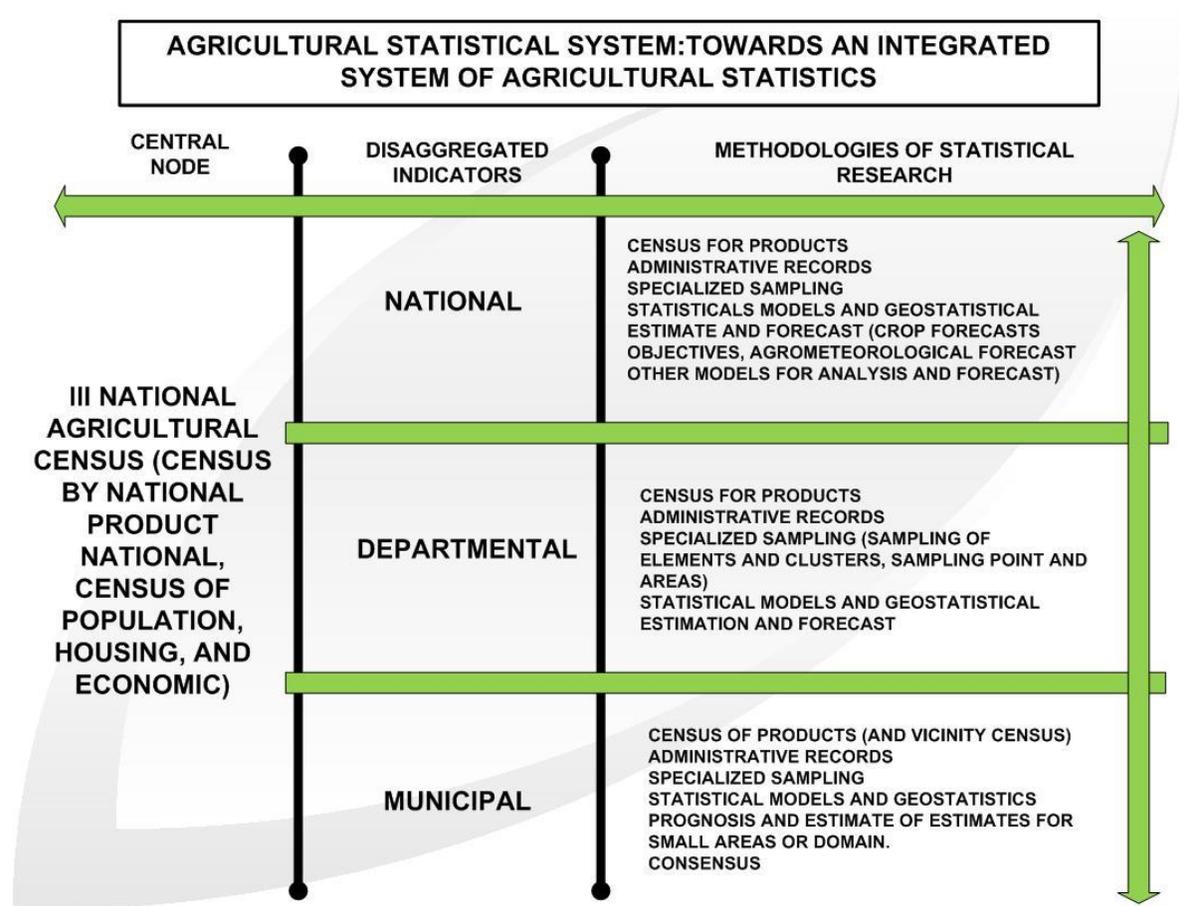
FEDECAFE is the guild with more experience in the information production sector, in 1932 was made the first census Coffee, with a planted area of 356,245 ha. in 1955-1956, Census Coffee was update by a national sample coffee. In 1970 the Second National Census Coffee in 1980 took place the Third National Census of Coffee , in this statistical operation used intensively mapping and aerial photography, 1:10,000 (about 100,000 aerial photographs), and 1993-1997 was carried out the Fourth National Census Coffee , with coverage of 3,600,000 ha. in 600 municipalities and 20 departments. The census obtained information from producers, farms, plots, houses, infrastructure and homes, both coffee and other, capturing 669,000 units of agricultural production, (89% less than 3 ha) 566,000 farmers, 800,000 ha. Crop (technified 609,000) From the last coffee census, the guild structured Coffee Information System – SICA- in this system is provided for the objective forecasting of crop, the administrative plot record and coffee farm for the generation of technological indicators, productive and social and is investigating it in production costs, productivity, traceability, other products grown in coffee farms, holds the record for production volume, export and import of the fruit, domestic and international prices, the production value, value of exports and domestic consumption.

Other researches related to territorial agricultural statistics are the economic research of the land, rural socio economic stratification, the estimation of the family farm unit –UAF- under the responsibility of DANE, the value of the assets of rural land, geo-economic studies, physically homogeneous areas, rural cadastral formation required for the establishment of the rural tax base under municipal responsibility, is an important source for concurrent structuring of agricultural statistical system and particularly municipal territorial Local governments have records of each rural property owners of rural land, and therefore constitutes an excellent medium for the development of administrative records that can be integrated with departmental systems and national agricultural statistics. Also, at this level territorial administrative records are concomitant with the municipal tax system to complement the scope of the SEA, related to the activities of industry,

commerce and service in the agricultural sector. Below in Figure No. 4. Presents the methodological framework of territorial SEA.

A methodology has not been developed in Colombia, are the census neighborhood, this is a permanent generation of municipal level indicators (and even veredal) where farmers in their respective areas of work record information from farming, under an institutional, technical, spatial and temporal defined by the parties, (agricultural producers and the system administrator at the municipal level), these arrangements usually require information in both directions flow. This alternative statistical research is very cheap but requires a very high level of statistical culture.

Figure No. 4. Statistical research methodologies Agricultural Statistical System.



Source: DANE, SEA

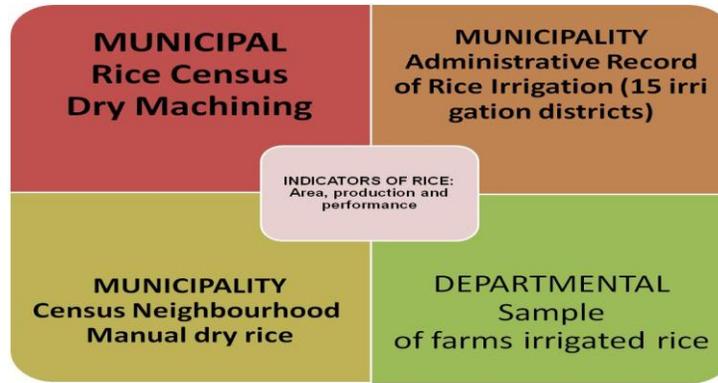
The modern geographic information technologies, such as Aerial photographic images, satellite images (K, Okamoto and M. Fukuhara, 1995), digital photogrammetry, and geographic information systems allow efficient structuring and operationalization of the agricultural statistical system from the municipal level. The above-mentioned developments and research are specified in the construction of unique

national framework for agricultural and geo environmental basic instrument for the integrity, harmonization of indicators in the National Statistical System.

## 6. INTEGRATION OF REGIONAL AGRICULTURAL STATISTICS

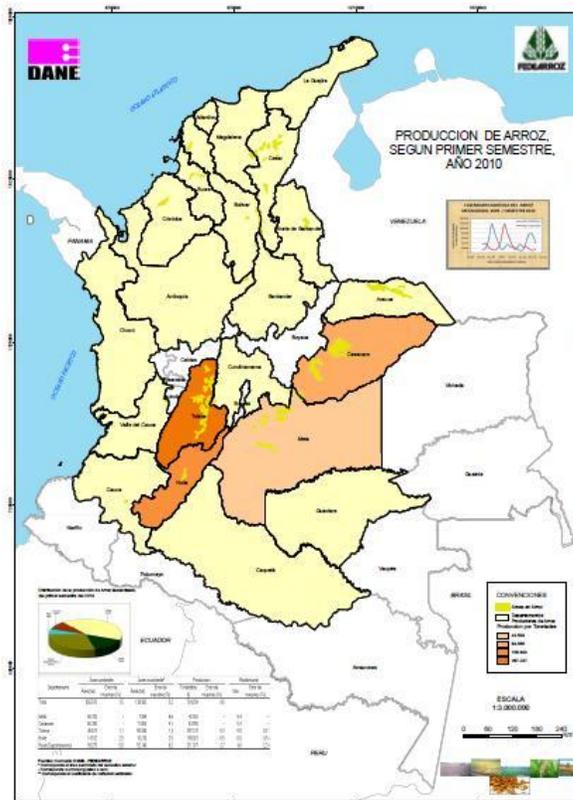
The SEA for long term should consider national statistics and territorial statistics, which seek complementarity in generating indicators on the three levels and the efficiency of the system as a single unit. One of the alternatives methodology to structure the system is from of the Third National Agricultural Census or surveys by product, in the latter case, the solution to the territorial level would be also by product. The –SEA- with excellent municipal base is part of the solution to the demand for information on other political and administrative level users and consumers of agricultural information. The Indicators and methodologies can be supplemented from the municipality to the national level and national level to the municipality. There will be indicators generated from national level quarterly, semiannual, annual, triennial, quinquennial and other indicators will be generated from the municipal level and aggregated to the departmental and national levels biannual and annual within the context of efficiency and completeness of product agricultural. The realization of the above model can work with the guilds agricultural production for long term, starting with participation in the III CNA, with cost efficiencies of field operatives and socialization and internalization of research at the farming populations in the country. Also integrating the guilds in the later generation of statistics would facilitate the taking of information, the production of unique indicators and overall system efficiency. An example of the above and that DANE is jointly developing with FEDEARROZ is the generation of territorial indicators at municipal area production and yield of rice machining (II National Census of Rice - 1999 and III National Census of Rice -2007) and then structured three methods of statistical research for the production of some conjunctural indicators on a monthly, semiannual and other area, production and performance, partial censuses, administrative record level of 15 irrigation districts, and sampling of items (information at the department and department group) as follows. Based on the indicators generated during one decade of research is underway production forecasts using time series methods

Figure 5. Generating indicators Mechanized rice at the national level, from a territorial view of statistics.



Source: Dane - Fedearroz, SEA, 2010.

Figure 6. Geographical disaggregation of the indicators of mechanized rice



Source: Dane - Fedearroz, SEA, 2010.

## 7. NATIONAL STATISTICAL SYSTEM –SEN AND THE REGIONAL AGRICULTURAL STATISTICS

According to DANE, the National Statistical System-SEN is: "The organizational structure and inclusive of all statistical activities carried out by sectoral and regional public institutions of the state or private agents of the latter, whose product, strategic statistical information shows the situation and interdependence of economic, environmental, demographic and social, as well as its relationship to the physical and territorial space (Garcia 1999:9). The Dane is responsible for the regulation and coordination of the system through policies, rules, tools and standards to the production of strategic statistical information quality, timeliness, comparability, relevance and a harmonized. The SEN is part of a universe that contains statistical information (environmental, social and economic) and non-statistical. Also SEN to ensure current, relevant and territorial, have instruments such as the National Strategy for Statistical Development (ENDE), National Strategic Plan for Statistics (Pendes) Accelerated Data Program (PAD); information maps sectoral; Statistical Information System to Support Territorial (SIEAT) standardization of methodologies, best practices for statistical development; reports Regional Economic situation (ICER), ensuring of quality information statistical strategic, nomenclatures and classifications. DANE has developed and made available to the general public the methodology of

This is a starting point that contains the techniques, procedures and tools for developing statistical plans, as well as basic guidelines for the constitution and territorial systematization of statistical information, under the National Statistical System (SEN). Strategic Territorial Planning Statistics (PEET). Complementary to the above DANE has been constructed Statistical Information System to Support Territorial-SIEAT, created to provide relevant and strategic spatial information which will help for the design, monitoring and evaluation of programs and policies to be implemented in a geographical determined. The system's objective is to provide information within the territory to support the decision making processes of planning, implementation and evaluation of territorial and national administrations. The result is a statistical information system with information from various entities of national and territorial levels.

- Database of indicators and metadata from the municipal, departmental and national.
- Periodic information, indicators and metadata from different statistical operations.
- It is currently developing the query module, whose structure includes 5 thematic areas, 16 subjects including agriculture and 33 subtopics.

## CONCLUSIONS

It is recognized that the production of territorial agricultural statistics is very limited, has been mixed, diverse, non-integrated and comes from different sources, where it has privileged the national, regional and municipal level marginalized.

However today the territorial agriculture and forest statistics in Colombia have advanced a conceptual framework (SEN, ENDE, PENDES, SIEAT, AGRONET, SIPSA, FEDECAFE-SICA, AUGURA-BANATURA, CENICAÑA -AEPS, FEDEARROZ, FEDEPALMA-SISPA, FEDEPANELA-SIPA FEDEGAN-SINIGAN) where takes into account the current development of DANE, MADR, the agricultural production guilds, departments and municipalities, likewise the recommendations of the FAO, USDA, EUROSTAT, OCDE. Also today have large conceptual advances and information technology (database systems advanced, scalable, network consultation systems, mobile systems capture, web capture systems, GIS, digital photogrammetry, image satellite and Aerial photographic) and agreement to advance in the right direction, as has been raising the Agricultural and Rural Statistical System-SEA DANE. In this context, the SEA requires technical leadership, institutional consensus between producers and users, role differentiation and gradual development and assertive in all its parts (institutions, norms and standards, methodologies, regulations, administrative and financial). Always keep in mind that Colombia faces an international environment increasingly complex, competitive and interdependent that became a reality with the signing of free trade, TLC. Also the environment in agriculture is more important against the global phenomenon of climate change and the SEA in this context, becomes a strategic competitive factor.

## BIBLIOGRAPHY

ADRIÁN RODRÍGUEZ Y MILAGRO SABORÍO -2007. Algunas Consideraciones sobre la Definición y Medición Rural. IICA, Proyecto Definición de lo Rural – y Urbano. San José de Costa Rica, Costa Rica. 18 p.

ARBIA GIUSEPPE and ESPA GIUSEPPE, 2001. Optimal Spatial Sampling Strategies for Agricultural and Environmental Data. Department of Sciences, Faculty of Economics, University G. D annunzio. Conference on Agricultural and Environmental Statistical Applications in Rome. Rome, Italy. 10 p.

BANCO MUNDIAL, 2004. Colombia, Una Política de Tierras en Transición. Doc. No. 29 de agosto de 2004. Documentos CEDE, ISSN 1657-5334. Bogotá, Colombia. 97 p.

CORPORACIÓN COLOMBIA INTERNACIONAL, 2009 – 2010. Resultado del Proceso de Siembras y Producción de Algodón. Región Costa - Llanos 2009-2010. Reportes de Oferta Agropecuaria. Sistema de Información de la Oferta Agropecuaria. Bogotá, Colombia. 43 p.

DANE\_MADR, 1995 al 2005. Encuesta Nacional Agropecuaria. Bogotá, Colombia.

DANE-FEDEARROZ, 2000-2010. Encuesta Nacional de Arroz Mecanizado. Bogotá, Colombia. 30 p.

DANE, 2005. Censo General 2005, Censo General 2005, Nivel Nacional. Bogotá, Colombia. 501 p.

DANE, 2005. Metodología Censo General 2005. Colección Documentos – Actualización 2009 Núm. 86. Bogotá, Colombia. 230 p.

DANE, 2007. Colombia Una Nación Multicultural. Su Diversidad Étnica. Dirección de Censos y Demografía. Bogotá, Colombia. 47 p.

DANE, 2003. Censo de Plantaciones Forestales Comerciales del departamento de Antioquia. Bogotá, Colombia. 56 p.

DANE-FEDEPAPA, 2002. I Censo Nacional del Cultivo de Papa en el Departamento de Cundinamarca. Bogotá, Colombia. 44 p.

DANE-ASOHOFRUCOL, 2002. Censo Hortícola de la Sabana de Bogotá. 29 p.

DANE, 2005. Censo de Plantaciones Forestales Comerciales, Comerciales – Protectoras y Protectoras del Departamento de Magdalena. Bogotá, Colombia. 54 p.

DANE-FEDEGAN HUILA, 2002. Censo Pecuário Bovino del departamento del Huila. Bogotá, Colombia.

DANE, 2008. Encuesta Nacional de Desempeño Agropecuario -ENDA. Bogotá, Colombia. 68 p.

DANE-CONALGODON, 2003. Áreas Cosechadas en Algodón, Producción y Transformación. Región del Interior semestre A y B. Bogotá, Colombia. 31 p.

DANE, 2009. La Estadística Estratégica del Sector Agropecuario en Colombia: Un Nuevo Modelo de oferta. Revista de la Información Básica, Vol. 3. No.2 Diciembre de 2009. Bogotá, Colombia, 14 p.

DANE, 2010. Instrumentos para el Fortalecimiento del Sistema Estadístico Nacional. Estrategia para el Fortalecimiento Estadístico Territorial. Herramientas estadísticas para una gestión territorial más efectiva. Bogotá, Colombia. 58 p.

DANE, 2009. Metodología Cuentas Nacionales de Colombia, año base 2.000. Tomos 1, 2 y 3. Colección documentos – Actualización 2009, Número 87. Bogotá, Colombia. 58 p.

DNP, 2000. Unidad Agrícola Familiar, Promedio Municipal. Manual Metodológico para la determinación de la Unidad Agrícola Familiar Promedio Municipal. Dirección de Desarrollo Agrario y Dirección de Desarrollo Social. Bogotá, Colombia. 40 p.

DNP, 2011. Plan Nacional de Desarrollo: 2010-2014. Prosperidad para Todos. Bogotá, Colombia. 591 p.

FAO, 1982. Estadística agrícola: Estimación de las Superficies y de los Rendimientos de los Cultivos. Dirección de estadística departamento de política económica y social. Roma, Italia. 192 p.

FAO, 1996. Encuestas agrícolas con múltiples marcos de muestreo. Vol1, Encuestas Basadas en métodos de Muestreo de Áreas y Explotaciones. Roma, Italia. 141 p.

FAO, 2007. Un sistema integrado de censos y encuestas agropecuarias. Volumen 1, Programa Mundial del Censo Agropecuario 2010. Roma, Italia.

FAO, 2004. Relationships to considerer when Planing the Population and Housing. Census and the Agriculture Census. Distrito Federal, México. 7 p.

FAO, 2004. Improving cost – effeteness and relevance of Agricultural censuses in África: Linking population and Agricultural censuses. Naman Keita. Senior Statistician. FAO Regional Office for África, Ghana. Distrito Federal, México. 9 p.

FEDEARROZ - DANE, 2008. I, II y III Censos Nacionales Arroceros, 2007, 1998, 1988. Bogotá, Colombia. 196 p.

FEDERACAFE, 1974. Atlas Cafetero de Colombia. Censo Cafetero de 1970. Bogotá, Colombia.

FEDERACAFE, 1982. Censo Cafetero de 1980. Bogotá, Colombia.

FEDERACAFE, 1993. Sistema de Informacion Cafetera. Encuesta Nacional Cafetera, Manual de Procedimientos. Santafé de Bogotá, Colombia.

FEDERACAFE, 1993. Censo Nacional Cafetero. Sistema Información Cafetera -SIC, 1993. Bogotá, Colombia.

FEDERACAFE, 2000. Muestra Maestra de la Zona Cafetera. Submuestra de la Cosecha Cafetera. Gerencia Técnica, Oficina de Estudios y Proyectos Básicos, Programa de Información por Encuestas. Bogotá, Colombia. 77 p.

GENOVESE GIAMPIERO, 2001. Recent Development in the Crop Forecasting System of the MARS Project of the JRC - EC. Joint Research Centre, EC, Space Application Institute, Ispra (VA) Italy. Conference on Agricultural and Environmental Statistical Applications in Rome. Rome, Italy. 4 p.

GILPIN ALAN, 2003. Economía Ambiental. Un Análisis Crítico. Alfaomega. México, D.F. 334 p.

GSCHWANTNER THOMAS, KARL GABLER, KLEMENS SCHADAUER, and PETER WEISS, 2009. Development of the Austrian National Forest Inventory. Viena, Austria. 270 p.

HART D. ROBERT (1985). Agroecosistemas, Conceptos Básicos. Centro Agronómico Tropical de Investigación y Enseñanza. Turrialba, Costa Rica.

HIMAT, 1985. Instituto de Hidrología, Meteorología y Adecuación de Tierras. 1985. Inventario de Cuencas Hidrográficas en Colombia. III Congreso de cuencas Hidrográficas en Cali - Bogotá.

HOUSEMAN, E.E. (1975) Area Frame Sampling in Agriculture. Statistical Reporting Service, SRS No.20, USDA Washington.

IBGE, 1996. Pesquisa Objetiva de Previsão de safras. Metodologia. Fundação Instituto Brasileiro de Geografia e Estatística. Diretoria de Pesquisas. Departamento de Agropecuária. São Paulo, Brasil. 85 p.

IDEAM, MINISTERIO DEL MEDIO AMBIENTE, PNUD, 2001. Primera Comunicación Nacional ante la Convención Marco de las Naciones Unidas sobre el Cambio Climático, Bogotá, Colombia.

IGAC, 2007. Gestión Catastral. Número Especial Estadísticas Catastrales 2000 – 2007. Análisis Geográficos, Revista del IGAC No. 34. Bogotá, Colombia. 296 p.

KALMANOVITZ S. y LÓPEZ E.E., 2006. La Agricultura Colombiana en el Siglo XX. Fondo de Cultura Económica. Bogotá, Colombia. 433 p.

KISH, L., Survey Sampling, John Wiley and Sons, Inc., New York 1965.

KISH, L. -1990. Métodos de muestreo para las encuestas agrícolas. Colección FAO: Desarrollo Estadístico No. 3, Roma.

LOETSCH F, HALLER KE, 1964. Forest Inventory. Vol. 1. Statistics of forest inventory and information from Aerial Photographs. BLV Verlagsgesellschaft, München, Basel, Wien, 440 p.

MADR-IICA, 1995. Censo del Minifundio en Colombia. Bogotá, Colombia. 180 p.

Ministerio de Agricultura, 1993. Diseño Institucional del Sistema de Información del Sector Agropecuario de Colombia – SISAC. Diseño Técnico del Módulo de Área, Rendimiento y Producción, MAPRE. Agricultural Assessments International Corporation. Bogotá, Colombia.

Ministerio de Agricultura y Desarrollo Rural, 2001. Sistema de Información Rural y Agrícola. Corporación Latinoamericana Misión Rural Sistemas Especializados de Información SEI S. A. Bogotá, Colombia. 140 p.

Ministerio de Agricultura y Desarrollo Rural y CCI, 2006-2009. Encuesta Nacional Agropecuaria 2006, 2007, 2008 y 2009. Bogotá, Colombia. 194 p.

Ministerio de Agricultura y Desarrollo Rural y CCI, 2009. Evaluaciones Agropecuarias a nivel Nacional. Bogotá, Colombia. 420 p.

Ministerio de Agricultura y Desarrollo Rural, 2004-2008. Anuario Estadístico de Frutas y Hortalizas 2004 – 2008 y sus Calendarios de Siembras y Cosechas. Dirección de Política Sectorial. Bogotá, Colombia. 290 p.

Ministerio de Agricultura y Desarrollo Rural, 2003. La Cadena del Azúcar en Colombia. Observatorio Agrocaldas. Colombia. Bogotá, Colombia. 25 p.

Ministerio de Agricultura y Desarrollo Rural, 2005. La Cadena de Banano en Colombia. Observatorio Agrocaldas. Colombia. Bogotá, Colombia. 51 p.

Ministerio de Agricultura y Desarrollo Rural, 2005. La Cadena del Caucho en Colombia. Observatorio Agro cadenas. Documento de trabajo No. 63. Colombia. Bogotá, Colombia. 40 p.

Ministerio de Agricultura y Desarrollo Rural, 2005. La Cadena de Algodón en Colombia. Una Mirada Global de su Estructura y Dinámica, 1991 - 2005. Observatorio Agro cadenas. Documento de trabajo No. 53. Colombia. Bogotá, Colombia. 40 p.

Ministerio de Agricultura y Desarrollo Rural, 2005. La Cadena de Arroz en Colombia. Una Mirada Global de su Estructura y Dinámica, 1991 - 2005. Observatorio Agro cadenas. Documento de trabajo No. 52. Colombia. Bogotá, Colombia. 40 p.

Ministerio de Agricultura y Desarrollo Rural, 2005. La Cadena del Cacao en Colombia. Una Mirada Global de su Estructura y Dinámica, 1991 - 2005. Observatorio Agro cadenas. Documento de trabajo No. 58. Colombia. Bogotá, Colombia. 51 p.

Ministerio de Agricultura y Desarrollo Rural, 2005. La Cadena Forestal y Madera en Colombia. Una Mirada Global de su Estructura y Dinámica, 1991 - 2005. Observatorio Agro cadenas. Documento de trabajo No. 64. Colombia. Bogotá, Colombia. 44 p.

Ministerio de Agricultura y Desarrollo Rural, 2003. La Cadena de Oleaginosas, Aceites y Grasas en Colombia. Observatorio Agro cadenas. Colombia. Documento de trabajo No. 2. Bogotá, Colombia. 11 p.

Ministerio de Agricultura y Desarrollo Rural, 2005. La Cadena Agroindustrial de la Panela en Colombia. Una Mirada Global de su Estructura y Dinámica, 1991 - 2005. Observatorio Agro cadenas. Documento de trabajo No. 57. Colombia. Bogotá, Colombia. 24 p.

Ministerio de Agricultura y Desarrollo Rural, 2005. La Cadena de la Papa en Colombia. Una Mirada Global de su Estructura y Dinámica, 1991 - 2005. Observatorio Agro cadenas. Documento de trabajo No. 54. Colombia. Bogotá, Colombia. 30 p.

Ministerio de Agricultura y Desarrollo Rural, 2005. La Cadena del Tabaco en Colombia. Una Mirada Global de su Estructura y Dinámica, 1991 - 2005. Observatorio Agro cadenas. Documento de trabajo No. 55. Colombia. Bogotá, Colombia. 44 p.

Ministerio de Agricultura y Desarrollo Rural, 2005. La Cadena del Plátano en Colombia. Una Mirada Global de su Estructura y Dinámica, 1991 - 2005. Observatorio Agro cadenas. Colombia. Bogotá, Colombia. 20 p.

Ministerio de Agricultura y Desarrollo Rural, 2005. La Cadena de la Molinería, Repostería y Panadería en Colombia. Una Mirada Global de su Estructura y Dinámica, 1991 - 2005. Observatorio Agro cadenas. Documento de trabajo No. 61. Colombia. Bogotá, Colombia. 40 p.

Ministerio de Agricultura y Desarrollo Rural, 2005. La Cadena de Cereales, Alimentos Balanceados para Animales, Avicultura y Porcicultura en Colombia. Una Mirada Global de su Estructura y Dinámica, 1991 - 2005. Observatorio Agro cadenas. Documento de trabajo No. 51. Colombia. Bogotá, Colombia. 56 p.

Ministerio de Agricultura y Desarrollo Rural, 2005. La Industria Procesadora de Frutas y Hortalizas en Colombia. Observatorio Agro cadenas. Colombia. Bogotá, Colombia. 52 p.

Ministerio de Agricultura y Desarrollo Rural, UN, IAvH Y CÁMARA DE COMERCIO, 2010. Agenda prospectiva de Investigación y Desarrollo Tecnológico para la Cadena Productiva de Plantas Aromáticas, medicinales, Condimentarias y Afines con Énfasis en Ingredientes Naturales para la Industria Cosmética en Colombia. Bogotá, Colombia. 184 p

Ministerio de Agricultura y Desarrollo Rural, UN y BIOGESTIÓN, 2010. Agenda Prospectiva de Investigación y Desarrollo Tecnológico para la Cadena Productiva de Mango Criollo Procesado para la Exportación en Colombia. Bogotá, Colombia. 175 p

Ministerio de Agricultura y Desarrollo Rural, UN y CORPOICA, 2009. Agenda Prospectiva de Investigación y Desarrollo Tecnológico para la Cadena Productiva de Uchuva en Fresco para Exportación en Colombia. Bogotá, Colombia. 152 p.

NEALON, J.P. (1984) Review of the Multiple Frame Estimators. Statistical Reporting Service, SRS No. 80, USDA, Washington.

## Colombian agricultural statistics system, SEA. Dane

OECD, 2001. Agricultural Policies in OECD Countries, Monitoring and Evaluation 2001.

OECD, 2000. Agricultural Policies in Emerging and Transition Economies.

OKAMOTO K and FUKUHARA M., 1995. Estimation of paddy field area using the area ratio of categories in each mixel of Landsat TM. Division of Changing Earth and Agro-Environment, National Institutes of Agro-Environmental Sciences, 3-1-1 Kannondai, Tsukuba-shi, Ibaraki 305, Japan.

OTÁÑEZ GUILLERMO, 2007. Seminario Taller sobre Sinergia de las Operaciones Censales. Reunión del Grupo de trabajo FAO/IICA sobre estadísticas Agropecuarias. Aguascalientes, México. 24 p.

OTÁÑEZ GUILLERMO. (1988). Metodología del Muestreo Agrícola de Áreas en Colombia. Ministerio de Agricultura, Sistema de Estadísticas Agropecuarias por Muestreo (SEAM). Bogotá, Colombia.

RAO J,N,K, 2001. Small Area Estimation with Applications to Agriculture. Conference on Agricultural and Environmental Statistical Applications in Rome. Rome, Italy. 10 p.

RODRIGUEZ CASTILLA AMADEO, 2007. El Sistema Estadístico Nacional Agropecuario y Desarrollo Rural - SENADER. Bogotá, Colombia.

RONDEUX J, 1999. Forest inventories and Biodiversity. Unasylva 196:35-41.

TORRES JOSE EDDY, 2007. Evaluación y Conceptualización de un Sistema de Información Agropecuario. Proyecto MIDAS, Componente de Políticas. Bogotá, Colombia. 45 p.

VOGEL, F.A. (1986) Sample Design and Estimation for Agricultural Sample Surveys. Statistical Reporting Service, USDA, Washington.

UNITED STATES DEPARTMENT OF AGRICULTURE. 1983. Scope and methods of the statistical reporting service. Miscellaneous publication number 1308. Washington D. C. EE.UU.

UNITED STATES DEPARTMENT OF AGRICULTURE. 1987. Basic Agricultural Survey Statistics and Methods. National Agricultural Statistics Service. Washington D. C. EE.UU. 350 p.

UNITED STATES DEPARTMENT OF AGRICULTURE. 1996. Area Frame Point Sampling. An Exploratory Study to Measure Nicaragua Agricultural Production. National Agricultural Statistics Service Washington D. C. EE.UU. 44 p.