EX-POST EVALUATION

Final Report

"RESEARCH PROJECT FOR SOY PRODUCTION IN PARAGUAY"

Prepared By:

- Idelín Molinas Vega
- José Buttner
- José Ibarra
- Osvaldo Peralta

In collaboration with:

- Mirna Vera

INSTITUTO Desarrollo

JICA

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Third Party Review by External Experts

Ex-Post Evaluation on *the " RESEARCH PROJECT FOR SOY PRODUCTION IN PARAGUAY"*

** This Third Party Review by External Experts is to examine the end-product (an evaluation report and a summary sheet) of ex-post evaluation of the above-mentioned project in light of its structure, verification procedure and overall consistency. It is to be noted that the review is not to question the validity of the evaluation results per se.*
** On the leftmost column of each item, choose the rating from A as 'excellent', B as 'good', C as 'acceptable' and D as 'unacceptable'.*
** When you choose D for an item, specify the reason in comment fields.*
** For more details of viewpoints for each item, refer to the corresponding page of 'JICA Project Evaluation Guideline' which is indicated on the rightmost column of each item.*

1 Evaluation Framework

		Reference page No. of 'JICA Project Evaluation Guideline'
B	(1) Time Frame of Evaluation Study	97
Viewpoint	Necessary field survey activities such as data collection and discussion with counterparts are appropriately set within the time frame of the evaluation study. Time frame also contains preparations such as distribution of questionnaires, and are appropriate in terms of timing, length and schedule of the evaluation study.	
B	(2) Study Team	107
Viewpoint	Team members are assigned on a impartial basis, and are with balanced specialty.	
Comments		

2 Date Collection and Analysis

B	(1) Evaluation Questions	51
Viewpoint	Evaluation questions are in line with evaluation purposes and set properly in the evaluation grid. General questions as to the five evaluation criteria are narrowed down to more specific sub questions to identify necessary information/data to be collected.	
B	(2) Data Collection	72
Viewpoint	Data collection is conducted based on the evaluation grid, and is sufficient for obtaining answers for evaluation questions. Additional information are collected for unexpected and newly confronted questions during the process.	
B	(3) Measurement of Results	61
Viewpoint	Achievement level of overall goal is examined on the basis of appropriate indicators, being compared with targets.	
B	(4) Examination of Causal Relationship	62
Viewpoint	The causal relationships whether the effects for the beneficiaries resulted from the project is examined either in a qualitative or quantitative manner (i.e. Are the effects at the overall goal level caused by the project intervention?)	
Comments		

3 Evaluation Results

C	(1) Impact	57, 85-86

Viewpoint	Perspectives for evaluation of 'Impact' (e.g. achievement level of the overall goal, causal relationships between the outcome of the project and overall goal, ripple effects) are substantially covered. Grounds for judgment are clearly stated in a convincing manner.	
C	(2) Sustainability	58, 85-86
Viewpoint	Perspective for evaluation of 'Sustainability' (e.g. probability of activities to be continued and outcomes to be produced in terms of 1)policies and systems, 2) organizational and financial aspects, 3) technical aspects, 4) Society, Culture and environment and) are substantially covered. Grounds for judgment are clearly stated in a convincing manner.	
C	(3) Factors Promoting Sustainability and Impact	85-86
Viewpoint	Promoting factors on 'Impact' and 'Sustainability' are analyzed properly based on the information obtained through evaluation process.	
C	(4) Factors Inhibiting Sustainability and Impact	85-86
Viewpoint	Inhibiting factors on 'Impact' and 'Sustainability' are analyzed properly based on the information obtained through evaluation process.	
B	(5) Recommendations	87-88
Viewpoint	Recommendations are made thoroughly based on the information obtained through the process of data analysis and interpretation. Recommendations are specific and useful for feedbacks and follow-ups, preferably being prioritized with a time frame.	
B	(6) Lessons Learned	87-88
Viewpoint	Lessons learned are derived thoroughly based on the information obtained through the process of data analysis and interpretation. Lessons learned are convincing and useful for feedbacks, being generalized for wider applicability.	
Comments		

4 Structure of Report

B	(1) Writing Manner	89,103
Viewpoint	Logical structure and major points are clearly described in an easily understandable manner.	
B	(2) Presentation of Primary Data and Utilization of Figures	89,103
Viewpoint	Sufficient primary data such as on the target, contents and results of interviews and questionnaires are presented properly in the report. Figures and tables are utilized effectively to present statistics and analysis results.	
Comments		

5 Overall Review based on 'Criteria for Good Evaluation'

B	(1) Usefulness	13-14
Viewpoint	In light of the effective feedback to the decision-making of the organization, clear and useful evaluation results are obtained.	
B	(2) Impartiality and Independence	13-14
Viewpoint	Evaluation is impartially conducted in a neutral setting	
B	(3) Credibility	13-14
Viewpoint	In light of the specialties of evaluators, transparency of the evaluation process and appropriateness of the criterion of judgment, evaluation information are credible.	
C	(4) Participation of Partner Countries	13-14
Viewpoint	Partner countries' stakeholders participate actively in the process of evaluation, not just provide information.	
Comments		

Overall Comment

The perception of the projectors concerning to the influence of CRIA in the contribution to the investigation and the identification of new areas appropriate for the cultivation and the validation of appropriate technologies of cultivation, is not correct since its contribution as an institution was always very poor. In later comments we can notify that where they develop more deeply points like how CRIA took actions in the project, the author modified his concepts through comments like "lack of efficient diffusion mechanism in MAG..." , etc.

A not clear focus point could be found in the explanation about the cultivation areas, where it is quoted about the 50 ha of soybean cultivation in the department of Misiones in the beginning of the project and the 13,500 ha (right now this number has already increased to 16,000) of the actuality. We believe that this phenomenon can not be explained as the effect of the project like the report shows, but the real reason can be found purely in the situation of the market and in the expansion of the soybean cultivation at the eastern area of the country.

However, this comments do not disapprove the quality of the report.

What happens here is that the evaluators of impact and sustainability can only see the reality of this matters through interviews and comments of others. The perception of those who actually work in the field everyday is totally different.

Date: **July 20th, 2006**

Name of the Third Party: **Ing. Agr. Luis E. Cubilla R.**

Designation: **Agricultural Field Advisor**

Name of the Institution: **Cámara Paraguaya de Exportadores de Cereales y Oleaginosas - CAPECO**

Index

Abbreviations

MAG	Ministerio de Agricultura y Ganadería (Ministry of Agriculture and Livestock)
CRIA	Centro de Investigación Agrícola (Regional Center for Agricultural Research)
DIA	Dirección de Investigación Agrícola (Directorate of Agricultural Research)
DEAG	Dirección de Extensión Agraria (Directorate for Agricultura Extension)
JICA	Japan International Cooperation Agency
DISE	Dirección de Semillas (Directorate for Seeds)
PRISOJA	Programa de Investigación de la Soja (Soybean Research Program)
CETAPAR	Centro Tecnológico Agropecuario en Paraguay (Center for Agricultural Technology in Paraguay)
DGEEC	Dirección General de Estadísticas, Encuestas y Censos (General Directorate for Statistics, Surveys and Census)
BCP	Banco Central del Paraguay (Central Bank of Paraguay)
PIB	Producto Interno Bruto (Gross National Product)
USDA	United States Department of Agriculture
CAPECO	Cámara Paraguaya de Exportadores de Cereales y Oleaginosas (Paraguayan Chamber of Cereals and Oily Seeds Exporters)
CAH	Crédito Agrícola de Habilitación (Agricultural Credit Agency)
FDC	Fondo de Desarrollo Campesino (Peasant Development Fund)
SCN	Soybean Cyst Nematode.
APAM	Asociación de Productores Agrícolas de Misiones (Association of Agricultural Producers of Misiones)
DCEA	Dirección de Censo y Estadísticas Agropecuarias (Directorate of Agricultural Census and Statistics)
SEAM	Secretaría del Medio Ambiente (Secretariat for the Environment)
MSP y BS	Ministerio de Salud Pública y Bienestar Social (Ministry of Public Health and Social Wellbeing)
MIC	Ministerio de Industria y Comercio (Ministry of Industy and Commerce)

1.- INTRODUCTION

1.1.- Project Background

Soybean production improvements and increased value added at local level are still priorities inside the National Improvement Plan of the Paraguayan Government. Soybean production is considered as an strategic sector within the government's development program, and Soybean Research Program (PRISOJA-Programa de Investigación de la Soja) is still underway for the improvement in productivity in soybean production.

From an income generation point of view, one must consider that the Paraguayan economy is the most agrarian one of South America. Approximately a third of the GNP (Gross National Product), comes from the farm sector and a fifth part comes from de agricultural sector [see Table 1.1.1]. Within this, soybean production is the greatest contributor to agricultural production and its share increases constantly. Also, the farming sector absorbs about un third of Paraguay's labor force (DGEEC 1993, 1999) and contributes with 65% of the registered exportations of goods (BCP 1999).

The farming sector structure in 1990 was built with a 62% of the agricultural sector, 27% from livestock production and 11% by others (forest, fishing and hunting). By 2000, the agricultural sector was built on 59% agricultural, 30% livestock and 11% others. In 2003, the composition was 67% agricultural, 25% livestock and 8% others.

The most important products inside the agricultural sector in 2003 were soybean (39%), manioc (17%), sweet corn (8.5%), wheat (7%), sugar cane (3.6%) and cotton (3%).

We observe a continuous stagnation of labor intensive agriculture in contrast with the expansion of capital intensive agriculture (Table [1.1.2]). By 1990, labor intensive agricultural products comprised 35% of the sector production, and capital intensive agricultural products comprised 26% (Figure [1.1.2]). By 2000, labor intensive agricultural products dropped to 25% of the production of the agricultural sector, and capital intensive ones comprised 42%. By 2003, labor intensive agricultural products comprised only 21%, whereas capital intensive ones rose to 46%.

Table [1.1.1]: Production Sector Structure (in percentages)

Description	Año					
	1990	1995	2000	2003*	1990-2000	2000-2003
Agriculture	17,20%	16,10%	15,90%	20,50%	1,20%	9,90%
Livestoc k	7,50%	7,50%	8,10%	7,60%	2,70%	-1,10%
Explotación Forestal	2,70%	2,80%	2,90%	2,50%	2,50%	-4,00%
Caza y pesca	0,10%	0,10%	0,10%	0,10%	2,60%	0,70%
Sub-total producción						
Bienes agropecuarios	**27,50%**	**26,50%**	**27,00%**	**30,60%**	**1,70%**	**5,40%**
Mining	0,50%	0,50%	0,50%	0,40%	2,70%	-9,30%
Industry	16,10%	14,80%	14,30%	13,50%	0,80%	-1,00%
Construction	5,20%	5,30%	5,70%	3,90%	2,80%	-11,10%
Sub-total producción otros bienes	**21,80%**	**20,60%**	**20,40%**	**17,70%**	**1,30%**	**-3,80%**
Total producción bienes	**49,30%**	**47,10%**	**47,40%**	**48,30%**	**1,60%**	**1,60%**
Electricity	2,80%	4,70%	6,50%	6,60%	11,00%	1,60%
Agua y servicios sanitarios	0,40%	0,50%	0,50%	0,50%	3,40%	3,80%
Comunication and Transport	4,60%	4,70%	5,60%	6,10%	4,10%	3,50%
Sub-total servicios básicos	**7,80%**	**9,90%**	**12,70%**	**13,30%**	**7,00%**	**2,60%**
Comercio y finanzas	26,40%	26,00%	20,60%	19,80%	-0,50%	-0,40%
General Government	4,50%	5,10%	6,30%	5,40%	5,40%	-4,10%
Housing	2,60%	2,70%	2,90%	2,90%	3,00%	1,20%
Other services	9,40%	9,20%	10,20%	10,40%	2,80%	1,50%
Sub-total otros servicios	**42,90%**	**42,90%**	**40,00%**	**38,40%**	**1,20%**	**-0,30%**
Total producción servicios	50,70%	52,90%	52,60%	51,70%	2,30%	0,40%
Producto Interno Bruto a Precios de Mercado	100,00%	100,00%	100,00%	100,00%	2,00%	1,00%

Source: Central Bank of Paraguay. National Accounts Bulletins Números. 37 y 40.

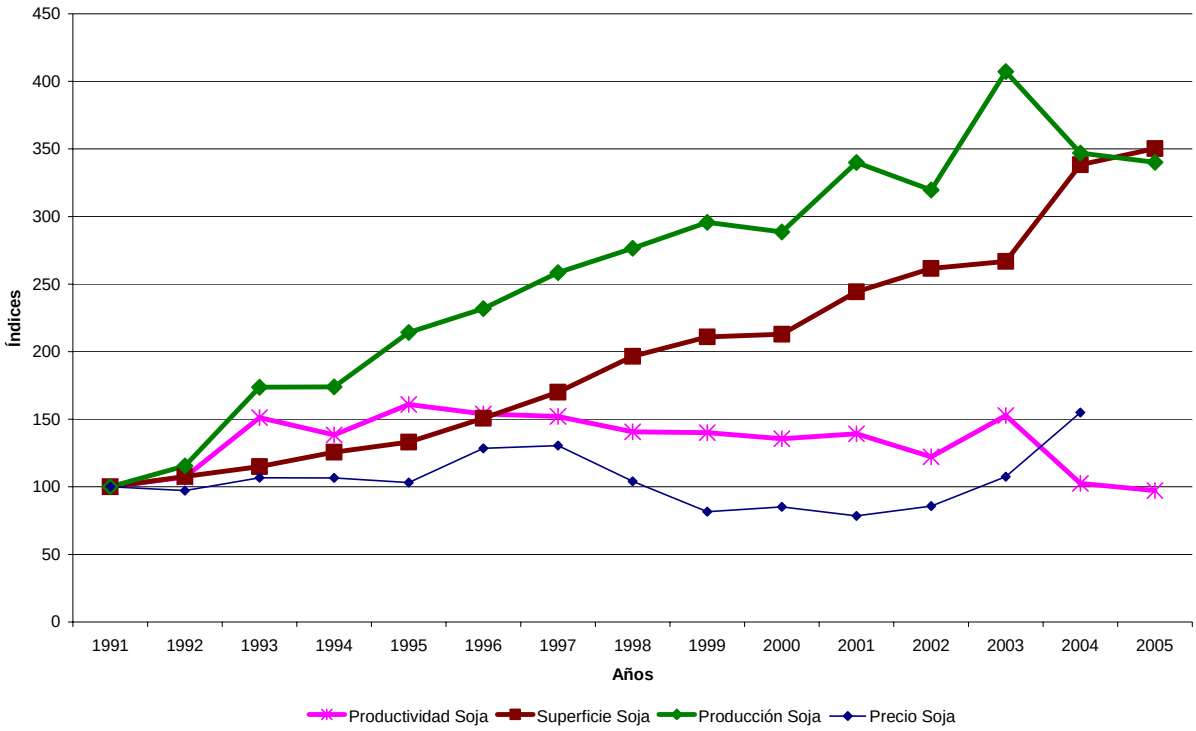
Table [1.1.2]: Participation of main crops in Agricultural GNP (%)

Rubros	Year			
	1990	1995	2000	2003
Intensivo en mano de obra				
Algodón en rama	14,5	11,3	5,9	3
Caña dulce	4,1	4,1	3,3	3,6
Hortalizas y legumes	4	4,8	4,8	4,3
Fruits and Vegetables	12,7	10,9	11,4	10,2
Sub-total:	**35,3**	**31,1**	**25,4**	**21,1**
Intensivo en capital				
Soy	18,8	28,7	37,6	38,8
wheat	7,4	3,8	4,1	6,9
Sub-total:	**26,2**	**32,5**	**41,7**	**45,7**
Rubros Mixtos:				
Sweetcorn	5,2	9,2	7,1	8,5
Mandioca	14,3	15,8	13,7	17,2
Sub-total:	**19,5**	**25**	**20,8**	**25,7**

Source: **:** Central Bank of Paraguay. National Accounts Bulletins Números. 37 y 40.

The price of soybean in international markets has presented an ascending tendency within the 1991/1997 period, has declined in the years 1997/2001 and has subsequently increased within the 2001/2004 period. (Figure [1.1.1]). We observe that the hectares cultivated of soybean have increased still in periods of deterioration of the international prices. This would be indicating that the decisions of production responds better to long-range expectations rather than to reactions of profit value of short time limit.

Figure [1.1.1]: Evolution of Cultivated Surface, Production, Productivity and International Market Prices Indices. Years: 1991-2004.



Soybean plays a central role in the generation of Paraguayan economy's income, characterized by continuous deficit in charge account and chronic deficit in the commerce of goods. Inside the commerce of goods, the contribution of the agriculture is emphasized and inside this sector the contribution of the soybean exports has a prominent place.

Table [1.1.3]: Exports by Aggregated Groups. Years: 1994-2000.

Description	Years						
	1994	1995	1996	1997	1998	1999	2000
Agriculture	432.975.946	513.825.341	584.026.724	660.303.403	590.240.807	425.931.611	439.711.726
Livestock and its by-products	131.583.613	128.306.222	132.398.965	136.110.753	160.029.086	94.034.584	128.289.178
Food industrially processed	40.774.252	61.708.662	105.938.595	130.053.763	89.648.385	74.183.881	94.726.063
Woods and its by-products (includes wickerwork)	78.898.387	89.426.951	94.124.191	99.853.512	69.568.018	58.527.206	412.070
Leathers and by products	65.878.852	58.705.477	42.766.437	42.665.137	39.046.158	37.287.888	131.372.759
Other industrial goods.	11.770.072	15.287.268	24.831.158	16.817.646	19.547.405	15.035.739	19.785.244
Mining Industry and its by-products	27.350.629	17.656.868	22.118.099	20.171.348	12.679.016	5.006.832	11.973.580
Textiles and clothing articles	6.577.058	9.304.809	14.350.398	14.480.894	13.101.793	13.225.080	23.272.635
Other farming-industrial goods	14.416.493	11.868.426	11.969.328	8.887.643	8.066.057	8.510.577	8.622.545
ChemicalProducts	6.078.295	11.499.704	9.921.884	12.680.774	11.495.122	8.843.433	10.993.614
Vehicles and tractors	0	1.708.652	951.699	661.622	561.631	131.664	113.281
Fishing	518.554	32.857	30.570	84.657	99.083	35.886	44.613
Art and Antiquities	10.796	0	8.483	0	20.600	0	40.000
Guarantees	0	0	8.594	7.394	0	15.070	0
Total	**816832947**	**919331237**	**1043445125**	**1142778546**	**1014103161**	**740769451**	**869357308**

Source: Own elaboration based on data from BCP-Department of International Economy.

The analysis of the classified exports registered within the 1994-2000 period, in aggregate groups, reveals the following:

(i) Agriculture contributed with 56% of the exports registered in that period, livestock and its by-products 14%, woods and its by-products 7,5%. That is to say, approximately the 78% of the registered exports come from the forest and farm sector.

(ii) The farming-industrial exports (food processed industrially and leathers and by-products) comprise 15,5% of the exports on the average within the indicated period.

(iii) As for the volatility of the different groups of exports, it can be emphasized that the less volatile one within the indicated period were livestock, followed by the agricultural ones.

(iv) The agro-industrial exports present a greater volatility that the farming exports.

(v) The agricultural exports register an increase during the 1994/1997 period, to register a descending tendency in the years 1998/2000. The decrease of the agricultural exports in the period 1998/2000 coincides with the descending tendency of the international prices for soybean and cotton.

[1]To account for volatility two measures were considered that present consistent results. The first one was the standard deviation of the exports on the value average of the same exports in the period under analysis. The second was the standard deviation of the indices of the exports by group of products.

Table [1.1.4]: Exports by Main Products (in thousands of dollars FOB) Period 1980-2004

Year	PRIMARY PRODUCTS						
	AGRICULTURAL					Llivestock	
	Cotton Fibers	Coffee	Tobacco	Yerba Mate	Soy	Meat	Leather
1980	104.546	2.303	10.142	1.930	42.098	1.054	3.117
1981	127.210	1.260	6.458	349	47.533	3	6.554
1982	120.550	307	5.947	168	89.612	2.075	6.768
1983	83.563	0	10.171	41	84.445	5.272	7.285
1984	130.530	108	15.253	178	99.338	4.585	7.112
1985	141.360	88	6.033	92	100.477	1.446	5.221
1986	80.271	0	5.448	137	43.867	33.918	9.732
1987	100.038	0	9.860	1.110	122.783	21.178	13.788
1988	209.381	0	5.970	11.321	153.816	23.104	16.716
1989	303.505	40.345	2.152	5.375	382.973	96.123	24.031
1990	328.925	20.520	5.685	2.191	267.429	133.709	27.787
1991	313.927	6.171	7.655	1.096	157.125	55.199	28.269
1992	200.298	1.102	6.893	283	137.221	47.496	37.454
1993	155.522	1.805	7.011	131	223.689	47.082	53.880
1994	151.725	1.767	6.943	199	222.259	55.419	62.995
1995	268.064	798	6.804	246	175.923	54.862	58.557
1996	188.146	846	8.816	113	324.157	46.826	41.959
1997	72.857	1.958	8.010	180	493.598	49.202	42.367
1998	75.419	718	8.222	265	440.315	69.462	38.803
1999	61.546	93	6.170	351	307.135	35.394	36.989
2000	78.493	385	3.673	297	285.924	72.728	56.082
2001	83.469	38	3.427	436	356.315	78.091	58.403
2002	35.961	149	4.309	650	340.684	72.471	57.588
2003	58.098	119	4.153	778	516.959	60.150	54.744
2004	109.763	62	5.707	340	575.924	161.157	53.216

Source: BCP, International Economy Department, 2005

The agricultural exports by main products are presented in the Table [1.1.4]. In the table the following aspects are to be emphasized:

(vi) The participation of soybean among the main agricultural products of export in the last decades is emphasized. Within the five main agricultural products of export, soybean had a participation of the 83% in the 2004, 78% in the 2000, 43% in 1990 and 26% in 1980.

(vii) Annual rates of growth of soybean exportations were of 20% in the eighties, 1% in the nineties and 20% in the period 2000-2004.

(viii) In the nineties, the export of soybean reached its maximum in 1998 in order to descend during the 1999/2000 period, due to the fall of its international prices.

From the point of view of production, the achieved quantities have constantly increased, as can be seen in Figure [1.1.1]. This production's increase has been a consequence,

mainly, of the increase of the cultivated extension, with little variation in the productivity. This situation has been aggravated by droughts during the last two years.

These droughts have diminished significantly the productivity. A similar situation is being observed during the present year (2005), and it affects mainly to the so called "early cycle" soybean varieties. According to estimations of technicians from the Cooperative Colonias Unidas, the loss in productivity would reach the 40% for the "*early cycle*" varieties, that is approximately the 60-70% of the sown surface.

Even in this situation, the Paraguayan production has been such that puts the country in sixth place among the world producers, and in fourth place among the world exporters. (Table [1.1.5])

Table [1.1.5]: Production Sectorial Structure (in percentages)

MAIN WORLD SOYBEAN PRODUCERS (Millions of tons)		MAIN WORLD SOYBEAN EXPORTERS (Millions of Tons)	
1. U.S.A.	85.48	1. U.S.A.	27.49
2. BRASIL	64.50	2. BRASIL	22.30
3. ARGENTINA	39.00	3. ARGENTINA	7.67
4. CHINA	18.00	*4. PARAGUAY*	*2.75*
5. INDIA	6.60	5. OTHER	2.53
6. PARAGUAY	*5.00*		
7. OTHER	12.19		

Source: USDA February 2005 – Zafra 2004/5.

The situation reflected in the previous table, is for itself is a clear sign of the high degree of competitiveness in the production of this commodity. This situation is perceived with clarity by the business producers of soybean in Paraguay. To this point, key stakeholders interviewed recently (Molinas and Ibarra, 2004), affirm that "the production of soybean in Paraguay is at the vanguard with respect to technological level. This, due to all the technology that is applying as for example direct sowing, support of the private sector (mainly multinationals companies); little participation of the State; high training level of producers and businessmen". Another key actor interviewed in the same study, affirms likewise "the level of our producers is very high; we are in (4º) fourth place in export on a worldwide basis, without any type of official support, without credits, without subsidies, and fundamentally without a State policy, and with environmental benefits with the new techniques used in the production". The stakeholder adds that "our production is among the best ones in the world, and stands out that our production does not have credits, subsidies and other advantages that countries such as US, Brazil, Argentina give to their producers".

As for the factors that had more impact in the improvement of the competitiveness of soybean, key stakeholders interviewed by Molinas and Ibarra (2004), as well as those interviewed for this work, coincide in indicating biotechnology -especially the use of genetically modified seeds-, direct sowing, management of information, modernization of the agricultural administration - achieved through continuous training-, agriculture of

precision based on the use of state-of-the-art equipment and tools, and soil analysis and adequate fertilization to each plot of cultivation.

By means of the genetic engineering it is possible to transfer genetic information of a live organism to another, although the species possess not affinity among themselves, in such way that it would be capable to express some characteristic that originally did not possess. Then a genetically modified organism (GMO) is the one that contains in its structure genes of another live being.

According to "Datos Agropecuarios" (2004), un-official estimations indicate that in Paraguay 70% of almost 2.000.000 of hectares that are sown with soybean, are cultivated with genetically modified materials introduced without control, from neighbor countries. It indicates likewise that Paraguay has more than the 60% of genetically modified soybean. Key actors interviewed, in independent form for this report, have indicated that the surface sown with genetically modified seeds oscillates between 70% and 90% of the cultivated area, varying according to the zone of the country. Palau (2004) establishes that the soybean sown is almost all genetically modified (90%) and introduced by means of contraband. Facetti (2002) mentions the 60% of the total of the soybean cultivated in the country is genetically modified.

1.2.- Project Overview

In January of 1996, the Republic of Paraguay issued a request of Technical Cooperation to the Government of Japan, for the purpose of undertaking themes related to diverse aspects of the improvement in the soybean production in the country.

Based to the previous request, JICA sent a Preliminary Study Team in January of 1997 and a Implementation Study Team in August of 1997. Both governments agreed to formulate a Research Project on the Production of Soybean in Paraguay for the purpose of increasing research capacity of the Regional Center for Agricultural Investigation (CRIA – Centro Regional de Investigación Agrícola) related to the genetic improvement, agronomy and management of soil in the production of soybean. In October of 1997, with the arrival of the long-term Japanese Team of Experts, the project began. In June of 2000, JICA sent the Advisory Team to conduct the Intermediate Evaluation jointly with the Paraguayan counterpart. The Advisory Study Team evaluated the progress of the project activities, recommending measures that should be taken for the operation of the Project in the remaining period. As a consequence they elaborated the Tentative Detailed Plan of Implementation (TDPI) included in the Appendix.

In March of 2002, the Joint Evaluation Committee for the Project Final Evaluation was established. The Evaluation Committee carried out an analysis of the results obtained and their relations to the purpose of the Project, finding that they had been reached or very next to be reached the goals of the project in the aspects of: relevance, efficacy, efficiency, impact and sustainability. Recommendations were made to be undertaken during the remaining period of the project and in the immediate subsequent one. The project was finished in September of 2002.

1.3.- Study Objectives

In order to evaluate the impact of the Research Project on the Production of Soybean in Paraguay on the Overall Goal of the project, the local office of JICA has entrusted Institute DESARROLLO to conduct and ex-post evaluation of the above mentioned project. The objective of the present study is to verify important aspects related to the Impact and the Sustainability of the mentioned project after it was finished. For this evaluation it must be kept in mind the Overall Goal of the project, as well as the Purpose of it.

The project's overall goal is:

"Stable productivity and an expansion of the production area of soybean will be achieved through the development of breeding techniques, sustainable agronomical techniques, and conveying of appropriate techniques to farmers in Paraguay, thus contributing to the stability and development of Paraguayan economy"

The project's purpose is:

"The research capability of CRIA related to breeding, agronomy and soil management in soybean production will be enhanced for the development of appropriate varieties and a sustainable cultivation system"

The evaluation of the present project will contribute to future decisions for the execution of projects in similar areas based on the lessons learned.

1.4.- Scope of Work

The emphasis of the work is centered in the evaluation of the results obtained by the project, and its impacts, within the Regional Center for Agricultural Research (CRIA), which reports to Directorate of Agricultural Investigation (DIA – Dirección de Investigación Agrícola) of the Ministry of Agriculture and Livestock (MAG).

The evaluation of the impacts of the project and the sustainability of it is based on the area of influence of the CRIA, with emphasis on the areas of more direct application of the covered aspects by the project.

1.5.- Evaluation Team

The evaluation team is composed by:

José Büttner: General Coordinator

José Ibarra: Field Work Coordinator

Idelin Molinas Vega: Processing and Analysis of Evaluations

Osvaldo Peralta: Interviews and Processing

Mirna Vera: Collected Information Processing

1.6.- Study Period

The study is developed between the months of November and December of 2.005, with sporadic interruptions to attend the availability of the workers and producers interviewed.

2.- EVALUATION STUDY APPROACH

2.1.- Methodology

The evaluation was carried out by means of the application of interviews, focal group, using the Project Cycle Management (PCM) methodology, emphasizing in the Impact and Sustainability to the counterpart institution, in this case, the Regional Center of Agricultural Research (CRIA). Likewise, interviews were carried out to members of the Direction of Agricultural Investigation (DIA), Producers, seed distributors, Producer's Associations and experts in the area of agricultural production.

For the collection of information, different sources were visited, such as: administrative offices of the DIA and CRIA, Central Bank of Paraguay, Direction of Statistical Agribusiness, library of the College of Agricultural Science (National University at Asunción) and Paraguayan Chamber of Exporters of Cereals and Oily Beans (CAPECO).

The collection of data and interviews were designed to obtain information which allows answering the specific and main questions formulated for this work, as well as to quantify the indicators, that are shown in the Evaluation Grind attached in the Appendix.

Based on collected data the degree of impact of the project was evaluated, reflecting the quantitative and qualitative changes; as well as factors that promote and inhibit the sustainability of the project were identified.

2.2.- Logical Framework

A copy of the Logical Framework used in the project is enclosed in the Appendix, as well as its components and activities.

The achievement of the project's purpose was verified through the available documentation, which has been previously evaluated by the Final Evaluation Team in March 2002.

3.- RESULTS

3.1.- Impact of the Project

3.1.1.- Policy Aspect

The evolution of soybean production in Paraguay has been in constant increase since the eighties, becoming the most important crop to support the country's economy. As mentioned before, the structure of the farm sector in 1990 was conformed of 62% of the agricultural sector, 27% of the livestock sector, and 11% by other (forest sector and hunt and fishing). In 2000, the sector was conformed by 59% agricultural, 30% livestock and 11% others. In 2003, the composition was of 67% agricultural, 25% livestock and 8% others.

The surface covered with soybean increased continuously in recent years, even in times of international prices drops, or as a result of two consecutive years of drought during soybean growing periods.

The importance of the information previously presented can be appreciated if we visualize it through the lines of investigations that the CRIA has pursued during the recent years. On one hand, the CRIA has contributed to the policy of improvement of soybean production through research on identification of new apt areas for soybean cultivation, and to the validation of more adequate cultivation techniques. On the other hand, the CRIA investigation based on soybean varieties, has been centered in the conventional varieties (not genetically modified), in which it has obtained significant achievements through the development of new varieties in recent years. This line of research seeks to produced varieties that are adapted to the conditions in Paraguay and especially to the zones of intensive cultivation.

CRIA's contributions are given in varieties that are losing land set against the genetically modified varieties, where the production of conventional varieties is diminishing continuously. Nevertheless, the investigations on varieties and techniques of improvement can reinforce the creation of local labor, through the improvement of varieties that can be used for organic cultivations, and for the production in farms of small producers.

Table [3.1.1.1]: Quantity of exploitations according to size of the soybean cultivated surface.

	Total Explotac.	CULTIVATED SURFACE (has.)							
		< 2	2 - 5	5 - 10	10 - 50	50 - 100	100-200	200-500	> 500
REGION ORIENTAL 2002	**27.806**	**4.386**	**5.782**	**4.478**	**6.100**	**3.884**	**1.848**	**1.045**	**283**
Total Farms (%)	100	15,8	20,8	16,1	21,9	14,0	6,6	3,8	1,0
1991	26.717	4.820	7.481	5.273	6.821	1.304	630	305	83
Variation (%)	4,1	-9,0	-22,7	-15,1	-10,6	197,9	193,3	242,6	241,0
Tamaño de la Explotación									
Menos de 5 has.	1.460	960	500	-	-	-	-	-	-
De 5 a menos de 10 has.	4.050	1.420	2.180	450	-	-	-	-	-
De 10 a menos de 20 has.	7.550	1.470	2.470	2.740	870	-	-	-	-
De 20 a menos de 50 has.	6.105	481	592	1.150	3.882	-	-	-	-
De 50 a menos de 100 has.	3.834	43	22	123	1.104	2.542	-	-	-
De 100 a menos de 200 has.	2.811	10	15	12	198	1.235	1341	-	-
De 200 a menos de 500 has.	1.268	-	2	1	29	71	401	764	-
De 500 a menos de 1.000 has.	410	2	-	1	12	17	64	189	125
De 1.000 a menos de 5.000 has.	273	-	1	1	5	19	37	79	131
De 5.000 a menos de 10.000 has.	30	-	-	-	-	-	3	10	17
De 10.000 y más has.	15	-	-	-	-	-	2	3	10
ORIENT REGION	**27.806**	**4.386**	**5.782**	**4.478**	**6.100**	**3.884**	**1.848**	**1.045**	**283**
Departaments									
01. Concepción	61	20	10	-	20	-	11	-	-
02. San Pedro	269	34	19	11	34	47	66	51	7
03. Cordillera	-	-	-	-	-	-	-	-	-
04. Guaira	150	70	60	-	-	-	20	-	-
05. Caaguazu	1.422	110	240	251	461	139	105	99	17
06. Caazapa	2.570	1.700	140	250	120	143	106	100	11
07. Itapua	12.698	1.641	3.623	2.643	2.887	1.051	500	283	70
08. Misiones	4	-	-	1	2	1	-	-	-
09. Paraguari	71	71	-	-	-	-	-	-	-
10. Alto Parana	7.852	510	1.220	971	2.116	1.837	795	280	123
11. Central	-	-	-	-	-	-	-	-	-
12. Ñeembucu	1	-	-	1	-	-	-	-	-
13. Amambay	186	-	20	10	42	1	43	55	15
14. Canindeyu	2.522	230	450	340	418	665	202	177	40

Source: MAG, 2002.

Table [3.1.1.1] indicates that 47% of the farms cultivating soybean have less than 20 hectares and 53% of the producing farms of soybean have 20 hectares or more. In 2002, there were only 283 large producers of soybean that cultivated more than 500 hectares of the sector. There were less than 3200 producers that cultivated 100 or more hectares and 7.060 producers that cultivated 50 or more hectares of soybean. On the other hand, there existed more than 14.600 producers that cultivated less than 10 hectares of soybean and approximately 4.400 producers that cultivated less than 2 hectares of soybean.

Of the same Table, it can be seen that 52% of the producers of soybean cultivated less than 10 hectares (in the 2002). In interviews carried out for this report it was pointed out that most of the technical aid is directed to medium and large producers, and to producers associated in cooperatives. Nevertheless, it is worth to indicate that on the

average only the 17% of the exploitations belonged to some organization in 1996/97 (MAG 1997:59), with what is reasonable to infer that great part of the small producers of soybean receive little or none technical aid.

On the other hand, the financial organizations aimed to the rural segment, consider soybean as the area that they finance mainly. In fact, the agricultural area with greater financing of the Crédito Agrícola de Habilitación (CAH) in the 2002 was soybean (CAH, 2003). The financing for soybean from the CAH constituted 47% of the granted credits to the agricultural sector and 25% of the total disbursements of the institution in 2002. Similarly, 52% of the total credits approved by the Fondo de Desarrollo Campesino (FDC) in 2003 were directed to the soybean cultivation (FDC, 2004).

Another aspect to keep in mind is the scarce diffusion of the varieties developed by CRIA among producers using conventional varieties. In interviews carried out for this work with seed suppliers and producers of soybean, it was found that great part of the surfaces cultivated with conventional seeds use foreign varieties, mainly from Brazil. This is supported by DISE reports (2005) and the main varieties used in the influence area of CETAPAR (2005).

The previous statement could be explained by the aggressiveness expressed by the sale force of the foreign varieties, associated to an important number of foreign origin soybean producers (Molinas and Ibarra, 2004).

This situation presents an aspect to be considered under the policies of MAG's point of view (through the Direction of Agricultural Investigation), where they should define more efficient diffusion mechanisms for developed varieties at CRIA. This is to allow an approach to small producers, which represent a substantial part of the soybean producers.

In regards to issues related to plagues and diseases, the perception of the producers is that CRIA's performance is comparable to other foreign high level research centers and because of that, there is no need to go to foreign centers in order to tackle problems (interviews to technicians of Cooperativa Colonias Unidas , Nov 2005).

This affirmation is supported by current developments and investigations on the diseases Soybean Cyst Nematode (SCN) and the Soybean Rust. At the moment, the investigations done in this direction are ready to produce resistant varieties to these attacks. The release of at least two varieties resistant to SCN and one with tolerance to Soybean Rust is expected by 2007.

The research undertaken by CRIA is not supported by a National Plan for Improvement of Soybean Production, which is a factor that inhibits the potential development installed in CRIA. Currently, and since the Cooperation Project (1997-2002) finished, only two investigations have been financed by institutions that had no connections to MAG. These investigations are: "Evaluation of Possible Sources of Resistance to the Soybean Rust in Paraguay", financed by the U.S. Department of Agriculture (USDA) and "Effect of the Vesicular-Arbuscular Mycorrhizas in the Growth of the Soybean in three different types of soil in Paraguay", financed by the enterprise "Golondrina S.A." For other works in the area of Agriculture of Precision there is an incipient support of small producers with infrequent contributions.

Moreover, there is lack of an adequate coordination during research and tests being performed by different agencies of MAG and other private research centers. In interviews to members of DIA, CRIA and CETAPAR, it was pointed out that there is collaboration among the different research centers, but there is coordinated agenda to optimize resources, improve aspects of production and contribute to the welfare of soybean producers.

3.1.2.- Technological Aspects

Keeping in mind the Overall Goal of the project and the results obtained in the project, the impact reached after the project conclusion (1997-2002) has been affected by diverse factors: weather, regional economy, costs or producers needs, viability for the application of the achieved results, access to the information and financial resources among others.

In order to achieve the Overall Goal of the project, CRIA focused its investigations in three areas of study: 1) Genetic improvement of soybean techniques; 2) Soil Management Techniques 3) Cropping Techniques. The technological impacts associated with each one of these three areas as discussed in the following sections.

1) Genetic soybean improvement techniques

During the development of the project, CRIA launched to the market the varieties CRIA 1-AURORA and UNIALA, registered in 1.997 at DISE, which originated from the variety ALA-60. These varieties are a product of previous investigations supported by JICA. Subsequently the varieties CRIA 2-DON RUFO and CRIA 3-PUA'E were registered in 2.001 (DISE, 2.001). In March 2005, CRIA released the varieties CRIA 4-GUARANI and CRIA 5-MARANGATÚ.

CRIA keeps experimental lots in many locations, like Captain Miranda in Itapua; Tomás R. Pereira, Itapua (north); CETAPAR, Caaguazú; Yhovy in Canindeyú. Besides this, CRIA obtains data through the Network of Tests, in which businesses and seed suppliers registered at DISE participate. The varieties registered by CRIA present different degrees of adaptability according to the regions where they are sown, as it is observed in the Table [3.1.2.1].

Table [3.1.2.1]: Recommended zones for different varieties of soy cultivation.

VARIETY	ZONES OF GREATER PERFORMANCE
UNIALA	Misiones, Colonia Yguazú
AURORA	Colonia Yguazú, Alto Paraná
DON RUFO	Itapua, Colonia Yguazú,
PUA'E	Itapua, Colonia Yguazú, Alto Paraná, Canindeyú, Amambay
GUARANI	Colonia Yguazú
MARANGATU	Colonia Yguazú, Canindeyú

Source: * Disclosure Bulletin, CRIA. Interview to APAM producers, Agro Santa Rosa.

Based on CRIA data and interviews to producers for this report, data on the different varieties performances in different regions were collected. The AURORA variety presents good performances in the zone of Alto Paraná (CRIA, Disclosure Brochure). The variety DON RUFO presents better performances in Captain Miranda and Colonia Yguazú (CRIA. Disclosure Brochure 2001).

According to the obtained results, the performances vary depending on to the region where the test was done. These variations can be due to weather factors, characteristics of the land, adaptation to the place, etc. (Table [3.1.2.2]).

Table [3.1.2.2]: Comparison of Performance in kg/hectares of the varieties launched by CRIA and other commercial varieties (average values of different localities).

Variety	Years						
	1994/95	1995/96	1996/97	1997/98	1998/99	2001/02	2002/03
ALA-60	3.899	3.793	-	-	-	-	-
AURORA	4.370	4.350	3.993	3.850	4.140	2.750	2.870
UNIALA	3.703	3.960	-	3.681	-	2.539	3.039
DON RUFO	-	-	-	-	-	2.500	2.826
PUA'E	-	-	-	-	-	2.767	3.335
OCEPAR – 14	-	-	-	-	-	2.968	3.424
Br-16	-	-	-	-	-	2.716	3.485
Average						2.707	3.163

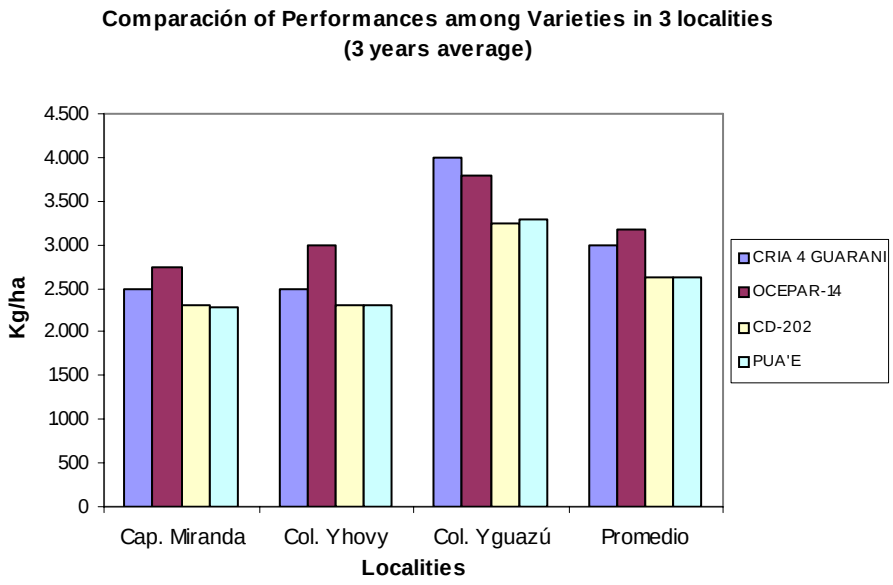
Source: CRIA

As it is observed in Table [3.1.2.2], there are no substantial differences in performance among the different varieties of CRIA and other companies. In 2001/2002 and 2002/2003 campaigns, the average performances were of 2.707 kg/ha and 3.163 kg/ha respectively. In both campaigns the variety OCEPAR-14 was the one that presented better performance. The varieties PUA'E and AURORA are CRIA varieties that had better results. UNIALA presented better results in Misiones, with productions of approximately 3.000 kg/ha (Aguiar, O., Secretary of the Association of Agricultural Producers of Misiones – APAM. Interview. Dic 2005).

Recent investigations at CRIA indicate that the varieties PUA'E and MARANGATU are rougher and present a semi premature cycle of fast growth. Plus, they present good adaptability to the region of Misiones (Paniagua, M. Interview. Nov 2006).

In Table [3.1.2.1] data of performances of four varieties of soybean in three districts are observed. The performances are the average of three years. There are no substantial differences between the varieties GUARANI and PUA'E in Capitan Miranda and Colonia Yhovy; nevertheless in Colonia Yguazú the differences are more accentuated, with performances of 4.000 kg/ha for GUARANI and 3.300 kg/has for PUA'E. The variety OCEPAR-14 was superior only in Colonia Yhovy with 3.000 kg/ha, GUARANI, 2.500 kg/ha and the varieties CD-202 and PUA'E were similar with 2.300 kg/ha. The best performances were in the region of Colonia Yguazú, possibly due to the adaptability to the conditions related to soil and whether (Disclosure Bulletin CRIA, 2005)

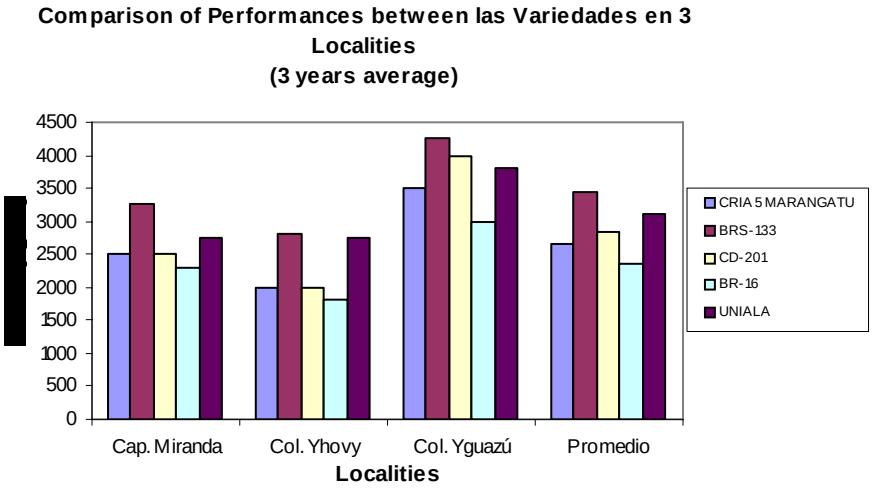
Figure [3.1.2.1]: Comparison of Performances of the varieties GUARANI and PUA'E with other commercial varieties.



Source: CRIA

The performances for the variety CRIA 5, MARANGATU, compared with other Brazilian varieties and UNIALA are presented in the Diagram [3.1.2.2].

Figure [3.1.2.2]: Comparison of Performances of the CRIA varieties, MARANGATU and UNIALA with other commercial varieties.



Source: CRIA

The performances were superior in the region of Colonia Yguazú. The varieties BRS-133 and CD-201 were the ones that obtained greater performances, with 4.250 kg/ha and 4.000 kg/ha respectively. In all the regions, the variety UNIALA was over GUARANI. Nevertheless, Bianchi, O. (Interviewed Dec 2005), emphasized that the Variety GUARANI is accepted for the producers for being an early variety with good performance and uniformity of the grain. These factors facilitate the handling and the

cropping. At the moment of the interview, no orders from the producers of this variety existed. This situation could be reverted if CRIA has more financial resources to increase the activities of promotion of its products.

CRIA continues its investigation on resistance to diseases. At the moment, 10 promising candidates exist. In the seminar "Investigation of the Cultivation of Soy in Paraguay" (CRIA, 2002), three CRIA works (done by their technicians) were presented, referring to resistance to diseases. Studies related to the resistance to Soybean Cyst Nematode (SCN, *Heterodera glycines Ichinohe*), (Tsuchiya T, 2003) were carried out. Ten candidates of soybean with resistance to SCN are in phase of investigation. They are in the evaluation process at the National Network of Tests and in multiplication phase of mother seeds for their short-term release (Paniagua, M., Interview Jan 2006). The achieved results in two cultivation cycles in 2001/2002 and 2002/2003 indicate that among the "resistant lines to the SCN, the LCM-154 (CRIA's line) it was superior to the others by a high performance and because they responded well in favorable environments it and was consistent" (Chávez, C; Tsuchiya, T; Komeichi, M; et. al., 2004).

In 2.007, the release of two varieties with tolerance to the Soybean Cyst Nematode (SCN) and that of a variety with resistance to the Soybean Rust is expected. The importance of this work is related to the rise of the disease in three departments of the country: Canindeyú, north of Alto Paraná and Caaguazú, which accounts for 68% of the total soybean production in 2004.

Another research is related to the resistance or tolerance to Soybean Rust, through the agreement USDA/CAPECO/CRIA (Paniagua, M. Interview. Dec. 2005). Prior studies indicate that the varieties PUA'E presents moderate tolerance to Soybean Rust (Tsuchiya T, 2003). All CRIA varieties present tolerance to the "Mancha Purpura" (Paniagua, M. Interview. Nov 2006).

CRIA varieties tests (related to performances, tolerance to plagues and diseases, response to fertilization, etc.,) can be applicable to almost all of the country's soybean areas, except Conception and Amambay, where CRIA does not has tests fields. The data collected at all test fields is available for producers.

An important added value of the varieties developed at CRIA is the protein level of oil extracted from these varieties. For example, the variety AURORA is preferably used for human consumption. There is a demand for the increase of this variety's cultivation area for organic producers of Bella Vista, Itapúa (Junghanns, E. Interview. Dec. 2005). The Cooperativa Yguazú, cultivates this variety for export and also for human consumption. Besides the protein level, this variety presents uniformity of shape and size of the grains, essential characteristics for that market (Orchiola. Interview, Dec. 2005)

The recently launched varieties, GUARANI and MARANGATU have similar protein levels to the ones presented by the AURORA variety. In Table [3.1.2.3] the different varieties with their values of oil and protein are presented.

Diagram [3.1.2.3]: oil and protein concentration of soy grain varieties

VARIETIES	PROTEIN CONCENTRATION (%)	OIL CONCENTRATION (%)
GUARANI	43,5	20,1
PUA'E	42,5	20,5
UNIALA	41,7	21,1
MARANGATU	41,1	21,7
BR-16	41,1	20,5
AURORA	41	-
OCEPAR-14	40,9	21,6
BRS-133	40,6	21,2
CD-202	38	23,2

Source: Disclosure Bulletin, CRIA 2.005

The GUARANI variety presents greater concentration of protein (43.5%) as compared to the other studied ones. PUA' E presented 42.5% of protein, however, it was one of the lowest in terms of content of oil, 20.5%; comparable to the BR-16 and GUARANI (20,1%). The MARANGATU variety presented 41.1% of protein, comparable to the values of UNIALA, B R-16, AURORA and OCEPAR-14. The contents of oil for the MARANGATU varieties reached 21.7%; UNIALA, 21.1%; BR-16, 20.5%; AURORA, (no data) and OCEPAR-14, 21.6%. The varieties BRS-133 and CD-202 presented the lowest concentrations of protein: 40.6% and 38% respectively.

It is important to remark the importance in the contents of oil and protein since these characteristics are considered important for human consumption and also, for the industrialization of soy.

2) Soil management techniques

This research area was performed in the Department of Misiones, with the objective of gathering information regarding to appropriate areas for soybean cultivation.

At the beginning of the project only 50 hectares of soybean crops were identified in Misiones. Nowadays, there is information that supports the existence of 13.500 hectares of cultivated soybean (DCEA, 2005).

As a result of these studies, the Government of Misiones obtained a database of all generated information during the project, applicable to soybean cultivation and other crops, since the research included the highland areas with agricultural capacity.

The studies were on the use of Remote Sensing and soil management for soybean production with direct sowing (Kawamura, P, 2002). Using Remote Sensing, plenty of information was gathered, such as satellite images with surface data (in hectares) by districts of the Department of Misiones according to the indicated classification; numerical data on distribution of the surface of the land in hectares, image classified with zone of the elevation 100 msnm and the corresponding surface by districts of Misiones. With this information it is possible "to define the most adequate areas for the beginning of soybean cultivation in the Department of Misiones" (Kawamura, P, 2002).

After the works made by Pastor T. Kawamura on Remote Sensing, the Precision Agriculture Department was created in the 2004. This Department works with external financing from several enterprises through donations and contributions that are worth from 1.000 to 1.500 dollars per year. At the moment, the Precision Agriculture Department is performing some studies for the application of this technology in small farms. In September of 2004 the First International Seminar on Experiences on Precision Agriculture within Argentina, Chile and Uruguay, took place at CRIA's facilities. This seminar was organized by CRIA and coordinated by Pastor Kawamura with PROCISUR and IICA support. .

The results of the first trial conducted by CRIA, in the Precision Agriculture Sector were published in CRIA's Report in 2004. The equipments used are those acquired for the Project of Improvement of Soybean - CRIA/JICA. The objective of the study is to generate a work methodology for the elaboration of georeferenced maps of corn for producers situated within the small and medium range. These maps can be used for specific soil and cultivation management" (CRIA, Annual Report 2005).

In 2005, CRIA established the first experimental plot of Precision Agriculture in a surface of 2.4 hectares. The objective is to quantify the agronomic and economic feasibility of the use of agriculture of precision. The project lasts three years, with the possibility of extending it for one more year, according to the results obtained (CRIA, Annual Report 2005).

Other ongoing projects are in the area of Coronel Bogado, Itapua, with Mr.Oscar Benítez's contribution (CRIA's technician), with five local producers in lands with thirty to fifty years of agricultural use. This project's objective is to generate the soil acidity map in small producers' farms.

It is important to remark that the agriculture of precision is still with little developed in the country, for this reason, the different studies/researches carried out at CRIA are pertinent.

Another important aspect of CRIA's research is related to direct soybean sowing on areas of native or cultivated pastures. According to producers, this technique brings benefits to the subsequent growth of the soybean, but presents problems at the moment of the crop, since there are no harvesters adapted to meadows land conditions and mechanical damages might occur. The alternative adopted by producers for the first year is the use of conventional sowing, mainly by land leveling and from the second year on they perform minimum farming or direct sowing system. This technique prevents from the excessive mechanization of soil, thus reducing erosion levels and facilitating the mechanized crop (Aguiar, O., interviewed Dec 2005). This technique implemented by CRIA (also adapted by producers) could be applicable to other meadows areas where soybean cultivation may be incorporated.

At the moment, there is available information regarding to optimal areas for soybean cultivation in Misiones. Public and private institutions as CAPECO and the Direction of Census, Agricultural Statistics and Surveys of the Ministry of Agriculture and Livestock, used information originally generated by CRIA, especially those referred to optimal areas for soybean cultivation, remote monitoring and GIS (Geographical Information System), which are updated every year.

3. Cultivation Techniques

CRIA has done investigations on crop rotation within the direct sowing system. One of the objectives was to substitute wheat with sunflower in the rotation plan. Several combinations exist, sorted by short, medium or long cycles.

Studies were performed on winter behavior of sunflower crop (Helianthus annuus L.), sown in ten different seasons. The obtained results suggest that CRIA should continue with the shortest cycle varieties in order to synchronize with the "maximum soybean sowing potential performance, subsequent to sunflower". Another alternative is sowing sunflower in June to have soybean sown in November. However, one should be careful with frosts during the winter season (Palacios, A; Barboza, V; Hakoyama, S; et. al, 2004).

Currently, in all central and southern regions (Misiones, Itapua, Alto Paraná Sur and Caaguazú) the sunflower is sown within the rotation plan of direct sowing system. In Alto Paraná Norte and Canindeyú, wheat and "zafriña" corn are cultivated in winter since there are varieties adapted to those regions, but there are no sunflower varieties (Aguiar, O; Warlike, A; Bianchi, O. Interview. Dic 2005).

At this moment CRIA does not carry out further studies on sunflower within the soybean system, but they perform sunflower performances tests, independently from soybean. The performances tests are done with hybrid varieties of sunflower, of intermediate and early sowing cycle (15 – 20 of July) (Paniagua, M. Interviews, N. 2006)

In relation to the studies on the effects of the mycorrhiza fungi for phosphorous best utilization, the achieved results were not precise and did not have impacts among the producers. The results suggested that the best effects of the mycorrhiza are in the sunflower system – soybean or fallow land-sunflower-soybean, where greater levels of development of the mycorrhiza in the soil were observed, compared to those where another rotation plan was used (wheat-soybean; oat-soybean). The study concludes that there would be better results if the same investigation was performed in less fertility zones like Misiones, where the effect would be much stronger (Barboza, V; Palacios, A; Díaz, M; et. al., 2004).

3.1.3.- Environmental Aspects

After the Soy Production in Paraguay Investigation Project was finished (1997-2002), the development of investigations of new soybean varieties by CRIA continues with the so called "conventional varieties", named in that way so that they can be differentiated from "genetically modified varieties".

Almost all those interviewed by the Evaluation Team indicated that approximately more than the 70% of the soybean cultivated in the country is genetically modified, being Argentina the main genetically modified soybean seed supplier for Paraguay.

With the genetically modified soybean RR use (Round up Ready) in Argentina, after 8 years of continuous use, a change in the type and formulation of the herbicides used is observed. However, there is no effective reduction in its utilization. After the

application of more than 60 types of chemical formulations in the tasks of pre-sowing and in those of pre-emergency and post-emergency cultivation, only two formulations were used the genetically modified soybean: the 2,4 D and the glyphosate, in the different phases of cultivation as an unique tool for weed control. However, a gradual but constant elevation is observed, in the number of applications done as well as the dosage of the used product.(Souza C, J. 2004).

The herbicide glyphosate has an extensive spectrum, eliminating both the dicotyledonous type herbs –wide leaves- and monocotyledonous –narrow leaves ones. Two phenomena can be present linked to the same ecological root:

a) The development of new weeds tolerant to herbicide due to free space that remains after the disappearance of other plants –notion of ecological niche.

b) The development of genetic resistance that can be transferred to the new generations of plants –notion of resistance.

In Argentina, in the soybean nucleus zone of the Pampas region, a series of weeds that historically did not constitute a problem now require special control. Similarly, some species have turned more difficult to control due to their own structural characteristics. This genetic resistance is transmitted to the next generations (Souza C, J. 2004).

The massive adoption of direct sowing, the adoption of soybean cultivation resistant to glyphosate, the cropping of only soybean and the substitution of traditional herbicides with that of glyphosate have created pressure over weeds. Currently there are nine species suspiciously tolerant to glyphosate in its standard dose, in the soy area in Argentina (Souza C, J. 2004) The experience in Argentina shows us that soybean crop management using glyphosate herbicide generates some difficulties which are important to consider in our country.

Some producers, within CRIA's area of influence, interviewed by our evaluating team have already mentioned the resistance that certain weeds are developing to the herbicides, specifically "la lecherita" (Euphorbia heterophylla) and the "ysypoi" (Ipomoea sp.), generating problems of control and eradication. It is assumed that there will be a subsequent need of other chemical herbicides, which at the same time can cause new resistant plants, besides other environmental impacts depending on the type of product used.

In CRIA's Annual Report 2005, 4 different weed species with moderate susceptibility to glyphosate are mentioned, "la lecherita" (Euphorbia heterophylla L.), the "ysypoi (Ipomoea sp.), the "capi'i pororo" (Digitaria insular L.) and "pasto cloris" (Chloris sp.)

In interviews that the Evaluation Team carried out with producers of organic soybean, some mentioned that with the use of the genetically modified varieties of soybean, in addition to the use of glyphosate herbicides, a defoliant of more dangerous environmental effects is being used. Other sources expressed it could be the "paraquat" herbicide, which is very used in soy production zones or the "diquat". In interviews with key informants in other study, Paraquat is also mentioned as an herbicide used in soybean zones (Molinas and Ibarra, 2004).

The paraquat is a toxicological class I product, "highly toxic", prohibited and restricted in numerous countries, nevertheless used in our country. It is one of the insecticides of the so called "Dirty Dozen", for which there is a world campaign against the utilization of the these most dangerous insecticides for the environment and human beings.

Small producers also cultivate soybean, either for human or animal consumption or as income crop, where organic soybean is used as an alternative production in zones of Itapua.

Agro-Dickel currently collects approximately 1000 hectares of organic soybean for export. The varieties used are Br 4, Br 16, Br 36, Don. Rufo, Uniala and Aurora. An organic soybean producer expressed that the varieties he used were Br 16, Br 36 and Aurora, but he preferred Aurora because of the quality of the obtained oil. Nevertheless, he mentioned that the "Monarca" variety from Brazil has been considerably requested, displacing Aurora to the second place according to his preference.

In conversations with a CECTEC (Center of Education and Training of Rural Technologies) technical advisor, of Pirapey, Itapúa, he declared that they are encouraging small producers to cultivate organic soybean, either for animal consumption or for export mainly. The producers keep their own seeds, mentioning Ala, Aurora and Br 16 as some of the varieties used.

CRIA's varieties are being used for organic crops at small, medium and large farms. However, the cultivated surface is small compared to the not-organic soybean, but looking at the smaller impacts caused to the environment and the benefits for the sector with smallest income (in the case of small producers), it is an alternative that deserves greater support so that the social and environmental benefits can be expanded.

The use of the genetically modified soybean varieties in the country and its impacts in the environment and in the human being over the years, lead us to consider the Principle of Precaution and its implications.

The associated uncertainty to the potential threats for the environment has often been used as an excuse for not taking actions that protects it. However, it is not always possible to have clear evidence of a threat to the environment before the damage occurs. A common element in the several formulations of the Principle of Precaution is the recognition that the lack of certainty related to a threat to the environment should not be used as an excuse for not taking measures to avoid damages. The Principle of Precaution recognizes that to delay actions until sufficient evidence of damage exist, generally implies that later, it will be very costly or impossible to avoid the damage. The use of the principle promotes actions to prevent risks of serious or irreversible damages. The principle consistently provides an important political base to anticipate, prevent and mitigate environmental threats. (The Precautionary Principle Project, www.pprinciple.net, December 2005).

It is important that CRIA collects the implications of the Precaution Principle in such a way that the country's biodiversity conservation, (the ecosystems, the species of flora and fauna and the genes), are not threatened. The release of only conventional varieties on CRIA's part can be considered as support to this principle. Nevertheless, the Law 294/93 of Evaluation of Environmental Impact and the Law 2309/03 that ratifies the

Protocol of Cartagena on Security of the Biotechnology of the Agreement on Biological Diversity, constitute the legal instruments that the country can count with to legislate the genetically modified units, where the SEAM as well as other (MAG, MSP and BS, MIC, among others) should coordinate and find an agreement for.

Mycorrhiza fungi is the symbiotic association that naturally establishes itself among the roots of the majority of the plants with beneficial fungus of the soil. It has been proved that the mycorrhiza play a crucial role in the plants life, helping to surpass situations of stress, mainly in soil degraded by excessive farming, contamination, drought, deficiencies in nutrients, etc. This association would be a natural form to reduce the problem of the low fertility of soils. (Barboza et al, 2002).

Based on the study of the relation between covered cultivations and mycorrhiza fungi activity in soybean, Barboza et al. (2002) indicate that it would be very important to have these studies done in degraded, poor land so that the effect of micorrhiza can be more determinant.

The continuity of the mycorrhiza study (considering poor degraded soil conditions that are found in extensive areas of the country), is an aspect to highlight, as the investigation's conclusions have indicated it. Recovering the degraded lands of the country is a duty, which is why the mycorrhiza research team can offer important proposals for extensive regions of the country. Also, the mycorrhiza advantages related to contamination, the drought and nutritional deficiencies should be considered.

The recovery of degraded agricultural lands would be able to generate a special contribution to the search of alternatives that decrease the pressure on the remaining wooded areas of the oriental region of Paraguay, along with the direct sowing system and organic soybean production.

In Misiones, the appropriate lands for soybean are located in the high areas, with a wavy topography and good drainage. They present low natural fertility since they possess little nutrients reserve, and a low cationic exchange capacity. They require good fertilization management and possess low water retention capacity. They are susceptible to eolic and water erosion and to surface warm-up. (González et al, 2002).

Similarly, González et al. (2002). recommend that they should give fertilization management a special care, due to these soils' low cationic exchange capacity. This is the reason why it will be necessary to do a fertility diagnostic through chemical analysis of soil every 2 or 3 years.

Soybean in Misiones has become important, as we see in Table [3.1.3.2], starting from 159 has. in the year 1991 to 30.000 currently (according to interviews by the evaluator team with the Agricultural Producers Association of Misiones, APAM). CRIA collaborated with this soybean advance in Misiones since one of the project's purposes was to enlarge CRIA's investigative capacity with soil management in new areas where soybean production was being introduced and expanded. This is specifically applicable to the case of the Department of Misiones.

Diagram [3.1.3.2]: Misiones Soy cultivada Surface.

Year	Soy Cultivated Area (ha)	Source

1991	159	MAG (2002)
2002	120	MAG (2002)
2002/ 2003	1630	Estimaciones del CRIA
2003/2004	12,500	MAG (2004)
2004/ 2005	13.500	MAG (2005)
2005/2006	30.000	Estimations of APAM in evaluator team's interviews

CRIA's Annual Report 2000/2001 indicates that the Soybean Program in the area of research, accomplished to develop a soil classification map for soybean production to convert meadow areas to cultivated fields. This required a planning method as well as technical guides for direct sowing introduction.

Among the investigation's conclusions done by González, A. et al (2002) related to soil management techniques for soybean in Misiones, it is indicated that the use of appropriate techniques, as well as the direct sowing adoption, contributes to a stable increase in agricultural productivity, as well as soil conservation when facing erosion and fertility improvement. The better the coverage of soil with stubble (rastrojo), the more and better benefits on soybean development.

APAM members expressed in an interview that at this moment they continue with soybean cultivation implementation in Misiones, with some modifications of CRIA's recommendations based on their experience. This is due mainly to the problems with the use of agricultural machineries in the zone of Misiones.

The use of CRIA's soybean varieties has been inserted into the direct sowing system that is implemented in diverse regions of the country, with different associated agronomical practices, all seeking a more conservative soil management.

In relation to the direct sowing system the following remarks can be made:

a) The direct sowing system generally improves soil properties due to the incorporation of vegetables residues.

b) The implementation of the direct sowing system needs to be studied from the perspective of ecological sustainability of the implemented productive system.

c) The direct sowing system does not degrade the soil as much as the conventional system.

d) The increase of herbicides and chemical fertilizers used in soybean cultivations should be carefully analyzed in relation to the environmental sustainability of the productive system.

In the interview with the Evaluation Team, Alfonso Guerreros (from Colonias Unidas Co-operative's seeds production), mentioned the direct sowing system implemented by producers, pointing out the importance to apply an adequate direct sowing system and not only to reduce it to some aspects of it, which could generate undesired environmental impacts, affecting the productive system's sustainability.

González et al. (2002) indicate that in case soybean was introduced in Misiones, they suggest soybean as an alternative crop for small farmers. This does not necessarily mean the exclusion of traditional crops. It will be necessary to emphasize the conservation of the eco-system, for which they suggest conservation-friendly practices. Also, due to little chemical products management currently used by these producers in local farming, they propose the production of organic soybean.

The natural eco-systems modification, especially the Misiones natural fields, is a very important aspect to keep in mind when leading the agriculture and soybean farming practices, considering the effects in these eco-systems as well as in the native vegetable and animal species.

The alteration of water cycles, nutrients, the trophic chain (cadena trófica) alteration and its impacts, assuring the conservation of the natural resources biodiversity, requires continuity on the studies on the environmental impact that causes the natural fields conversion to agricultural production systems. These studies should be encouraged as soon as possible in order to seek the sustainability of the production system.

CRIA's investigation results somehow remarked this aspect already, delimitating future investigation works that should be implemented in Misiones, as – for example - the eco-system conservation and organic soybean production.

On the other hand, it should not be forgotten that the Department of Misiones has only one Wild Protected Area, The Wildlife Refuge of Yabebyry of 30.000 hectares, only 3,1%, of the entire Department - 955.600 hectares, under poorly known conditions in regards to its degree of consolidation. For this reason, the effective protection of natural high fields of this zone of the country, like the Wild Protected Area, as well as the appropriate water course, should be assured before the modification and degradation process gets extended in these eco-systems with the farming advance. Similarly, these natural fields management with sustainable farm production systems should also be implemented. This is a reason why CRIA's contribution is more than necessary.

3.1.4.- Socio-cultural Aspects

Given the nature of the project and the surroundings in which it was developed – mainly within the installations of CRIA -, its socio-cultural aspects have not been relevant, except some observations.

In this case, we can mention that with the increase of cultivated lands in the Misiones area, the interviewed producers mentioned that there has been a small increase in the economic activity of the region, mainly due to the creation of jobs in areas related to mechanical and civil work. This last activity is related to works of infrastructure.

The farmers dedicated to the cultivation of varieties for consumption consider that the varieties developed by CRIA offer an attractive option, since there is a high content of nutrients and oil production comparable to those developed in other countries.

3.1.5.- Institutional and Management Aspects:

The "Centro Regional de Investigacion Agricola (CRIA)" - Regional Centre of Agricultural Research", a branch office of the "Dirección de Investigación Agrícola (DIA)" – General Management of Agricultural Research of the Ministry of Agriculture and Livestock - is located in the District of Capitan Miranda, Departamento de Itapua, on Road VI, 16 kilometers away from the city of Encarnacion.

The total area of CRIA is about 118.5 hectares and has a sub-tropical weather, with an annual average temperature of 20.6° and annual average rain of 1.700mm.

The main function of CRIA is to generate technology for the solution of problems within its area of influence that can affect the agricultural production, observing the preservation of natural resources.

The internal organization of CRIA has 78 people, including personnel at the Experimental Field "Tomas Romero Pereira" (9 persons). The organization of CRIA reflects the activities undertaken and its structures is represented in the organization chart presented in the Attachment (CRIA, Nov. 2005)

The Research Project for Soybean Production undertaken in Paraguay from 1997 until 2002 strengthened the research capacity of CRIA, emphasizing three areas: breeding, agronomy and soil management techniques. With this purposes, the project financed the presence of Japanese experts for long and short terms (see detailed list in Final Report, March, 2002), training for employees of CRIA during the project 1997-2002 (see detailed list in Final Report, March, 2002) and the purchase of equipment for the lab and general support (see detailed list in Final Report, March, 2002)

Regarding Human Resources training, 11 persons received training in Japan within the period of September 1998 and November 2002. The training was directly to areas related to the purpose of the project. At the time the interviews for this report were performed, 7 of the trainees were still assigned to CRIA, but only 3 are still related to the original topics of training. This situation is described in Table (3.1.5.1):

Table [3.1.5.1]: List of Paraguayan Staff trained in Japan and current assignation

Name	Training	Current workplace
Carlos Paniagua	"Management of Center of Agricultural Research" (28/09/98 – 13/10/98)	Retired
Adrián Palacios	"Production of cultivarion under Rotation" (22/03/99 – 27/10/99)	Supervisor of Weed Control and Agricultural Sector - CRIA
Casiano Altamirano	"Management of Field work in experiments with soy" (22/03/99 – 27/10/99)	Field work assistant – Soy Genetic Iprovement – CRIA
Eduardo Rodríguez	"Master in Biotechnology" (April-2000 - March-2002)	Attending a PHD Program in Japan

Julio Morel	"Study of Soil Diagnose" (26/06/00 – 20/12/00)	Program of Technical Assistance of MAG – CRIA
Pastor Kawamura	"Techniques of Remote Sensor" (25/06/01 – 01/12/01)	Supervisor of Computering (IT) and Agriculture of Precission – CRIA
Mario Díaz	"Cultivation Development Techniques" (02/07/01 – 01/12/01)	Technical Assistane– Section of Seed Production – CRIA
Alodia González de Altamirano	"Management of Organic Material in Soil" (04/07/01 – 01/12/01)	Supervosor of Soil Section – CRIA
Carlos Chávez	"Resistance Techniques to Nematodo del Quiste en Soja" (31/05/02 – 28/11/02)	Private Company
David Bigler	"Resistance Techniques to Nematodo del Quiste en Soja" (13/08/01 – 07/09/01)	Private Company
Javier Szostak	"Study of Soil Features through Chemical Análisis" (05/06/02 – 28/11/02)	Supervisor of Seed Production Section

Source: CRIA

Among the technical trained personnel currently assigned to the improvement of soybean, only one received training in Japan and only one has university level degree.

It is important to remark that besides the personnel who were trained in Japan, 8 more personnel were assigned to the project and 3 of them received training in Brazil. Of these 3 trained personnel, only 1 is still present at MAG.

The permanency of technicians originally trained for the project and the incorporations of new professionals to CRIA is affected by the lack of assigned resources, as well as the lack of a research program which can facilitate the retention of well trained personnel.

Even with the current conditions, CRIA has continued its research works and this has resulted in the development of 2 new varieties of soybean, after the finalization of the cooperation project in 2002. It has developed 10 promissory types with resistance to the Soybean Cyst Nematode (SCN), which is undergoing an evaluation process through the National Network of Testing. It is also undergoing through a phase of multiplication of seeds –"Mother" Category- for its release shortly. It is estimated than in 2007 at least 2 more varieties with resistance to Nematodo del Quiste will be available (interview with CRIA personnel, Nov. 2005)

As a result of the researches performed by CRIA, 17 articles were published as related to soybean improvement, during the period of 2002-2004. In Table [3.1.5.2], the proceedings are listed as well as the number of articles about improvement of soybean in each of them.

Table [3.1.5.2]: Articles related to genetic improvement published starting in 2002

SOURCE	NUMBER OF ARTICLES
CRIA.. JICA/MAG. Paraguay. 2.002	4
CRIA. Resultados de la Investigación de Soja. Ciclo 2001/2002. PRISOJA/CRIA. Paraguay. 2.002.	3
TSUCHIYA, T. Reasons why the improvement of the Soy is done in Paraguay. JICA. Paraguay. 2003.	1
JICA, 2.003Improvement for the Resistance to Nematodo del Quiste de la Soja. Takehiko Tsuchiya. Paraguay.	7
TSUCHIYA, T. Expert's Final Report. JICA. Paraguay. 2.003	1
CRIA. Technical Workshops. Memories. Paraguay. 2.004.	1
Total	**17**

Source: CRIA's Publications and Annual Reports

These articles were published during the project development (1997-2002), except the last publication which is an achievement of CRIA, independent of the JICA project. It is important to remark that these articles are all related to genetic improvement of soybean. CRIA still produces information in other areas of research about soybean and other cultivations (see Attachments: List of Publications)

On the other hand, innovations in the area of application of remote techniques for the optimization of production are still being developed. Different test with Agriculture of Precision have been conducted with good results. These results have been presented in seminars and to interested private companies. Currently, private companies are analyzing the idea of financing researches in this area. (Interview to CRIA personnel, Nov. 2005).

Also, CRIA has secured financing funds for research in areas of plant pathology and agronomy. Funding has been obtained for the study "Evaluation of Potential Sources of Soybean Rust Resistance", in collaboration with the U.S. Department of Agriculture (USDA). Also, a local company named Golondrina S.A., has agreed to finance the research study on "Effects of the Vesicular-Arbuscular Mycorrhiza fungi (VAM) in the soy growth in three different soil types of Paraguay" (interview to CRIA personnel, Nov. 2005).

The activities detailed above show that the knowledge and abilities transferred during the Research Project on Soybean Production in Paraguay, are still present, although it has been weakened due to the low retention of personnel and the inappropriate recruit of new workforce. Getting external financed funds and developing new varieties are results of the initiative and capacity of the members of the technical team.

The acquired equipment consisted mainly in vehicles and machinery, which are being operated and maintained by personnel of CRIA.

One of the aspects that have not been tackled systematically is the "institutional relations". Even though CRIA has frequent contact with other national centers of research, with educational and research institutes, producers, city councils and

Departmental Governments, there is not a defined structure that can allow the optimal use of human and material resources available at CRIA.

One of the frequent observations noticed in interviews made for this report is the lack of synchronization perceived by the producers and seed suppliers between the activities undertaken by CRIA and the needs of the producers.

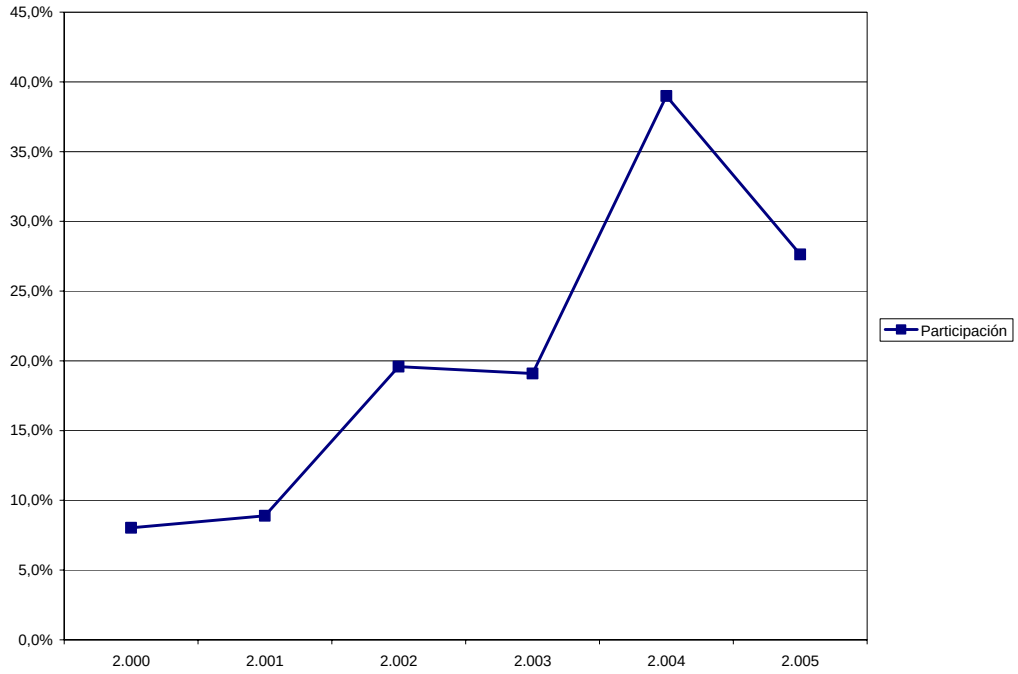
These perceptions, which are not necessarily accurate, show the deficient relationships with institutions, organizations of production, universities and other centers of research and studies. In many cases, the perception of the producers is affected by the high presence of genetically modified soybean production and the scarce diffusion of the achievements of CRIA.

3.1.6.- Economic and Financial Aspects

Detailed data about budget execution of CRIA was not possible to obtain, neither at CRIA's nor at the Direccion de Investigacion Agricola (DIA) – Direction of Agricultural Research -. The only data that was accessible and available were the budget for the Plan Operativo Anual of CRIA– CRIA's Operative Annual Plan – and the budget executed by CRIA as provided by DIA.

These two sources of information have different split sections, which precludes comparison and analysis between them. However, the Budget allocation supplied by DIA indicates a slight increase in Personnel Services and a clear increase in the participation of other areas that do not include Personnel Services. This last group of the budget presents an increase of 8.9% in 2001 to 27.6% in 2005, with a strong participation of consumption goods and Physical Investments.

Figure [3.1.6.1] Evolution of Non-Personal Services in Total CRIA's Budget (%)



Source: DIA

From the point of view of income generation, CRIA produces its own income through the sale of seeds, royalties related to seeds developed by CRIA, evaluation of crops, testing on the application of herbicides and soil analysis.

During 2005, some 76 tests on crops are underway and also some 40 tests on effectiveness of herbicide application. Considering that the cost of each test on crop is about Gs. 5MM (about USD 830) and that each test of application of herbicides costs Gs. 12MM (about USD 2.000), and also the fact that each of these tests lasts approximately 2 years, it can be estimated that income generation of CRIA through the use of its own capacity is significant as compared to the allocated budget (interview to CRIA personnel, Nov. 2005).

Even though the Final Evaluation Report of the Project (March of 2002) included formal commitment of the Ministry of Agriculture and Livestock (MAG) to perform the necessary diligences with all the pertinent authorities to have all the income generated by CRIA returned directly and fast to CRIA, this has not been possible yet at the time of this evaluation.

BUDGET EXECUTION - CRIA (ESTIMATE)

DIRECTION OF AGRICULTURAL RESEARCH (In thousands of Gs.)

Description of expenses	2000		2001		2002		2003		2004		2005	
	Budget.	Real Expense	Budget.	Real Expense	Budget.	Real Expense	Budget.	Real Expense	Budget.	Real Expense	Budget.	Real Expense
Personal Services		1.002.028		909.018		880.007		881.876		921.856		982.246
Non Personal Services		27.312		32.813		75.167		72.438		154.385		69.758
Consumption Goods		52.291		44.042		100.195		90.244		273.869		135.967
Physical Investment		0		0		38.895		35.339		95.838		117.831
Transfers		0		0		0		10.000		50.270		31.428
Other expenses		7.911		11.899		0		0		14.600		20.000
TOTAL		**1.089.542**	**0**	**997.772**	**0**	**1.094.264**	**0**	**1.089.897**	**0**	**1.510.818**	**0**	**1.357.230**

Year	**Budget submitted by CRIA (POA)** – In thousands of Guaraníes
1997	529.062
198	518.804
1999	518.804
2000	108.016
2001	108.016
2002	188.829
2003	188.829
2004	290.132

3.2.- Sustainability of the Project

3.2.1.- Policy Aspect

The evolution of production and the cultivated area of soybean during the last years, as well as the increasing participation of producers (small, medium and large producers) indicates that the production of soybean will still be one of the most important activities in the Paraguayan economy. This situation must be handled strategically by the Paraguayan Government and specially by the Ministry of Agriculture and Livestock through the "Dirección de Investigación Agrícola" (DIA)

For the formulation of a sustainable production of soybean in Paraguay, not only Government Agencies and International Cooperating Agencies should be involved. It is necessary a more fluid relationship between the National Government Agencies, departmental and local Agencies, as well as representatives of the producers and the citizens that live in the farming areas.

For this purpose, there is an increasing positive attitude of the large producers of soybean to explore better mechanisms to work at the local level involving organized communities, local governments and soybean production companies (Molinas & Ibarra, 2004).

The effective participation of local governments is a key element in this process. On one hand, this fact induces local authorities to become more involved in the real aspects that affect their district. The active participants include: producers, peasants and business people, neighborhoods and local and state agencies that provide service within the district. On the other hand, local governments have the attribute of having been legitimately chosen in democratic and competitive elections. The different political lines are generally represented in the municipal legislation. This legitimacy grants power to local authorities to represent the district before the central and departmental governments. This fact grants the local authorities the role of regulator in issues related to national policies associated to health, education, infrastructure, environment, agriculture and industry within the district. The role of moderator can be executed now within a legal frame, even though there is a limited formal decentralization in the country.[1]

The bases of this potential agreement should be a strategy of development reached geographically and should involve the main protagonist of the economic, environmental and social process related to soybean production.

On the other hand, the continuous spread of soybean production among those producers with less than 20 hectares urges a more effective coordination between research agencies of MAG, and specially CRIA, with those agencies that provide technical assistance to small producers to improve the efficiency in the transference of technology.

[1] In this regard, Instituto de Desarrollo is performing an pilot projecto at the District of Carapegua since the beginning of 2002, with encouraging preliminary results (See Molinas and Martinez, 2004)

This is even more important given the fact that only a small portion of small producers has access to technical assistance, as it is indicated in the following table:

Table [3.2.1.1]: Technical Assistance 2000/01

		Number	**Percentage**	**Percentage**
Number of farms		394961	100%	
Requested to:		57409	15%	100%
	MAG	10574	3%	18%
	Exporting entities	1688	0%	3%
	Consumption Dist.	42	0%	0%
	BNF,CAH,FDC	31781	8%	55%
	Coop	5026	1%	9%
	Local Governments	1459	0%	3%
	NGOs	2394	1%	4%
	Other	4445	1%	8%
		57409		
Type of requested assistance				
Assistance in the development of cultivation			36%	
Credit for cultivation			52%	
Assistance for Animal breeding			4%	
Project Support			2%	
Comercialization of products			3%	
Organization			2%	
Other			1%	
			100%	

Source: Elaboración en base a la EIH 2000/01.

The EIH 2000/2001 indicates that the assistance to small farms (20 hectares and less) reaches 15%. The participation of the Ministry of Agriculture and Livestock and the State Financial organizations participation are 18% and 55% respectively. The participation of other units that include ONGs and local government reaches 15%.

The assistance to small farms refers mainly to the development of new crops (36%) and access to credits (52%). More than 2/3 of the country farms consider that the assistance they received was good.

As mentioned previously, the production of conventional varieties developed by CRIA may strengthen the increasing demand of organic products, which associated with a strong technical assistance will make possible the employment of labor force, counteracting the displacement of labor force with mechanization of soybean production. This opportunity is larger in areas where the production of soybean is spreading, mainly into areas no where cultivation was not done previously

On the other hand, the drought that affected the country in the last 3 years coincidently during the cultivation season makes necessary to convoke the different integrants of soybean production to create a strategic plan to avoid and minimize the loss resulting from the lack of rain.

3.2.2.- Technological Aspects

The information and technology generated by CRIA were adopted based on the interest of the producers, the level of applicability of the generated technology, and the means the information used to reach producers.

In the area of genetic improvement, where the results were higher in terms of volume of information, it can be observed that during the period of 2002 and 2005 there has been a decrease in the use of varieties produced by CRIA. The producer has access to a wide range of genetic alternatives with different variations of short, medium and long cycles offered by different seed supplier (DISE, Annual Report, 2005)

Even though the varieties AURORA, UNIALA, DON RUFO and PUA'E are known by the producers, there is a wide range of variety mainly from Argentina, Brazil (Annual Report, DISE 2004), besides the seeds produced locally. As a result of this situation, plus the limited divulgation of CRIA and the low availability of seeds, most of the producers buy seeds supplied by other companies, such as: CODETEC, EMBRAPA, NIDERA, among others.

During the last few years, there has been an important increase in the production of seeds at local farms and those classified as "not registered seeds" (probably illegally entered into the country), varying from 48% in 2000 to 71% in 2004 and the production at the national level decreased from 31% in 2000 to 23% in 2004%. See Table (3.2.1.1).

Table [3.2.2.1]: Quantity of produced, imported and not registered soy bean seeds (in percentage)

Year	Request (tons of seeds)	Production by registered companies (%)	Imports (%)	Own production and not registered income (%)
2000	96.000	31	21	48
2001	93.500	29	9	62
2002	105.000	41	8	51
2003*	-	-	-	-
2004	133.000	23	6	71

Source: DISE Annual Reports, 2.001 to 2.005.

As can be observed from the above table, the soybean varieties produced locally, including those of CRIA and other companies, have been continually losing share with respect to varieties of unknown origin and to soybean seed farmed by the producers. During the recent years, there has been an important expansion of areas cultivated with genetically modified soybean seeds.

The production with genetically modified varieties cost approximately 20 to 30% less than the ones with conventional varieties and this affects the choice of the producer (Guerreros, A. Interview, Dec. 2005). Basically, there are no differences in terms of productivity between the transgenic type and the conventional type, but there are some details that should be verified; for example, that the genetically modified soybean present deficient adaptation to local environmental conditions, especially those brought

from Argentina (Junghans, E. Interview. Dec., 2005, Guerreros, A. Interview. Dec., 2005, Paniagua, M. Interview. Jan. 2006), and also, that they have less tolerance to disease. However, the economic aspect and the easier handling characteristic (use of herbicides) are the determinant factors at the moment of choice.

Apart from the genetically modified varieties, the percentage of participation of CRIA is still low among the conventional type, having just a 5% of total participation. (Bianchi, O. Interview, Dec. 2005)

Representatives from cooperatives and associations stated that there is limited availability of seeds from CRIA, which is why the producers turns to other suppliers more frequently (Aguiar, O.; Interview, Dec. 2005; Seki, Y.; Interview. Jan. 2006)

Although CRIA's personnel of the seed production section participated in field work assignments, technical meetings, seminars, trainings, etc. (CRIA, Annual Report 2005), the volume of seeds sold is still low as compared with those of private companies. From this point of view there is a difference in performance between CRIA's technical capacity used to generate information and technology (new varieties) and the adoption of these varieties by producers.

Regarding to the transfer of technology, CRIA performed several activities in 2005. (Table 3.2.2.2). CRIA participates in several activities in different locations in order to communicate the works performed. However, they should improve their strategy of communication, in order to reach more producers in a more efficient way.

Table [3.2.2.2]: Communication Activities Performed by CRIA in 2005.

Place	Date	Transmission	Transfer
Hohenau	Dec. The 15th – 18th, 2004	-	Participation in the Aerodinámica. Speakers: Antonio Altamirano, Casiano Altamirano, Aníbal Morel, Carlos Chávez.
Naranjal, Itapua.	Feb. the 15th	-	Agroshow COPRONAR. Speakers: Casiano Altamirano, Antonio Altamirano.
CETAPAR; Campo 9; Troncal tres; Hernandarias; Santa Rita.	Feb. the 21st – 25th, 2005	Presentation of soy materials developed by CRIA	CETAPAR; Campo 9; Troncal tres; Hernandarias; Santa Rita. Expositores: Aníbal Morel, Antonio Altamirano, Carlos Chávez
Hernandarias	Feb. the 27th, 2005	-	Release of new varieties of soy: Guaraní y Marangatú

Source: CRIA, Annual Report 2005.

In comparison with other areas, the achieved results with regards to soil management techniques and the introduction of new technologies such as the sowing on pasture areas in the Department of Misiones, are encouraging. The available database, such as information regarding to identification of appropriate areas for cultivation of soybean, can be used for other agricultural crops; georeferenced identification of agricultural areas is applicable to other development programs, and the sowing of soybean in areas of pastures, an innovation in Misiones, are the starting point for the generation of information and a research area to be explored. All of this information is available for

the producer. However, there is not a generalized dissemination of information, neither of the information generated by CRIA, nor those generated by other sources.

An important aspect to be considered is related to the ownership of the land in the Department of Misiones. The majority of the producers use the land by means of leasing. There is no guarantee as for the renewal of the rental agreements which in average last 5 years. This situation causes uncertainty to producers, since they would need 5 to 7 years to recover the investment and generate profits. This occurs mainly because of the high cost in the first year, since the producer must eliminate the pasture and level the ground evenly. Besides, approximately 200 kg of fertilizers must be applied (Aguilar, O. Interview. Dec 2005). This situation of uncertainty could be a constraint factor for the increase of the soybean production areas in Misiones.

In case the adequate conditions for the production of soybean are met in the Department of Missions, there is a good scenario of growth for soybean production. This situation should go along with technical assistance to the producers, since currently the producers do not receive consistent technical support. This situation creates opportunity and challenge for the development of research lines for CRIA.

On other matters, with the creation of the Department of Precision Agriculture as a new field of study, CRIA has put itself in line with other research centers of Mercosur. The generation of information for producers of medium and small size expands the impact of this technology, often associated to large scale producers with a good level of capital invested. Nevertheless, more time is necessary to have a more precise evaluation of the impact that this technology generates for small and medium size farmers.

In the Agronomy Section, studies related to the "Effect of the Vesicular-Arbuscular Mycorrhiza fungi (VAM) in the growth of the soybean in three different floors from the Paraguay" were continued. It is important to remark that this study is financed by a local company Golondrina S.A. Technicians of CRIA presented the proposal of investigation to the company's representative that consequently agreed to finance. (Barboza, V. Interview, Jan. 2006).

In previous studies the effect of the mycorrhizas in the efficiency of absorption of fosforo was determined, with applicable results to the zone of Captain Miranda (Barboza, V; Palacios, A; Díaz, M; et. al., 2004). This study complements and expands the previous one, since it will have data of the Department of San Pedro, Caazapá and Itapua. The laboratory analyses are in its final phase. The analyses of soil and studies of biomass were carried out in the College of Chemical Sciences of the National University of Asunción (UNA). CRIA is currently analyzing the quantification of spores and percentage of colonization of the mycorrhizas in the roots of the soybean (CRIA, Annual Report, 2005).

Research works of CRIA are financed mainly with the contribution of paraguayan private companies as well as foreign institutions. It is important to remember the support of the University of Mississippi and the USDA for the financing of studies on the Soybean Rust. The funds are administered by CAPECO. The studies on Precission Agriculture and the research on mycorrhiza fungi are supported by private companies with donations, as it was cited before. The commitment of the technical investigators of CRIA to continue research stands out in the search for financial sources for their studies.

3.2.3.- Environmental Aspects

Three years have passed since the culmination of the project. This time has not been enough to obtain substantial conclusions with regards to the environmental sustainability of the projects being implemented in CRIA. For this to be possible, it is necessary to organize data and the results of experience in a systematic way, with continuous monitoring of the selected indicators of sustainability, which up to now has been a difficult process. Because of this, it is better to determine guidelines to incorporate and/or reinforce the environmental sustainability of the investigations of CRIA.

As long as CRIA researches contribute with proposals which accounts for environmental goals of short, medium and long range, it will be possible to assess the commitment of the organization with the environmental sustainability associated with their projects. The following objectives are examples which might be taken into account:

a) Avoid the degradation of agricultural lands through the conservation and improvement of farms and the recovery of the lands already degraded;

b) Avoid the negative impacts of the pesticides and chemical fertilizers in the environment and in the human beings; and

c) Avoid the destruction and degradation of the biodiversity and natural resources.

And, considering the short, medium and long time terms of each of the objectives, the researches would indicate us how effective is CRIA in the search of the environmental sustainability of the implemented projects.

An aspect to be highlighted is that only conventional varieties of soybean are the result from the investigations of CRIA and were presented to be used by producers. We can interpret this as an implicit support to the Principle of Precaution mentioned previously. This is because the impact on the environment and on human beings in the short, medium and long terms associated to the genetically modified organisms, which is very discussed nowadays, do not relate to the varieties developed at CRIA, at least up to now.

For works related to the use of land, it is necessary to specify the protected bio-diverse areas. For this purpose, it is necessary to coordinate activities with the SEAM and the local environmental authorities, in such a way as to assure their conservation.

Similarly, a continuous environmental monitoring of the situation of the work areas, which are very dynamic and changing, will serve to adjust the implemented research lines at CRIA.

3.2.4.- Social-Cultural Aspects

As mentioned previously, because of the nature of the project, it is not possible to evaluate explicitly the aspects of social-cultural sustainability. The project has contributed to some small impacts, although these impacts are not totally related to the project.

For this reason, the evaluation of the social-cultural aspect is not relevant to this report.

3.2.5.- Institutional and Management Aspects.

CRIA has kept the capability of a knowledge creation in the area of soybean which is recognized locally and internationally. Evidence of this is the research performed currently with local and foreign financial aids.

This sustainability will be fortified through the creation of an research agenda, set forth and coordinated with the Direction of the Agricultural Investigation (DIA), the producers, the seed distributors, the agricultural suppliers, the exporting companies of soybean and associated products, the local and departmental governments, National and/or International universities of research and colleges, as well as other institutions of experimental tests and research.

The first step can start with the "International Seminar of Soybean", to be carried out soon (and February the 23rd and 24th of 2006). This seminar is organized by CRIA along with the Association of Agronomists of Itapúa. It will include the participation of the key actors of the soybean production such as producers, associations of producers, representatives of the departmental government, representatives of the Ministry of Agriculture and Stockbreeding, representatives of Foreign and National Research Organizations, and representatives of international agencies. The occasion will be suitable for drafting an agenda of work that will constitute a guideline for future research at CRIA, as well as work coordinated with other organizations.

The creation of an agenda of work will serve to focus the need for training and development of new skills, as well as the incorporation of new members to the staff of CRIA. This last topic is very important, having into account that of the current staff, only 14 out of 78 have university degrees in areas related to CRIA research (Annual Report CRIA, December 2005) and only one of the staff members assigned to the soybean program has a university degree.

The continuous rotation of qualified personnel, mainly associated to issues related to income, does not contribute to the continuous flow of the activities taken by CRIA. This situation should be considered when planning the activities, as well as in the identification of additional resources.

An important aspect to be considered is the generation of new research projects in association with private companies as well as local or foreign agencies. The recent experience of contribution in areas of the Soybean Rust and Mycorrhiza fungi are examples of the capacity installed. This capacity should be recognized and reinforced so that it keeps fortifying the research capacity of CRIA.

3.2.6.- Economic and Financial Aspects

The increasing requests of services by CRIA are due to the continuous growth of soybean cultivation and the development of new foreign varieties along with the diffusion of the agriculture of precision. The services performed by CRIA generates additional income other than those included in the assigned budget, and this fortifies the development of the abilities expected from CRIA

This will be possible only through the implementation of mechanisms that permit the return of the resources generated by CRIA to the original source (CRIA) in a proper way. This situation has already been object of analysis and request from previous Evaluation Teams and has become part of a commitment by MAG's representatives to expedite the necessary steps that allows CRIA the utilization of its own generated resources. We have not been able to find the documents that support the facts that the actions carried out by MAG took indeed place, but it is important to remark that the procedure is not in place yet.

3.3.- Analysis of Sustainability and Impact Factors

3.3.1.- Promoting Factors of Impact and Sustainability

There are many different factors which support the achieved level of impact, as well as to the sustainability aspects of the project. The following list includes the most significant promoting factors of the impact and sustainability:

- Soybean is one of the most important agricultural products. It contributes significantly in the generation of foreign exchange which levels the trade balance. The production of soybean is one of the priorities in the growing economic policies of the country, therefore, is and active issue of the Paraguayan Government agenda.

- The international prices of soybean and the international demand of this product have been increasing constantly in recent years, stimulating the national production through the growth of the cultivated surface. This situation has sustained even in the case of minor decreases in international prices.

- The Paraguayan production reflects the technological advances in the soybean production. The high degree of competitiveness achieved is a consequence of the use of leading technologies, which in turns reflects the constant re-investment in the field.

- The development of varieties adapted to different zones of the country produces steady results which contribute to attractive returns for the producers. The continuous development of new varieties reflects the degree of advancement in knowledge and technology and translates into benefit for the producers.

- The well-timed development of new varieties allows the fight against plagues and diseases, diminishing the losses of production in a very short time. As an example,

new varieties developed are all resistant to Soybean Canker, an illness that little time ago caused significant damages to the production. Today, there are varieties being studied with good resistance al Soybean Cyst Nematode (SCN) and to the Soybean Rust.

- The decrease of the volume of chemically toxic products in the systems of soybean production is benefited with the development of new varieties tolerant to plagues and diseases. This contributes toward an environmentally sustainable production.

- The National Network of Tests has installations in the significant areas of soybean production, allowing the development of varieties, as well as the analysis of the adaptation of imported varieties. As a result, an adequate selection for the production is carried out.

- The varieties developed by CRIA have good characteristics in regards to animal and human consumption. The levels of proteins and of oils make them attractive for markets in growing demand, like the organic market.

- The use of conventional varieties is a friendlier technology in regards to the conservation of the ecosystem. It cooperates with the promotion techniques of organic production, allowing the incorporation of diverse types of producers, especially those with small farms. As a result, there is an increase of the labor employed and better margins of commercialization.

- The continuous expansion of the soybean production border is based on innovative techniques, just as those developed during the Project. This technology allows the identification of new areas for the cultivation and its potentials have been recognized for the producers and associations.

- The development of soil management techniques and cropping, along with the identification of new areas for sowing, allows a rational use of the land and facilitates the choice of an appropriate system of direct sowing of soybean.

- The utilization of remote techniques for the Agriculture of Precision generates an important volume of information that will be available for the producers, especially for those of small and medium size farms.

- CRIA counts with a professional staff committed with research and development. The production of CRIA has been sustained, in spite of having scarce resources. The commitment of the members of CRIA is recognized by the producers. This creates good channels of communication and means of exchange, which at the same time promotes a favorable and adequate use of the "know-how" developed in CRIA.

- The technical skills of professionals at CRIA allows for the identification on new research in areas associated to the production of soybean. This facilitates contact with national and international organizations related to research, promotion and production of soybean. The recognition of the abilities and competences of the personnel of CRIA facilitates the continuous advance in the production of soybean.

3.3.2.- Inhibiting Factors of Impact and Sustainability

Just as there are series of promoting factors for impact and sustainability of the project, there are also some factors that inhibit these aspects. Their identification and recognition allows the identification of areas for future improvements in order to facilitate the advance in the production of soybean. Some of these factors are:

- The lack of a national agenda properly coordinated regarding to the production of soybean does not facilitate the optimization of the available resources, nor the correct channeling of concerns of the different participants, such as the Department of Agriculture, the Direction of Agricultural Investigation, Associations of Producers, Departmental and Local Governments.

- The existence of new plagues and diseases can present an obstacle for the sustainable production of soybean. In this aspect, it is important the role and work of CRIA as an agent of research and validation of technologies, through works within the institution and in constant contact with other national and foreign research centers.

- The growing participation of genetically modified varieties presents additional challenges for CRIA since up to now, only conventional varieties have been focused.

- The continuous decrease of cultivated surface associated to conventional varieties, the lack of an adequate national promotion network of new varieties, the great offer from foreign conventional varieties with a great promotion campaign, results in a very small participation of the varieties developed by CRIA. This situation should be analyzed by the pertinent agencies.

- It is necessary to fortify the means of communications with producers, especially with those of the small and medium size. The insufficient knowledge of the producers in regards to the developments of CRIA results in deficient channels of communication.

- The increased in mechanized farming areas with the consequent substitution of labor and the lack of a technical program of aid to small soybean producers reinforces the negative perception of the sowing of soybean. This situation should be analyzed and the works should be coordinated by the pertinent governmental agencies in order to develop a plan of promotion and technical aid to the small producers, who constitute a large percentage of the producing units.

- The continuous degradation of the natural resources, land, water and biodiversity in areas of soybean production should be focused constantly in coordination with national policies and the expectations of the community.

- The lack of a training and continuous renewal of the staff in CRIA seriously affects the adequate sustainability of the project. It is necessary that DIA – the agency that groups the research centers - prepares a plan of training and development to be included in the agenda. This agenda should detail the training and development of appropriate resources determined for each of the centers.

- The lack of sufficient resources assigned for the research inhibits the development of human resources and adequate use of material resources installed in CRIA.

3.4.- Conclusions

The information generated by CRIA produced a relative impact according to the area of research and the zone of application of that technology. The varieties produced are to be emphasized, especially the last two developed, Guarani and Marangatú as products resulting from the project financed by JICA.

CRIA generated information on areas appropriate for soybean in the Department of Misiones, using georeferenced information. This information was available for the first time for producers and the methodology is applicable to other crops, just as it has been shown through recent works (P. Kamawura, Memorias CRIA 2005).

Innovative investigations like soybean sowing in meadowed lands and the effect of mycorrhiza fungi on the efficient use of phosphorous by plants; studies of resistance to diseases such as Soybean Cyst Nematode and Soybean Rust, positions CRIA as a reference in the investigation of soybean in the MERCOSUR area.

Greater impact and sustainability can be expected with a superior capacity of dissemination, improvement in its promotion strategy for products developed, having a more efficient impact on the producers' decision making process at the time of selection of the genetic material for sowing.

The investigations made by CRIA should consider the socio-environmental situation of the affected areas and the needs of the producers. The protection and conservation of the natural resources as well as of the biodiversity of genes, species and ecosystems should be assured, preventing CRIA's investigations from damaging and degrading the environment.

The development of an agenda of investigation with the Central Government, the producers, Departmental Government and associations of producers will facilitate the identification of other areas of investigation and will also facilitate the disclosure of the results.

The lack of availability of the resources generated by CRIA is a condition that works against CRIA's sustainability. The bureaucracy that affects the process of returning the monetary resources generated by CRIA has been object of several presentations before this work, and even of a formal commitment from the Ministry of Agriculture and Livestock (MAG), which up to date, has not been solved yet. We consider this an important aspect for the sustainability of CRIA and its investigations.

It is important to remark the respectful attention and open attitude of the technical personnel at CRIA towards this Evaluating Team, offering precise and pertinent information that was very helpful for the purpose of this work.

4.- RECOMMENDATIONS AND LESSONS LEARNT

4.1.- Recommendations

Based on the data obtained for this report and of the analysis of them, this Evaluating Team finds the following recommendation pertinent:

- Having an Agenda for the National Investigation of Soybean that contemplates the desires and concerns of the diverse stakeholders involved in the production of soybean. This includes representatives from the producing, environmental, local, departmental, and national authorities, as well as business persons and researchers.

- Strengthening the existing dissemination mechanisms of CRIA's achievements focusing primarily on the communication with producers. Publications of materials aimed at producers are a good tool. These publications should be coordinated with the Direction of Agricultural Extension (DEAG) and complemented with the use of the CRIA's Internet site.

- Establishing agreements with firms for the diffusion of national varieties. This will allow the correct utilization of the resources present in CRIA, without neglecting the diffusion.

- Coordinating the supply of national varieties seeds with distributors and producers. Since there is a lot of offering of different varieties, the producer easily chooses another foreign variety instead of national seeds when CRIA's varieties are not available.

- Keeping up with the works of application of the remote techniques for the identification of appropriate lands and for the Agriculture of Precision. The success on the application of these techniques will ease the process of identification of new proper areas for the cultivation of the soybean. It will also ensure the production of other agricultural areas.

- Combining researches about conventional varieties and researches about genetically modified varieties, through agreements that permit the adequate utilization of human resources and materials present at CRIA. The adequate balance of investigations on both types of seeds will allow a more efficient diffusion of the know-how and technology among the producers.

- In consideration of the environmental sustainability, the following indicators for future investigations are proposed for the work at CRIA:

    1. Surface cultivated with varieties adapted by CRIA with low impact in the biodiversity, the natural resources and human beings.

    2. Surface cultivated with organic soybean varieties of CRIA.

    3. Surface of agricultural lands recovered with CRIA's techniques.

4. Surface in which CRIA's techniques of conservationist of lands have been applied (avoiding the degradation of soil and negative impacts in other ecosystems).

5. Surface of zones in restoration phases and/or of natural and semi-naturals ecosystems

6. Drainage surface and natural systems of rivers dwellers protected in areas of influence of CRIA's projects.

7. Surface of the protected high fields of Misiones

8. Surface to which techniques of sustainable management of agricultural systems of CRIA have been applied

- From the institutional point of view, it is necessary to reinforce the technical staff of CRIA with professionals qualified in research techniques and with university level degrees. The continuous shrinkage of professional personnel of CRIA can seriously damage its capacity of research and development.

- It is necessary to develop a mechanism that allows an opportune use of the resources generated. It is also important to establish their use in line with the agreed research agenda.

- The transformation of CRIA into a decentralized unit is a pertinent proposal. This decentralization implies that CRIA with its own financial resources transferred from the Ministry of Finance (Ministerio de Hacienda), with the delegated authority to sign agreements with national or international agencies or companies or research centers, without the cumbersome procedures in place nowadays.

4.2.- Lessons Learnt

The lessons learned out of the analysis of the data collected in this report can be summarized as follows:

- It is necessary to coordinate and implement an agenda of analysis on the reality of the production of the soybean in the diverse zones of the country, involving the different stakeholders.

- The presence and permanency of qualified personnel in CRIA for research works should be analyzed by those responsible for different research centers. A development plan for each one of the members assigned should be established.

- It is necessary to strengthen the mechanisms of dissemination of the soybean-related results obtained. Specifically a greater approach to those who possess smaller crops must be reached (less than 20 Ha), since they represent the majority of the producers in the country.

- Reassuring financing sources in order to continue with the implemented research projects will contribute to the sustained development of the production of soybean.

- The environmental sustainability aspect of this project indicates the importance of proper and timely selection of environmental performance indicators, which should be monitored periodically. This should be implemented for coming projects

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6.- APPENDICES

6.1.- Logical Framework

PROJECT DESIGN MATRIX (PDM-e)

NARRARIVE SUMMARY	VERIFIABLE INDICATORS	MEASNS OF VERIFICATION	IMPORTANT ASSUMPTIONS
OVERALL GOAL Stable productivity and an expansion of production area of soybean will be realized through the development of breading techniques, sustainable cultivation techniques and the conveying of appropriate techniques to the farmers in Paraguay, thus contributing to the stability and development of Paraguayan economy.	Transition of production and planting area (by region)	Statistic data	National policy on agriculture is maintained.
PROJECT PURPOSE The research capability of CRIA related to breading, cultivation and soil management in soybean production will be enhanced for the development of appropriate varieties and a sustainable cultivation system.	Progress and results of researched in CRIA (Theses and reports, etc.)	Project record	1. The results of research and study are widely disseminated. 2. Prices of agricultural products are stable. 3. Researchers remain in CRIA 4. Financial condition of CRIA is appropriate and stable.
OUTPUTS 1. The researchers of CRIA acquire the following techniques and improve their technical capability. 1) Techniques for breading soybean 2) Cultivation techniques contributing to the establishment of an appropriate cropping system 3) Soil management techniques	1. Improvement of researcher' technical capability (Attainment of each research objective) 2. Status of utilization and maintenance of machinery and materials 3. Situation of linkage with other institutions	1. Survey by interviews to the experts and the researchers 2. Project record 3. Survey by interviews to the experts and the researchers	1. Counterpart researchers who have acquired the relevant technology do not resign. 2. Budget necessary for research is secured. 3.Linkages with CETAPAR and other institutions are properly maintained
ACTIVITIES To implement the following research activities 1-a. Collecting and selecting breading materials, and ecological classification (1) Collection and selection of breading materials (2) Ecological classification of breading materials 1-b. Studying the breading the breading techniques of appropriate varieties (1) Breading of high yielding varieties for Itapua/Alto Parana (2) Breading of varieties with appropriate growing periods for Itapua/Alto Parana (3) Breading of germplasm resistant to SCN 1-c. Improving the evaluation method of disease resistance 2-a. Studying cultivation techniques for the diversification of crops after/before soybeans (1) Ecological classification of sunflower (2) Improvement of the appropriate cropping system 2-b. Studying cultivation techniques for stable and high productivity (1) Effective utilization of soil-phosphorus by mycorrhiza (2) Improvement of deep application method of phosphorus fertilizer 3-a. Studying soil management techniques for new areas where soybean production is being introduced and expanded (1) Soil diagnosis for soybean production in Misiones (3) Improvement of soil management techniques in Misiones	INPUTS <Japanese side> 1. Experts 1) Long-term experts Leader, Coordinator, Soybean breeding, Cultivation, Soil fertility (5 experts) 2) Short-term experts When necessity arises 2. Provision of equipment 3. Acceptance of trainees 4. A potion of local expenditure <Paraguayan side> 1. Executing organization 2. Counterpart personnel 3. Running expenses 4. Land, building and facilities necessary for the Project. Survey by interviews to the experts and the researchers		1. Counterpart researchers are properly allocated 2. Cooperation by CETAPAR is obtained. 3. There is no critical change in the weather condition. 4. The public services such as telecommunication and electricity are secured. (Pre-conditions) 1. CRIA is the central research institution of soybean. 2. Normal conditions of socio-economics and natural environment are maintained stable. 3. National strategy on soybean does not change.

6.2.- Evaluation Grid

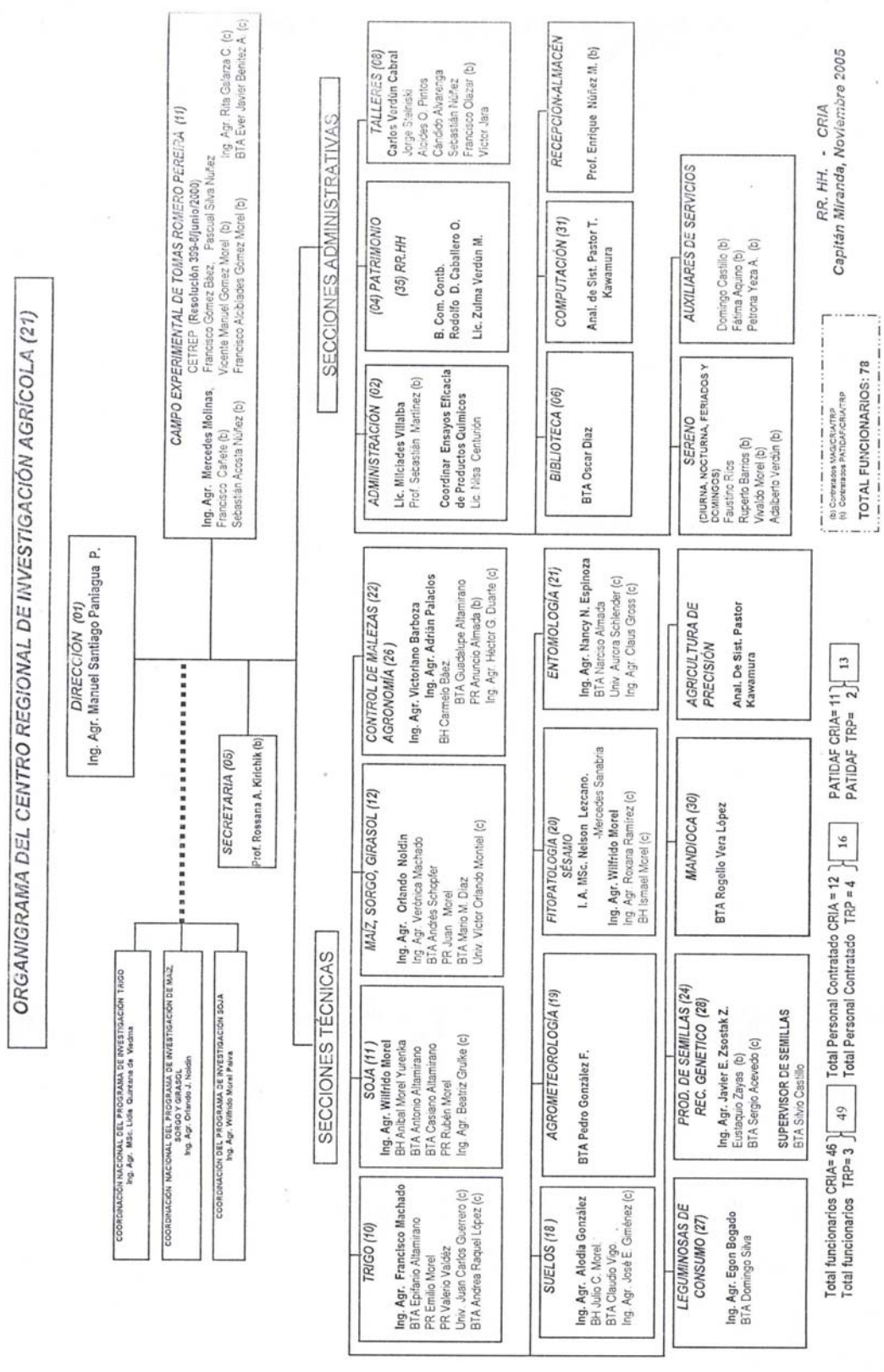
Evaluation Points	Control Points		Criteria of Reached Achievement Levels/ Indicator	Necessary data	Fuente de Verificación
	Main questions	Specific questions			
1. IMPACT	1.- ¿Up to what point has the Goal and the upper Goal of the project been reached since its final evaluation?	1.1.-¿What are the differences in reached productivities for those who used CRIA's techniques vs. those who didn't?	1.1.1.- Productivity of farmers that used CRIA's techniques; 1.1.2.- Productivity of farmers not reached by CRIA	Production data at producer's farms, either associated to CRIA or not	Interviews to staff from CRIA, CETAPAR, MAG, CAPECO, y Producers
		1.2.- What additional extension was managed to be covered with the techniques of soil management developed by CRIA?	1.2.1.- Percentage of growth of cultivated influencial zone CRIA, period 1997-2005	Cultivated surface in influencial areas of CRIA	Records from CRIA, MAG, CAPECO y Producers.
	2.- If the goal has not been achieved, which is the reason or the factor that impeded?	2.1.-Which are the factors that have affected the most in the fulfillment of the project's goal?	2.1.1.- List of factors that impede the achievement of the project's goal. Main participants' opinión about the mechanisms by which they were affected.	Statistics on the perception of the main involved people	Interviews to staff from CRIA, CETAPAR, MAG, CAPECO, y Producers
		2.2.-Which are the factors that affected the most in the fulfillment of the project's upper goal?	2.2.1.- List of factors that impede the achievement of the superior project's goal. Main participants' opinión about the mechanisms by which they were affected.	Statistics on the perception of the main involved people	Interviews to staff from CRIA, CETAPAR, MAG, CAPECO, y Producers
	3.- ¿Did The project contribute to the training and strengthening of the Regional Center of Agricultural Investigation (CRIA)?	3.1.- Has CRIA's contribution level been maintained after the cooperation was finalized?	3.1.1.-Evolution of the results in improvement areas, agronomy and soil management in the period of 1997-2005	Unattached statistics of reports, thesis, varieties in the period of 1997-2005	Records from CRIA, CETAPAR, MAG

Evaluation Points	Control Points		Criteria of Reached Achievement Levels/ Indicator	Necessary data	Fuente de Verificación
	Main questions	Specific questions			
		3.2.- Has the level of training for CRIA's personnle been maintained?	3.2.1.- Evolution of the relevant technical training related to soy in the period of 1997-2005	Unattached statistics of training in the period of 1997-2005	Records from CRIA
		3.3.- ¿Has the qualified technical personnel staff increased at CRIA?	3.3.1.-Evolution of technical personnel trained in areas related to soy in the period of 1997-2005	Records of technical personnel assignated to CRIA in the period 1997-2005	Records from CRIA
	4.- Have unexpected positive and negative effects been observed or in the project?	4.1.- Has the development of the institutional capacity of CRIA in the development of soy made possible to transfer better institutional skills to other products? ¿If so, which?	4.1.1.- Lista of institutional skills of CRIA that were usd in other lines	Unattached statistics of positive externalities, with its corresponding description and mechanisms through which they operated	Interviews to staff from CRIA, Producers, CETAPAR, MAG
		4.2.- Has the project had unexpected impacts in the project area?(environmental, economic, social, . ..)	4.2.1.- List of unexpected impacts (positive or negative) in the project area. Descriptions	Unattached statistics of positive externalities, with its corresponding description and mechanisms through which they operated	Interviews to staff from CRIA, Producers, CETAPAR, MAG

Evaluation Points	Control Points		Criteria of Reached Achievement Levels/ Indicator	Necessary data	Fuente de Verificación
	Main questions	Specific questions			
	5.- What factors have contributed to the negative and positive impacts?	5.1.- ¿What are the external factors that affected the most in either a opssitive or negative way in the fulfllment of the project?	5.1.1.- List of external factors that affected posittively or negatively to the fulfillment of the project. Opinion of main participants about the mechanism that affected the factors	Statistics of the perception of the main involved people	Interviews to staff from CRIA, Producers, CETAPAR, MAG, CAPECO
2. SUSTAINA-BILITY	6.- Have the results of the project been maintained since the finalization of the cooperation?	6.1.- ¿What are the conditions in which CRIA has maintained the project's results since the end of the cooperation?	6.1.1.- List of forms in which CRIA has maintained the benefits of the project and the description of the mechanisms through which it operated	Statistics of CRIA's actions	Interviews to staff from CRIA, CETAPAR, Producers
		6.2.- What is the level of CRIA's administrative capacity to keep the project's efficiency?	6.2.1.- Main involved people's scale of perception on the administrative capacity of CRIA	Statistics on the perception of the administrative capcity of CRIA	Interviews to staff from CRIA, CETAPAR, Producers
	7.- Are the transfer of technology, training of the personnels and the equipments donated still being used for the execution of the activities of this Center of Investigation?	7.1.- Was there a plan of resources develpment in CRIA?	7.1.1.- Assignment of resources for maintenance of programs in the period 1997-2005	Budget statistics of CRIA in the period of 1997-2005	Report on MH's Budget Execution

Evaluation Points	Control Points		Criteria of Reached Achievement Levels/ Indicator	Necessary data	Fuente de Verificación
	Main questions	Specific questions			
		7.2.- Has the level of technological transfer been kept after the cooperation ended?	7.2.1.- Evolution of activities of difussion in the period 1997-2005	Unattached statistics of publications, presentations, days in the field. . . In the period of 1997-2005	Records from CRIA, MAG, CETAPAR, Producers
		7.3.- Have the the relationships with equivalent institutions been kept within and out of the country?	7.3.1.- Evolution of agreements with similar institutions in the period of 1997-2005	Unattached statistics of agreements in the period of 1997-2005	Records from CRIA, MAG
	8.- What factors have contributed or inhibited the sustainability of the project?	8.1.-¿Did deseases and plagues appear after the project? What have been the international in the period? Are there other profitable lines that compete with soy?	8.1.1.- Records of average rain in the area of the project; list of diseases and plagues; international price level in the period 1997-2005	Statistics on rain, diseases, plagues and price levels	Statistics of the National Direction of Weather forecast. DEAG's records
		8.2.- Has the assignated budget level been maintained at CRIA?	8.2.1.- Evolution of budget and execution of budget of CRIA in the period of 1997-2005 (in constant Gs.)	Budget Statistics of CRIA in the period of 1997-2005	Report on MH's Budget Execution
3. OTHERS	9.- Has the participation of other donors been achieved to continue the goals of the project?	9.1.- Has the the participation of other donors been obtained to continue the goals of the project?	9.1.1.- Evolution of donations in the period of 1997-2005	Unattached statistics on donations in the period of 1997-2005	Records from CRIA y MAG

6.3.- CRIA's Organizational Chart



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