Pennsylvania State U., Michigan State U., and Texas A&M U.

University Consortium in Uruguay

Contract AID/La-722

Report No 8

# Project A

# Development Planning and Administration

# A REVIEW OF PROGRESS AND RECOMMENDATIONS FOR FUTURE ACTIVITIES

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June 1 - June 30, 1974

The objective of the short term consultant was to provide general technical assistance to long term consultant, Dr. James McGrann, and the Uruguayan research team working under Project A. Specifically, attention was devoted to (1) reviewing research activities and results accomplished to date, (2) developing effective means of communicating research results to appropriate audiences, and (3) developing a plan of work for the analysis under Project A yet to be completed.

These objectives were fulfilled during the term as nearly as possible within the time constraints. Accomplishments relating to each objective were as follows:

1. Review of Work Accomplished to Date.

The progress of research under Project A accomplished by Dr. McGrann and the Uruguayan team (including Miguel Cetrángolo, Vivian Lafitte de Cobas, Alfonso Carluccio and Gonzalo Pereyra) has been most impressive. This is especially true when considering the difficulties with resources encountered early in the project.

Most of the work to date has involved data collection, computer programming and analyses required to build a sound analytical base. At this point, data collection is complete in all livestock areas and eight linear programming models have been constructed. This represents a coverage of about 60 percent of the total land area of Uruguay. Data collection has been initiated in the cropping areas, but is incomplete as yet. Upon completion, this data base will be the most extensive and comprehensive source of farm level economic data available for agriculture in Uruguay.

A number of research reports have been completed or are in process of completion (see attached list). These reports are oriented to information needs at several levels including, farm and ranch managers and owners, policy makers and researchers.

In addition to contributions reflected in these and forthcoming research reports, Dr. McGrann and the Uruguayan counterparts have responded to short-term requests for information and economic assistance to several agricultural institutions including the Ministry of Agriculture (MGA), Plan Agropecuario, FUCREA, Wool Growers Association (SUL) and Experiment Station at La Estanzuela. Some direct economic assistance has been provided for producers. As more research results relating to Project A are published, requests for such assistance will probably increase.

2. Means of Communicating Research Results.

Research conducted under Project A will lead to results both of a technical and non-technical nature. Technical reports, such as those on the attached list will be completed and published for each major agricultural area. Basic input data and procedures as reported in "Coeficientes Técnicos y Presupuestos Parciales Para la Ganadería en la Zona de Basalto" provide useful farm management information as well as details upon which the linear programming models are based. These reports for each region and reports of linear programming results should be useful to agencies providing agricultural extension services to producers. The computer Manual "Manual Para Uso del Programa de Computación IBM-360-LPS" will be the first detailed guide to the application of linear programming analysis to farm management problems in Uruguay. This technique is used extensively in other countries and should be useful to agricultural researchers here.

The most important communications problem appears to be one of translating complex analytical results into non-technical language for use by decision makers with little or no quantitative or economic background. This problem was discussed at length with Dr. McGrann and his counterparts. It was agreed that primary attention should be given to this problem. The type of summary paper that should be useful for this purpose was prepared for consideration by Acting Minister Aznárez (see Attachment). Similar reports might be prepared on a periodic basis, or as research results become available. Moreover, the addition to the Tri-University Consortium of the agricultural communications specialist, Dr. C. Taboada, is most timely and full use should be made of his advice and services.

A set of three distinct types of publications was decided upon in order to reach all audiences that may use the results. These are:

(1) Technical reports, including reports of research results and procedures that are of a technical nature and useful primarily to agricultural extension agencies and other researchers. The computer manual and report on linear programming results of the Basaltic area are examples of this type.

(2) Information reports, including reports of basic data, trends in agricultural variables and cost analyses of a non-technical nature useful to planning agencies, producers and extension agents. The report of technical production coefficients and partial budgets and the analysis of price trends are examples.

(3) Economic memoranda, to include non-technical summaries, conclusions and implications and/or announcements of new research capabilities useful primarily to policy planners and heads of divisions within MGA, and other agricultural agencies. The summary report submitted to Acting Minister Aznárez is an example of this type of communication.

3. Plan of Work for Completing the Project.

The work to be completed under this project involves two separate but interrelated sets of activities. First, data collection and analyses for some farm and ranch level analyses need to be completed. Second, the macro agricultural sector model must be constructed. These activities are interrelated since the macro sectorial model depends directly upon the micro data and analysis.

The usefulness of the farm level (micro) analysis has already been demonstrated in those areas where models and reports have been completed. Results are used by MGA, SUL, FUCREA, Plan Agropecuario and other agencies. A degree of anticipation has developed on the part of these agencies for results for other agricultural areas. Hence, it is important that these analyses continue toward completion as rapidly as possible.

These points were discussed with Dr. McGrann and his counterparts. It was agreed that the present team of researchers, with the addition of needed field personnel, should be able to complete this work within a nine month extension beyond the August 8 project termination date.

The macro agricultural sector model builds directly upon the micro analyses but requires a considerable amount of additional information of an aggregate nature including quantities and prices of imports for agricultural production inputs, quantities and prices of export products, government taxes and subsidies, etc. Moreover, the macro model requires extensive effort to develop necessary computer software. The plan of work to complete the macro model was developed as follows:

(1) completion of farm level data inputs (McGrann and Uruguayan team)

(2) construction of computer model and collection of aggregate data (Roberto Vázquez and TAMU support)

(3) publication of reports and developing "on line" analytical capability within Uruguay (McGrann, Vázquez and Uruguayan team).

This work can be completed within eighteen months and will require support for Mr. Vázquez in the form of an assistantship and short-term (three months) travel to Uruguay for data collection and work directly with the Uruguayan counterparts.

The estimates and planning information to be gained from completion of the macro model justify this support. These are itemized as follows:

(1) Regional production levels and shifts in production that will maximize potential agricultural income within the country's resource constraints.

(2) Level of potential agricultural income.

(3) Investment requirements for increased production, including: fertilizer, seed, wire, petroleum, machinery and equipment, etc.

(4) Level of imports, by item and total foreign exchange, required to implement intensified crop and livestock production systems.

(5) Level of export potential by product and total foreign exchange earnings.

(6) Level of foreign agricultural trade balance (i. e. value of products exported less production inputs imported).

(7) Level of government revenue earnings associated with intensified agricultural production.

(8) Evaluation of effects of changes in relative prices of products and inputs on production, income, imports, exports and government revenue levels.

(9) Evaluation of effects of alternative government policies (pricing, etc.) on the agricultural sector, import-export balance and government revenue.

(10) Provides a continuous tool that may be called upon to gain estimates for short-run decisions or for long range planning.

4. Other Activities.

In addition to the activities outlined above, a significant amount of time was spent on details of the extension necessary for completing the work under this project in cooperation with Dr. McGrann, Mr. Thomas Stephens and Mr. Leonard Horwitz. It was agreed that AID would support the activities of this project until May, 1975. MGA agreed to increase its support of the effort above that previously supplied so that the work could be completed within the nine months extension period.

## SUMMARY AND RECOMMENDATIONS.

The work under this project has made significant progress since its inception. Limitations on physical and personnel support were severe in its early stages, but this situation has improved. A basic farm management data base and analytical capability has been developed that exceeds any previously available in Uruguay. A core of economic analysts has received training that should provide a continuing benefit to the agricultural sector.

The broad application of results by Uruguayan agricultural groups such as SUL, FUCREA, Plan Agropecuario and the Ministry of Agriculture is testimony to the usefulness of an interest in the research. Requests for information and analysis provided by the work have been numerous and may be expected to increase as more results are published.

Past activities have concentrated on building necessary basic data, analysis and expertise. Future activities can now concentrate on information flows that capitalize the basic work of the past.

Some specific recommendations relating to needed support by MGA and AID during the nine month extension are identified as follows:

### MGA Support Needed

In order to accomplish the initial objectives of the project it will require continuation of the following MGA support.

(1) four full-time staff members,
(2) the one full-time secretary,
(3) the office space we now occupy,
(4) continued MGA payment of computer time (approximately $1000 per month),
(5) the transportation presently provided.

In addition, the project will need the following support from the MGA.

(1) one full-time bilingual secretary,
(2) two field-men with agricultural degrees that have adequate experience doing full-time work so they can be used to gather producers data,
(3) office material support, particularly supplies for publication of results,
(4) formal coordination of research activities with the economic research branch of the Plan Agropecuario.

AID Support Needed.

AID support, in addition to present support, that will be needed is as follows:

(1) an assistantship for Roberto Vázquez, now at Texas A & M U.,
(2) travel support for Vázquez to spend three months in Uruguay for data collection and work with MGA research team,
(3) travel support for short-term (one month) consultant to assist Vázquez and MGA team in finalizing the macro model,
(4) a separate account for purchasing basic economic research methodology books and a computer card punching machine.

ATTACHMENT.

## Publications under Project A

- Coeficientes técnicos y presupuestos parciales para la Ganadería en la zona de Basalto.

- Coeficientes técnicos y Presupuestos parciales para la Ganadería en la zona de Cristalino.

- Coeficientes técnicos y Presupuestos parciales para la Ganadería en la Zona 4 y Sub-zona Garzón. *

- Análisis económico de los sistemas de producción tradicional y mejorado del área basáltica del Uruguay. **

- Manual para uso del programa de computación IBM-360-LPS. **

- Análisis de los precios pecuarios. **

- Análisis de los precios agrícolas. **

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* In print.

** To be submitted for approval.

First draft
MGA - DIEA
June 1974.

Summary and Implications of the Economic Analysis of Traditional and Improved Livestock Systems in the Basaltic Region of Uruguay.

The main purpose of this study is the development of agro-economic, linear programming models that represent typical systems of livestock and forage production in the Basaltic region in Uruguay. These models are useful tools for decision making, not only at the producer level but for the development of future economic policy.

The principal characteristics that constitute the structure of the production activity are; (1) internal resources of the productive entity including soils, labor, owner capital, and (2) external factors which the producers may only partially control including, prices, credit, input availability and adequate markets. The analysis is made under the assumption that the producers' primary objective is maximizing income within specified internal and external constraints. The analytical models are used to examine the effects on producers' output, income and resource use of varying resource constraints.

Description of the linear programming model.

The analysis was based on a typical ranch of the Basaltic region with respect to size and soil type. The typical size ranch is 2000 has. with 20% deep soils and 80% shallow soils. (The 1970 census data showed that the average size of ranches of more than 500 Has. was 2000 Has.).

Two different systems of production were considered. The "traditional" system represents the average conditions of the region where producers have not improved pastures nor livestock management. (97% of the area is in natural pasture). Cow and sheep breeding are the basic production activities. Production efficiency is low as indicated by the low weaning percentage (60% for breeding cows and heifers and 65% for ewes), the age at which steers are finished (475 kgs. at 56 months), etc.

The "improved" production system includes several different forage production alternatives. Together with the production of forage from unimproved pastures, alternatives are considered for improved forage production through sod-seeding and oversowing, and rotation of conventional pasture with annual forages --oats and sorghum. Improvement costs are financed with either owner capital, credit or some combination. An increase in the number of pasture divisions from 6 to 12 is included in order to improve grazing efficiency. Improvements in livestock management (breeding periods and weaning, an adequate livestock health program, etc.) are also considered. Production in the improved system is more efficient due to a combination of two factors: a higher level of nutrition and improved livestock management. The improved efficiency in production is reflected in the weaning percentage (80% for breeding cows and heifers and ewes), time required to finish steers (460 kgs. in 45 months), etc.

Economic results.

Economic results and production levels depicted by the linear programming model representing the traditional system closely correspond to those for producers using the traditional system of production in the Basaltic area (Table 1).

The estimated stocking rate was 0.83 AU (animal unit) on a dry cow basis (0.65 on a breeding cow basis). This estimate corresponds closely with producer survey and census data estimates and those made by CONEAT. Production of beef was estimated at 36,0 kgs. per hectare, mutton and lamb at 11,0 kgs. per hectare and wool at 6,0 kgs. or a total of 64 kgs. of meat equivalents. The net returns were estimated to be $ 18,359 per ha. or $ 36,718,000 for the typical ranch size of 2,000 ha.
In general, these results indicate that the analytical model accurately represents the practices and decisions of livestock producers in the area.

Results of the use of the model to analyze the economic feasibility of introducing the improved livestock and forage systems are also presented in Table The analysis indicates that production and income levels that could be expected with the same price levels and the introduction of improved forage and livestock systems are feasible even though input requirements are increased significantly. The improved forage and livestock

Table 1.

Results of the economic analysis of the traditional and improved systems of production in the Basalto region.

| | Unit | Traditional 1 | Improved 2 | Difference 3 = 1-2 | % increase 4=3x100/1 |
|---|---|---|---|---|---|
| Price relation of fleece wool to finished steers. | Pesos | 0.185 | 0.185 | - | - |
| Price relation of stocker steers to finished steers. | Pesos | 1.3 | 1.3 | - | - |
| Sheep/cattle ratio. | Head | 4 | 4 | - | - |
| Economic results. | | | | | |
| Income minus specified costs | Thousands of pesos | 36,718 | 83,346 | 46,628 | 127 |
| Income minus specified cost per hectare | Pesos | 18,359 | 41,673 | 23,314 | 127 |
| Production of beef and wool per hectare | | | | | |
| Beef | kgs. | 36.0 | 68.2 | 32.2 | 90 |
| Mutton and lamb | kgs. | 11.0 | 33.1 | 22.1 | 201 |
| Wool | kgs. | 6.9 | 11.2 | 4.3 | 62 |
| Meat equivalents[1/] | kgs. | 64.1 | 129.9 | 65.8 | 103 |
| Production and use of forages | | | | | |
| Total forage production | AUM[2/] | 28,000 | 39,306 | 11,306 | 40 |
| Production of improved forage | AUM | 0 | 17,622 | 17,622 | - |
| Percentage of improved forage | percent | 0 | 44.8 | 44.8 | - |
| Area improved | hectare | 0 | 17.6 | 17.6 | - |
| Percentage of total area improved | percent | 0 | 17.6 | 17.6 | - |
| Total annual forage produced | AU[2/] | 0.83 (0.35)[3/] | 1.3 (1.04)[3/] | 0.47 (0.39)[3/] | 57 |
| Identified resource requirements. | | | | | |
| Fixed investment[4/] | Thousands of pesos | - | 18,155 | 18,155 | - |
| Intermediate term capital[5/] | Thousands of pesos | 146,500 | 212,919 | 66,419 | 45 |
| Fertilizer | tons | - | 50.1 | 50.1 | - |
| Legume seed | kgs | - | 302 | 302 | - |
| Labor | man-years | 5 | 7 | 2 | 40 |

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1/ Production of wool times 2.48 plus beef, mutton and lamb.

2/ Animal unit month (AUM) is equal to 88 kgs. of total digestable nutrients (TDN) or the nutritional requirement to maintain a 380 kg. grazing dry cow. Animal unit AU is equal to 12 AUM. A dry cow's requirement is about 80% that of a breeding cow and calf.

3/ The value in parenthesis is breeding cow and calf equivalents.

4/ For pasture divisions and livestock watering facilities

5/ Used for livestock, machinery and pasture improvement

management system allows an increase in stocking rate to 1,3 on a dry cow basis (1,04 on a breeding cow basis). Income was maximized when about 18 percent of the land area was improved. Improved forage produced from this area accounted for about 45 percent of the total forage produced. Total forage production including the improved and unimproved increased 40 percent. The production of beef increased to 68,2 kgs. per ha., mutton and lamb 31,1 kgs. and wool to 11,2 kgs. per ha. Total meat equivalents produced were 130 kgs. or an increase of more than 100 percent over the traditional system of production.

Net income above specified cost was estimated to be $ 41.673 or $ 83,346,000 for a typical 2.000 ha. ranch. To accomplish these production and income increases, requirements for productive inputs increase significantly above requirements of the traditional production system. Use of intermediate capital increased to $ 212,919,000 or about 45 percent. The requirements of fertilizer and legume seed were estimated at 50,1 tons and 302 kgs. for the typical size ranch. Use of labor increased from 5 man-years in the traditional system to 7 man-years in the improved system. A fixed investment of $ 18,155,000 is required for pasture division and water improvements in the improved system.

The results summarized in Table 1 are for prices of inputs and livestock products during July 1973. Livestock and wool price levels for this period were historic high prices and mutton, lamb and wool prices were high relative to beef prices. The prices of stocker steers per kg. were high (130%) relative to finished steers. The results are also under the assumption of unrestricted capital and supply of inputs.

To evaluate the effects of changing relative prices between enterprises two lower price levels of mutton, lambs and wool were considered as well as the situation where stocker steers had the same price per kg. as finished steers, a more normal price relationship in Uruguay. The prices during the 1970 period for beef, mutton and lamb and wool were considered in the analysis to determine results under a very unfavorable price level especially for mutton and lamb and wool.

Intermediate term capital availability was restricted to determine the rate of return on additional availability of capital and to evaluate the present pasture improvement credit program. Price of phosphate fertilizer was increased over a range of 41,700 to 240,000 pesos per ton to show the effect on production and level of pasture improvement. The supply of legume seed was restricted at selected levels to estimate the economic effect of a limited supply of this input that is essential but often in limited supply in the area for pasture improvement.

Production and economic results of different levels of production response for pasture improvement were determined. This information assists in evaluation of alternative techniques of improvement where long-term data is inadequate to precisely quantify production response.

In general, the results indicate that producer net returns from the improved livestock and forage system, involving higher use of key inputs such as fertilizer, legume seed and pasture division, are very high. Policies that encourage greater use of this system will yield large production and income returns, even if costs of these inputs are higher than at present.

The research results substantiate recommendations that net returns are maximized with approximately 20 percent of the ranch land area improved. Actual results ranged from 17-24 percent of the total land area. It should be emphasized that improvements should be concentrated on deep soil in which case such improvements would account for 45-55 percent of total forage produced.

Results of the analysis for alternative relative prices and price levels considered and production response to improvement show that it is economically feasible to increase production similar to those indicated in Table 1 even at a less favorable relationship between costs of inputs and value of product. However, income level

decreases as product price decreases and input prices increase which lowers the profitability of improvement and the surplus that is generated that could be used to meet the increased capital requirement for the transition from the traditional to the improved system.

Policy implications.

The results of the economic analysis have implications for policy that relate to: (1) pricing of beef, mutton, lambs and wool, (2) pricing of inputs, (3) availability of input supplies, (4) credit and (5) markets for lambs. In addition to these specific implications the models can be used to analize the effects of other factors.

The relative prices between beef, mutton, lambs and wool have an important impact on the combination of cattle and sheep enterprises that maximize income. Historically this relationship has been very unstable which means producers have to frequently adjust to changing price situations to maximize income. Any effort to stabilize prices between enterprise groups could lead to improved resource use efficiency, greater income stability and would decrease producer uncertainty, particularly important to encourage long-term investments in pasture improvements.

A supply of key inputs required for the improved production system (fertilizer, legume seed, wire for pasture division, and products for an effective health program for livestock) must be insured if the systems are to be implemented. Results would indicate lower relative prices for inputs should be secondary to insuring their availability to producers.

A more flexible credit system, designed to closely meet producers' specific investment priorities rather than a few selected activities could increase profitable credit use. A frequently observed example illustrated in the analysis is where a producer does not have adequate credit for purchase of livestock to efficiently use increased forage production from a credit financed pasture improvement program. Full economic benefit cannot be realized from the pasture improvement because of poor utilization.

The potential for increasing mutton and lamb production is demonstrated. Present market conditions, however, will have to be changed to fully realize this potential. The lack of a market for lambs at weaning decreases the competitive advantage of the ewe relative to the wether, which in addition to the low weaning percentage for ewes, explains why there are so many wethers in the area. A policy to encourage increased mutton and

lamb consumption domestically to substitute for beef, a product with a greater demand for export, and development of foreign markets could result in a more economic efficient use of resources in the area. Of course, this also could have implications for improving the balance of trade position of Uruguay.

Research implications.

Results of these initial analyses, as well as the work leading to these results, identify problems that need further research attention.

Technical Research:

(1) The programming analysis of the Basaltic zone shows that improvements in livestock management and forage production should be closely coordinated if the full economic and production benefits of increased forage production are to be gained. Research to define and evaluate different production systems (both livestock and forage) could assist producers in the transition from the traditional to an improved production system.

(2) One of the most critical needs for further economic evaluation of pasture improvement is more data on production response to different types of pasture improvements and livestock grazing systems as well as quantification of risk associated with alternative ways to improve pastures.

(3) More technical information is needed to define alternative means to improve utilization of highly seasonal forage production. Physical information is needed on the potential of implementation of a planned deferred grazing system and/or supplemental feeding from forage conservation from the abundant spring forage growth.

conomic research:

(1) There is a need for more economic analysis at the producer level and better price and technical information.

(2) Production increases, shown to be feasible in the analysis, would cause major changes in input requirements, export levels, marketing facilities, etc. There is a need for a similar programming model at the national level that would enable the estimation of national production levels, input requirements, total import-export balances, transportation and processing capacities, and other aggregate effects of the transition from the traditional to the improved livestock systems.

(3) There is a need for a dynamic model to analyze the process of change as production moves from the traditional base to the improved method. The present model is static and does not entertain the problems of transition and adjustment.

(4) The analysis indicates that changes in prices of beef, mutton, lambs and wool cause major changes in the combination of activities that would maximize income. Economic research to develop and implement policies that improve the general economic setting and stabilize prices can have a significant stabilizing influence on the flow of output of these products and encourage transition from the traditional to improved system of production.