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DEVELOPMENT OF EFFICIENT MINERAL SUPPLEMENTATION
REGIMES FOR GRAZING RUMINANTS IN THE TROPICS

REPORT

Team Evaluation of DS/AGR Project 931-0600

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PROJECT BACKGROUND

History of the Project The Florida Mineral Project No. 931-0600, supported under AID contract, AID/ta-c-1153, was started in November, 1974. The project was reviewed in November, 1976 by an external evaluation team. Following this review, AID extended the project an additional two years. It is funded until November, 1980, at which time it will terminate unless further extended.

Definition of the Problem Mineral deficiencies occur in most tropical and semi-tropical regions of the world. Grazing ruminants are generally less productive in these areas than in the more temperate climates. Low productivity is associated with disease, low planes of nutrition, climatic stress and malnutrition resulting from mineral deficiencies or imbalances. Mineral deficiencies result in low reproductive performance, high mortality, slow growth rates and low production (milk, wool, etc.).

Objectives of the Project The primary objective of this project is to determine the essential mineral supplements for grazing animal diets to increase efficiency of meat and milk production systems with a resultant increase in quality and quantity of food in LDCs and a subsequent increase in employment and income levels. The specific objectives are as follows:

1. To experimentally determine the locations of mineral deficiencies, adequacies, and toxicities in selected areas of Latin America;
2. To establish the biological response and the economic benefit of mineral supplementation of grazing animals.
3. To evaluate methods of mineral supplement administration for grazing cattle;
4. To publish and distribute research information to stimulate wide spread use of mineral supplements for grazing ruminants.

MAJOR ACCOMPLISHMENTS OF THE PROJECT

The review team evaluated the overall progress made in the Florida Mineral Project since it was started in 1974, but gave special attention to the accomplishments since the previous review in 1976. It is apparent that this project has been highly productive, not only in identifying important dietary mineral problems but more importantly in developing a recognition among Latin American countries that these problems exist and should be dealt with by establishing mineral nutrition research laboratories and education programs.

Areas identified in the 1976 review as needing further study and development are briefly highlighted in the following summary.

1. Continue to strengthen the research capabilities of cooperating countries in evolving national mineral nutrition programs. Significant research has been initiated in 16 cooperating countries, directly involving 185 nationals. Surveys of mineral deficiencies and toxicities are under way, and the effectiveness of providing mineral supplements directly to livestock is being explored in a number of locations. Leadership by the University of Florida has played a vital role in stimulating cooperation among government, university and industrial personnel in seeking solutions to mineral problems in cooperating countries. Students trained by the University of Florida are returning to their home countries, thus adding their newly acquired expertise to the professional resources of the region.

2. Continue to obtain more data that will be useful in defining mineral relationships among soils-plants-animals. Extensive data have been collected which indicate that correlations among soil-plant-animal are low or non-existent for the minerals studied (Fe, Mn, Na, Zn). Liver samples collected from the most productive animals toward the end of the wet season are best for determining the mineral status of certain trace minerals in grazing animals.

3. Establishment controlled experiments with cooperating ranchers and experiment stations to provide more reliable information about the benefits of mineral supplementation. Controlled experiments are now underway in five countries— Bolivia, Brazil, Colombia, Peru, Venezuela. The primary benefits being obtained in these experiments are improved fertility and increased weight gains. In one experiment, calving percentage was increased by mineral supplementation from 50% to 75%. In one experiment weight gains were doubled as a result of mineral supplementation.

4. Establish experiments to determine the extent of carry-over from wet to dry season grazing. Preliminary research data from an experiment in Colombia indicate that major benefits may be obtained by feed-minerals only during the rainy season. Further exploration is needed in this area.

5. Generate research data which can yield cost: benefit ratios. Considerable data have been accumulated, but not yet analyzed which will be useful in determining cost: benefit ratios from mineral supplementation. Preliminary information indicates a return of at least double the investment in correcting mineral deficiencies.

6. Encourage local examination of mineral mixtures. It has been observed that many mineral supplements sold in Latin American countries are of poor quality, not meeting the guarantees on the labels. For example, an analysis of mineral supplements being sold by five different companies in Ecuador revealed that the percent of phosphorus was substantially lower than the amount guaranteed on the mineral label, in one case being practically zero.

7. Continue research efforts to simplify methods of assessing mineral nutrition status of grazing animals. Mineral research methodology has been a substantial contribution of this project, not only in terms of simplifying and standardizing the techniques but also in developing new practical approaches that can be introduced into LDC usage.

8. Establish cooperative mineral research program in South-East Asia and African Countries. Research program have been initiated in 3 Asian countries with more reconnaissance needed to further identify appropriate locations in Africa and Asia.

FUTURE NEEDS FOR MINERAL RESEARCH AND MINERAL SUPPLEMENTATION

The Mineral Research Project has made considerable progress in certain countries, and plans should be made, where feasible, to gradually turn over much of the responsibility for future mineral research to scientists within those countries. Examples include Brazil, Costa Rica and Colombia. This transfer of responsibility should be preceded by an evaluation of the state of readiness of the scientists and the commitment of the governments in the cooperating countries. Some assistance may continue to be needed in conducting difficult assays. (Even in the United States, few laboratories can produce reliable determinations of selenium, molybdenum and cobalt). In addition, there are some difficult problems in these countries, such as "cara inchada" "falling disease", and "secadera" which could be related to mineral inadequacies and require continuing intensive efforts to solve. It would be appropriate to set the schedule for transfer in consultation with all affected parties. A three year extension of the Project may provide sufficient time for an orderly and successful transfer in those countries with the most advanced programs. However, the transfer should not be tied to an arbitrary schedule but should proceed in a manner which will ensure that the investment to date will produce useful results.

In a number of countries, the Mineral Research Project is still developing. Equipment is not yet adequate, technicians are not yet completely trained, and financial commitments for independent support of mineral research are not fully developed. Atomic absorption spectrophotometry is a basic analytical technique in mineral research and involves skills that require extensive training and experience. The instrumentation is costly and requires technological support in the form of high quality electrical service and compressed gases such as acetylene, air, nitrous oxide, hydrogen, and argon. These, of course, are not universally available. Where the necessary infrastructure and trained personnel are not available, assistance will be required if this important project is to succeed.

Some additional questions, defining areas of research which have been initiated by the University of Florida and that warrant development, include the following:

- 1) Can certain mineral supplements be provided successfully on an intermittent basis to reduce cost, as compared to continuous administration?
- 2) Can low cost mineral sources, such as slag, be identified and successfully used as supplements?
- 3) Can mineral supplements containing potentially toxic levels of other elements be fed safely by using them for short periods or by feeding an antagonist to the toxic element(s) simultaneously?
- 4) What is the cause and prevention of "cara inchada"?
- 5) What is the cause and prevention of "secadera"?

Other problems and other countries have been tentatively explored concerning application of the same cooperative techniques in improving livestock production through mineral research. The University of Florida team members are well-qualified professionals, have extensive on-site experience, have a record of good judgement, and would be expected to provide real assistance to those countries that are willing to cooperate in helping themselves.

RECOMMENDATIONS

With AID support the University of Florida has developed a research system that has been unusually effective in obtaining LDC involvement. Much has been accomplished with a relatively small investment of U.S. funds because of the cooperative support from each of the 16 countries involved. Mineral deficiencies have been demonstrated in each country. Government officials have been persuaded that this is a problem seriously reducing livestock production and is one that can be corrected through proper application of research and technology. They have responded by establishing research laboratories for investigating mineral deficiencies. Scientists and technicians have been trained. Closer working relationships between research and extension agencies have been stimulated. Linkages have evolved between L.A. (and to a lesser degree Asia and Africa) and U.S. scientists and among scientists from many Latin American countries that will have long lasting beneficial effects.

The review team recognizes that there must be a termination point for AID support of this project, beyond which the LDCs should be expected to continue with mineral research on their own. However, they feel that this point will not be reached within the remaining year of the project. Few of the research laboratories involved will be strong enough at that point to survive on their own. Therefore the team recommends that this project be extended two years beyond it's proposed termination in November, 1980. This would provide an additional three years to transfer full responsibility to each country. They should be so informed.

The review team also recommends that the University of Florida and AID give consideration to initiating and expanding a similar program in Africa and Asia. This would require additional funds.

BUDGET EXPENDITURES AND PROJECTED COSTS

1. First Contract (1974-1976) Requested Funds	\$450,000
2. Contract Extension (1977-1980) Requested Funds	<u>450,000</u>
3. Total Amount for five years Requested Funds	\$900,000

Classification of Line Items	Available Funds to 10/31/79*	Expenditures to 3/31/79**	Estimated for 11/1/78-10/31/79
Salaries and Wages	\$247,983	\$195,440	\$48,200
Fringe Benefits	30,899	24,488	7,400
Overhead (45%)	125,102	98,790	25,020
LDC Counterparts	124,106	103,064	2,000
Travel & Transportation	133,273	159,868	22,800
Equipment & Supplies	57,250	33,070	43,580
Other Direct Costs	30,359	21,765	1,000
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TOTAL	\$748,972	\$636,486	\$150,000

*This would complete first four years of the five year contract.

**Based on University of Florida quarterly fiscal reports system.

PROPOSED BUDGET FOR FINAL YEAR OF PRESENT CONTRACT

(11/1/79 to 10/31/80)

<u>Line Item</u>	<u>Amount</u>
Salaries & Wages	\$53,000
Fringe Benefits	8,100
Overhead (45%)	27,495
LDC Nationals	2,500
Travel & Transportation	20,500
Equipment & Supplies	37,405
Other Direct Costs	1,000
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TOTAL	\$150,000