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LATIN AMERICAN PANEL

ON POST GRADUATE EDUCATION IN

AGRICULTURAL ENGINEERING



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EXECUTED BY THE FOOD AND AGRICULTURE ORGANIZATION
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INTER-AMERICAN INSTITUTE OF AGRICULTURE SCIENCES
OF THE ORGANIZATION OF THE AMERICAN STATES
NATIONAL AGRARIAN UNIVERSITY OF PERU



PERU GOVERNMENT



Report of the Panel

on

POST GRADUATE AGRICULTURAL ENGINEERING EDUCATION AND RESEARCH IN LATIN AMERICA

Jointly sponsored by

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National Agrarian University
of Peru



August 4 - 8, 1969

National Agrarian University
La Molina, Lima, Peru

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FOREWORD

At the threshold of the 1970's education in all its branches has advanced to include science and knowledge unknown only a few years ago. Agriculture and engineering science serving agriculture has shared in this application of new knowledge with the resulting influence of change. Latin America, with its vast human, material and physical resources, faces many problems in its development towards increased food production and improved living standards. Agricultural engineers, alone and in co-operation with others, seek solutions to the involved problems which demand vigorous application of knowledge, initiative and imagination. Adequacy in preparation of professional personnel demands modern high quality educational systems in which incomplete or obsolete education cannot be afforded.

As a contribution to the definition of educational requirements for agricultural engineers in Latin America a Panel on Post Graduate Agricultural Education and Associated Research in Latin America was organized and held in Lima, Peru, August 4-8, 1969.

The sponsors of the Graduate Programme in Agricultural Engineering at La Molina are satisfied that their objectives have been met. The interest and objectives of people engaged in agricultural engineering in the region have been united. The recommendations and suggestions, as contained in this report, will provide valuable guidelines for the future development of agricultural engineering education in this region. A Latin American Society of Agricultural Engineering (SLAIA) was formed in the Panel and this society is certain to play a major role in establishing technical and scientific education and applications needed to perform the tasks which lie ahead.

Sponsors of the Panel gratefully acknowledge the co-operation and efforts put forth by staff members of the National Agrarian University, participants from Latin America, consultants, students, and technical officers of the International Organizations involved. The work of Dr. A.P. Cobra, Panel Consultant, who assisted in planning, co-ordinating and executing the Panel and who compiled this report has been particularly appreciated. Participation by high level personnel from North and South America, Europe, Asia, and Africa have imparted a scientific character to this Panel on Agricultural Engineering Education which has not yet been surpassed in Latin America. The success of this meeting could not have been achieved without the much appreciated co-operation and assistance of all.

H. M. Lapp
Local Programme Head
UNDP/SF 80

Dr. L. Marcano
Director, IICA, Zona Andina

Ing. J. Quiroz
Director, Agric. Eng. Prog. U. A.

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COVER photograph. A pioneer agricultural engineering work at Pisac, near Cusco, the center of the Inca Empire in Peru. The "andenerias" in the foreground compare with modern terraces. (Courtesy of Empresa Nacional de Turismo).

1. PRELIMINARY CONSIDERATIONS AND PLANNING

1. 1. AGRICULTURAL ENGINEERING IN LATIN AMERICA

The Panel on Post Graduate Agricultural Engineering Education and Research in Latin America was held in order to provide the participants with a picture of the potential of Agricultural Engineering to serve agriculture and related industry in the development of Latin American countries; to acquaint them with educational programmes in this area being conducted in the National Agrarian University at La Molina, and to focus the need for Agricultural Engineers trained to the graduate level in Latin America and the education required to produce them.

Educational aspects of Agricultural Engineering Undergraduate programmes need to be oriented toward the preparation of professionals to meet the needs of improved rural living, agricultural production and industry.

Some aspects are primarily institutional. There is a need for requirements to guide institutions in establishing Undergraduate Programmes, taking into consideration the present status of the Latin American educational systems, with "Facultades" or "Escuelas de Agronomía", and their role in the development of Agricultural Engineering. There is also a need for an accreditation system among Latin American educational institutions to maintain standards and to intensify and facilitate academic exchange.

The advancements in Post Graduate Teaching and Research which constitute the realm of technological progress, rely upon undergraduate preparation. Graduate programmes in Agricultural Engineering have been initiated in Peru and Colombia. Other Latin American institutions are attempting to move toward graduate studies in this area. Guidelines and reference points must be set in order to insure a harmonious development of the profession. The role of graduate engineers must now be defined, based upon the experiences of professionals from Latin America and from other countries. The consolidation of a philosophy guiding graduate teaching and research in Latin America had to emerge to secure adequate professional services and to direct solutions for agricultural problems on a priority and regional basis.

The formulation of these important aspects related to Agricultural Engineering resulted from a series of experiences gained by regional and international organizations working in Latin America. One major event was the establishment of an Agricultural Engineering faculty by the National Agrarian University at La Molina, Peru, in 1960. A joint effort between this university and the United Nations Development Programme (UNDP) made possible the establishment of the Project (UNDP/SF 40).

The United Nations Development Programme provided international professional staff and consultants, fellowships to train staff members and purchased teaching equipment and books, while the National Agrarian University (UNA) offered local staff and physical facilities. To complement this development the Interamerican Institute of Agricultural Sciences (IICA) initiated a graduate programme in Agricultural Engineering at La Molina and received assistance from the United Nations Development Programme. This Project was part of the Institutes programme to serve Latin America and was designated UNDP/SF 80. In 1965 the National University of Colombia initiated an undergraduate programme at Medellín.

The development of these projects and the experience gained by other Latin American institutions could provide elements for a good analysis of the Agricultural Engineering situation in Latin America. Therefore, it was opportune to convene a meeting of personnel involved in these activities which could offer guidance for expansion of the profession on a sound base throughout the Latin Continent.

1. 2. THE PANEL AND THE PARTICIPANTS

Provisions for Panel meetings were contained in the 1963 Work Plan of the United Nations Development Programme (Special Fund) and Inter American Institute of Agricultural Sciences. Based on these provisions, the Local Programme Head UNDP/SF 80 in La Molina, Mr. H. Lapp, proposed that the project convene a Panel on Agricultural Engineering Graduate Education and Research. The idea was supported locally and by the FAO Education Consultant, and was, therefore, referred for approval for the 1968 Annual Review Meeting of IICA and FAO officials, in Rome. Approval was granted for a Panel on Post Graduate Agricultural Engineering Education and Associated Research in Latin America, to be held in La Molina, in the second half of 1969. Funds in the amount of U. S. \$15,000. were approved as well as provision for the engagement of a consultant to assist in planning, coordination, execution and preparation of a report on the meeting. Highly qualified and experienced Consultants from Canada, England, and the United States were invited to participate in the Panel programme. The Panel timing was selected to coincide with the presence of UNDP/SF 80 Experts and Consultants from Brazil, Canada, Egypt, England, India, Italy and the United States. These Consultants and Experts could exchange valuable information with representatives of Latin American countries, which could be of mutual benefit to these professionals and to future development of the project.

It was realized from the outset that much of the success of the Panel would depend on adequate participation from Latin American countries. There had been little opportunity in the past for an assembly of personnel



A view of the plenary session of the Panel. (Courtesy of "El Comercio")

involved with Agricultural Engineering to meet and to exchange ideas on the educational problems of the profession in this region.

It was also clear that most of the participants would not be able to attend the Panel at their own expense. Therefore, necessary funds were allocated to cover expenses of up to 20 outstanding participants engaged in the field of Agricultural Engineering Education from the various countries of Latin America.

Difficulties were encountered in identifying these professionals in the Latin American continent. However, it was possible to convene participants from twelve Latin American countries. Participants from eight non-Latin American countries, for the most part associated with international agencies also attended. The total number of participants registered in the Panel was 134, from 20 countries represented as follows:

Argentina	5	Ecuador	1
Bolivia	2	Egypt	1
Brazil	2	El Salvador	1
Canada	2	Holland	3
Chile	3	India	1
China	1	Italy	1
Colombia	7	Mexico	4

Peru	81	United Kingdom	2
Puerto Rico	1	U. S. A.	12
Trinidad	1	Venezuela	3

For a full list of participants, see Appendix C.

1. 3. PANEL COMMITTEES AND PROGRAMME

Committees were organized to arrange and provide services needed in all phases of the Panel, as follows:

- travel control, reception and lodging;
- local arrangements and transportation;
- themes and technical papers control and reproduction;
- open house at La Molina; and
- social events

The Panel had to deal primarily with the institutional aspects of education and research in the entire field of Agricultural Engineering. With the short time available, it seemed clear that it would not be possible for the Panel itself to formulate a specific master plan for the development of agricultural engineering in Latin America. However, the nature and dimensions of the institutional problems had to be exposed and given the widest possible attention. Thus, the Panel basically

had to deal with the "whys" and the "hows" of the institutional problems which affect the establishment of professional level agricultural engineering teaching and research programmes in Latin America, and to present the graduate programme in La Molina with its potential to serve institutions and agriculture in the region.

The example of La Molina might also give an opportunity to assess the nature and volume of work that lay ahead for the national governments, international agencies and personnel involved in education and research in Agricultural Engineering.

The Panel programme was developed to include the following aspects of Agricultural Engineering: the philosophy orienting education and research; the scope of the profession to serve Latin America; the present status in Latin America as related to other regions; undergraduate and post-graduate educational requirements as compared to those of the "ingeniero agronomo"; accreditation, administration and financing of teaching and research programmes; research methods and application. The programme was divided into an introductory topic and seven themes covering educational and research aspects of agricultural engineering. Some of the themes were specifically related either to education or to research, and those which involved both aspects dealt primarily with post-graduate programmes in Agricultural Engineering. Themes dealing essentially with education encompassed undergraduate and post-graduate topics, and those dealing with research also involved presentation of technical papers. The programme allowed time for participants to tour the teaching and research facilities on campus and to visit with the La Molina staff members. A meeting was scheduled for those interested in the formation of a Latin American Society of Agricultural Engineering (S.L.A.I.A.).

The effective working time of the Panel during the five-day week was 31.50 hours, and it was used, according to the various activities, as follows:

Activity	Number of Hours
-Registration, Foundation of S.L.A.I.A., Inauguration and Closure	4.50
-Education	10.25
-Research	6.00
-Education and Research (included visit to La Molina)	10.75
Total effective time:	<u>31.50</u>

In order to provide maximum time for discussion, the presentation for each paper was limited to between

15 and 30 minutes, according to the number of papers presented at each theme or topic. These papers were intended to introduce the subject and to highlight some major concepts so that the participants could give adequate consideration as they could relate to Latin American problems.

Simultaneous English/Spanish interpretation was provided for all Panel Sessions, which contributed efficiently to the exchange of ideas and discussion between speakers and members of the Panel.

Each theme or topic had a chairman and reporter to steer the panel meeting and compile major questions, answers, suggestions and recommendations addressed from the floor. The latter are included in part 3 of this report.

2. PROCEEDINGS

2.1. INTRODUCTION

This chapter records the sequence of events which took place during the development and proceedings of the Panel. The papers presented in the Panel are listed according to the themes and sequence of presentation, in section 2.3, with the respective paper number, author, title of the work and number of pages. Latin American Agriculture and Engineering Educational Institutions and related Government organizations may obtain copies of individual papers or a volume of the Panel papers, by writing to the Local Programme Head UNDP 80 Apartado 478, Lima, Peru.

2.2. INAUGURATION AND CLOSURE CEREMONIES

The opening and closure ceremonies and other meetings of the Panel took place in the Hotel Riviera in Lima. Most of the participants were accommodated in the hotel which provided for convenient communication with the organizers, contributed to full time attendance and facilitated close following of the timetable for the meetings. This location provided convenience and comfort for the participants, avoided transportation problems and allowed for effective use of time between sessions.

The inauguration took place on the morning of August 4, 1969, and the speakers were the Minister of Agriculture and Fishery of Peru, the Rector of the National Agrarian University of Peru (UNA), the Resident Representative of UNDP/SF in Peru, the Director of the Andean Zone of the Inter-American Institute of Agricultural Sciences (IICA), the Local Programme Head of UNDP/SF 80 and the Director of the Agricultural Engineering Pro-

gramme of UNA.

In his opening remarks, the Director of the Agricultural Engineering Programme at La Molina, Ing. Jorge Quiroz, welcomed the participants and referred to the pioneering programme in Agricultural Engineering at the University and emphasized the need for extending the application of sciences in the solution of problems of man, animals, soils, crops and their products. Mr. Quiroz told the participants that a developed agriculture can only be attained by a country... "when its land can give its maximum productivity and its products have been effectively transported, processed and marketed". He expressed gratitude for the contribution of the international agencies which have been furthering the development of Agricultural Engineering at La Molina, which is now able to serve not only Peru, but can assist other Latin American countries as well.

Mr. Herbert M. Lapp, Local Programme Head of UNDP/SF 80 project, conveyed his best wishes for the success of the Panel, and referred to the valuable contribution that a meeting of this nature can make to the development of post graduate studies at La Molina to serve the Latin American continent. Mr. Lapp commented on the planning and organization of the Panel, mentioning his appreciation for the presence of recognized Panel Consultants and Experts at the meeting and the valuable mutual exchange of informations which was about to take place. He also conveyed greetings to the participants from Mr. A. D. Faunce, Chief of Agricultural Services of FAO and from Mr. David Hartzog of the UNDP Office, in New York, and expressed regrets that they were not able to attend the meeting.

A message from the Rector of the National Agrarian University, Dr. Federico Anavitarte, was read by his representative. Regretting that he had not been able to attend the opening ceremony personally, Dr. Anavitarte expressed his satisfaction that La Molina was chosen for the site of another pioneering Agricultural Engineering event in Latin America. He expressed appreciation to the International Agencies for aid provided in the education of agricultural engineers and expressed his confidence that this cooperation with La Molina would not only benefit Peruvians, but also Latin Americans to whom the University could be of service.

Dr. Luis Marcano, Regional Director of the Andean Zone of IICA, briefly reviewed the Latin American field of action of the Institute he represented, and praised the efforts of its officials, namely Mr. Enrique Blair, a former Regional Director, for his leading work

in the development of Agricultural Engineering in the region. Dr. Marcano said that the establishment of a graduate programme through the joint action of IICA, UNDP/SF and UNA was an important step forward. In this connection, the role of the Panel is not only to strengthen the stimuli, but also to orient future graduate studies of Agricultural Engineering in Latin American countries.

The Resident Representative of UNDP/SF in Peru, Mr. A. Balinski, in his opening address emphasized the interest and the efforts of the organization he represented to participate in the solution of Latin American problems of development. He then said that "...it is essential to face the agricultural problems which acutely affect the economy and the society of these countries, with modern criteria and highly qualified personnel". The coincidence of a technical meeting of this nature and the forthcoming needs for the implementation of the Agrarian Reform, was regarded by Mr. Balinski, as a propitious event. He told the participants that the significance of the latter in the development of agriculture is not lesser than the demands which are to be imposed on local qualified personnel in applying their knowledge, initiative and creative imagination. After a brief exposure of the intents of the UNDP/SF in cooperation with the IICA and the UNA, in the development of Agricultural Engineering, he expressed his conviction on the importance of the profession and of the continental resonance given by the countries reached by the programme. Therefore, Mr. Balinski considered it superfluous at that opportunity to stress the need for agricultural engineers, but he warned of the risks involved in providing an incomplete or out-of-date preparation to these professionals. He proceeded to identify the fields of action in which the participation of these professionals were most needed in Latin America, mentioning: irrigation, including the utilization of ground water resources and design of hydraulic control structures; soil conservation procedures will be needed in the vast "selvas" of South America; the latter induces the need for studies in Rural Planning and settlements, services and facilities, such as: roads, potable water, living and housing sanitation, etc.; finally, research in the design of machines and planning for mechanization, without which only a subsistence production can be sustained. This analysis was one of the factors contributing to the success of the Panel, by providing a right perspective and a proper direction at the commencement of the works.

A message from Mr. Juan Felipe Yriart, Regional Representative of FAO for Latin America was read by Mr. Johan D. Berlijn, Agricultural Engineering Regional

Officer. Mr. Yriart expressed his regrets for not being present in the meeting, conveyed his greetings to the participants and pointed out that Agricultural Engineering in Latin America must be practiced with more care than it is in countries with more developed technology, which can utilize more specialized areas of work. Therefore, he said that the important role of the specialists gathered in the Panel was to establish efficient and uniform programmes to meet the needs of the different Latin American countries. He finally lauded the initiative of the institutions sponsoring the Panel and told the participants that this meeting could stimulate greater coordination among bi-lateral and regional international organizations having Agricultural Engineering programme in the region.

The representative of General Jorge Barandiarán Pagador, Minister of Agriculture and Fishery of Peru, regretting that the Minister had not been able to attend the Panel, conveyed his best wishes for the success of the meeting which arose out a great interest among the agricultural engineers from Peru and from all Latin America. He emphasized the educational value of the work of the participants and the benefits accruing to Latin American agriculture, and declared the Panel open.

The first part of the closure ceremony was reserved for presentation of the suggestions and recommendations for approval of the participants. The recommendations for each theme were read by the respective chairman for discussion by the Panel, and further suggestions were received for consolidation by the recommendation committee.

Following the approval of the recommendations, Dr. C. Hall, Head of the Agricultural Engineering Department, Michigan State University, in closing remarks expressed confidence in the results of the Panel saying that the objectives were met through fruitful and lively discussion, visits and exchange of ideas among the participants. He said that most of the participants were now acquainted not only with other Agricultural Engineering programmes being carried out in Latin America, but also with the needs and requirements involved. That the development of these programmes involved more than facilities, financial support, faculty and staff was manifest in the words of Dr. Hall, who considered students as an additional and probably the most important requirement. He pointed out that important nuclei have been formed during the Panel, which will grow and provide additional information for teaching and research of Agri-



Officials at the inauguration of the Panel (Courtesy of "La Tribuna")

cultural Engineering in Latin American countries. Dr. Hall expressed his appreciation to the sponsors of the Panel and to all participants who have contributed to the success in meeting its general and specific objectives.

The closure ceremony proceeded under the chairmanship of the representative of the Minister of Agriculture and Fishery of Peru.

Mr. H. Lapp, Local Programme Head of UNDP/SF 80 project, expressed regrets on behalf of Mr. P. Bernheim and Dr. Luis Marcano who were unable to attend the closure ceremony, addressed his appreciations and thanks to the participants of the Panel as well as to the members of the organization committees for their contribution to the success of the meeting.

Dr. F. Anavitarte, Rector of the National Agrarian University of Peru, told the participants that nine years ago the University he represented was called to play an important role in the development of agriculture in his country. The Agriculture Engineering programme among others offered by the University, was developed under the cooperation of International Agencies, whose support has been of a great value to the formation of well prepared professionals. He considered the continuation of this support, as well as that of local Governments, in providing funds for education and research through universities, to be an important long range investment for the development of agriculture in the region. Finally, he thanked the participants for their contribution to the Panel which he considered to be a fruitful meeting.

The representative of the Minister of Agriculture and Fishery of Peru regarded the recommendations of the Panel as a valuable document in setting guidelines for the betterment of agricultural education and research not only for Peru, but for all Latin American countries. He then declared the activities of the first Panel on Post Graduate Agricultural Engineering Education and Associated Research in Latin America closed.

2.3. LIST OF AUTHORS AND PAPERS PRESENTED

Inauguration:

1. Hall, C.
Philosophy of Agricultural Engineering & Education required for the profession 12 pp
2. Downing, C. E. G.
Role of Agricultural Engineering in Meeting the Needs of Improved Rural Living & Agricultural Production 16

Theme I: The Status of Agricultural Engineering Education in Latin America.

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|---|------|
| 3. Barañao, T., in Argentina | 8 pp |
| 4. Tomico, O., in Bolivia | 8 |
| 5. Cobra, A.P. in Brasil | 26 |
| 6. Ibáñez, M., in Chile | 7 |
| 7. Jarré, R., in Ecuador | 31 |
| 8. Mora, E., in Mexico | 10 |
| 9. Rodríguez Arias, J., in Puerto Rico | 43 |
| 10. Campbell, L., in Trinidad | 44 |
| 11. Dagger de Sánchez, A., in Venezuela | 30 |

Theme II: The Patterns of Development of Agricultural Engineering in Latin America and in other Regions of the World.

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| 12. Quiroz, J., in Peru | 33 pp |
| 13. Quintero, J., in Colombia | 14 |
| 14. McColly, H.F. in the Middle and Far East | 8 |
| 15. Roy, S., in India | 24 |
| 16. Ricci, C., in Europe | 25 |
| 17. Payne, P.C.J., in the United Kingdom | 9 |

Theme III: The Scope of Agricultural Engineering Programmes to Serve Latin America.

- | | |
|--|-------|
| 18. Lapp, H.
The Potential of UNDP 80 to Serve Latin America | 12 pp |
| 19. Bainer, R.
Institutional Requirements in Attaining the Capacity to Offer Programmes in Agricultural Engineering | 10 |
| 20. Garcés, C.
Experience in the Development of Accrediting Systems for Agricultural Institutions in Latin America | 15 |
| 21. Hasler, F.J.
Experience in the Development of Accrediting Systems for Agricultural Engineering in the United States | 6 |

Theme IV: The Education and Curriculum of the Agricultural Engineer and Its Relation to that of the Ingeniero Agronomo.

- | | |
|--|-------|
| 22. Berlijn, J.D.
The Education of the Agricultural Engineer and that of the "Ingeniero Agronomo" | 27 pp |
| 23. Bustamante, F.
A Suggested Undergraduate Curriculum in Agricultural Engineering for Colombia | 15 |

24. Quiroz, J. A Suggested Undergraduate Curriculum in Agricultural Engineering for Peru	15 pp
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A. 34. Barreto, H.	8 pp
B. 37. Teter, N.	7
C. 40. Berlijn, J.	14
D. 43. Quintero, J.	6

Theme V: Graduate Education in Agricultural Engineering in Latin America.

MINIMUM REQUIREMENTS FOR ESTABLISHING EFFECTIVE RESEARCH

25. Yeck, R., Requirements for Graduate Study in Agricultural Engineering	8 pp
26. Hobbs, W. The Nature and Content of Graduate Agricultural Engineering Programmes in Latin America	11

A. 35. Salas, F.	10 pp
B. 38. Yeck, R.	3
C. 41. McColly, H.	8
D. 44. Christiansen, J.	5

Theme VI: Financing and Administration of Agricultural Engineering Teaching and Research Programmes.

TECHNICAL PAPERS

27. Comejo, A.	12 pp
28. Payne, P.	9
29. Quintero, J.	7
30. Boyd, L.	9

1. Bainer, R. Harvesting Corn With a Grain Combiner	3 pp
2. Downing, C. Modern Man-Machine Systems in Agriculture	14
3. Wisner, E. Simulation of Hydrologic Data	9
4. Velasco, J. Development of a Furrow Rate of Advanced Mathematical Model	5
5. Ibrahim, A. Rural Settlement as Part of Rural Planning	9
6. Hall, C. Providing a Uniform Drying Zone of Grain in a Fixed Bed	4
7. Mufiante, R. Rural Settlements in the High-Jungle of Peru	20
8. Cavero, J. High Range Elastic Deformation Gauge	12

Theme VII: Research in Agricultural Engineering and its Application to Serve Latin America.

31. Boyd, L. Philosophy and Methodology of Research in Agricultural Engineering	8 pp
32. Blair, E. The Value of Agricultural Engineering Research in Enhancing the Economy of Developing Countries	18

CONCURRENT GROUP SESSIONS ON RESEARCH:
The letters A, B, C and D preceding the number of the papers indicate the area of specialization in which they are dealing, namely:

- A. Agricultural Products Processing
- B. Farm Structures and Rural Planning
- C. Farm Power and Machinery
- D. Soil and Water Engineering

RESEARCH IN THE ESPECIALIZATION

A. 33. Hassler, F.	4 pp
B. 36. Boyd, L.	5
C. 39. Payne, P.C.	10
D. 42. Wisner, E.	8

PROBLEMS OF VITAL IMPORTANCE IN LATIN AMERICA

2.4. OPEN HOUSE AT LA MOLINA CAMPUS

The programme provided an open house to acquaint the participants with students, staff members, teaching and research activities and facilities for the Agricultural Engineering Programme at the National Agrarian University, La Molina.

In 1961, the University through the Peruvian Government and with assistance from the Agency for International Development (AID) and the Interamerican Bank of Development (IDB), embarked on a long term loan involving over 6 million dollars, and the Peruvian Government contributed, in addition, approximately 1.5 million dollars. This provided resources for the planning and construction of a new University Campus at La Molina. The

new campus construction started in 1965, encompassing an area of 26 ha. Buildings having 42,500 sq. mts. of floor space, in various stage of completion, provide modern and adequate library, laboratory, office and college union accommodation. The Agricultural Engineering Programme utilizes 7,952 sq. mts. of that area, with 6,200 sq. mts. devoted to laboratory accommodation with space allocated to the specializations of Power and Machinery, Soil and Water, Farm Structures and Rural Planning and Agricultural Products Processing. The remaining 1,752 square meters provide for faculty facilities. The need for classroom accommodation will be met by 14,000 square meters of buildings in the new campus development plan, scheduled for completion in 1971. The Programmes of Agronomy and of Animal Husbandry should have new laboratories operating during the first half of 1970. The multinational Soil Programme sponsored by the Organization of American States will operate with the Agronomy Programme.

Student enrollment in the Programme advanced from 87 in 1962, to 433 in June 1969, while academic staff grew from 15 to near 50 in the same interval.

In 1962 the University established a five year undergraduate development programme assisted by the United Nations' Special Fund, and in 1964 a graduate programme on a similar basis was initiated as part of a project of the Interamerican Institute of Agricultural Sciences. Through these projects, a commendable staff training plan to prepare staff members for graduate level work has been adopted and is being implemented. Teaching and research equipment and assistance of experts and consultants in the various fields have also been provided. Research activities have been in progress since 1960, and 89 works have been published; extension projects have been carried out resulting in 15 publications introducing new techniques and methods in local farming. Undergraduate students were provided with teaching publications and translations to be used in the various Agricultural Engineering courses. Technical assistance has been given by staff members through international agencies, to projects being conducted in other Latin American countries.

All these features and activities of La Molina were presented during the open house to the participants, by the director, head of departments and students of the Agricultural Engineering Programme.

The progress of the Agricultural Engineering Programme being developed in La Molina was lauded by the participants, who were able to appreciate the infrastructure, the resources involved and the potential



Panel participants visit the new library of La Molina.

of the institution to serve the profession in Latin America.

2.5. FORMATION OF THE S.L.A.I.A. LATIN AMERICAN SOCIETY OF AGRICULTURAL ENGINEERING

A meeting was provided for interested participants to explore the initiation of a Latin American Society of Agricultural Engineering (SLAIA). The meeting took place on the afternoon of August 8, under the chairmanship of Mr. Jorge Quiroz, Director of the Agricultural Engineering Programme at La Molina. The inclusion of this meeting in the Panel programme proved to be opportune, as evidenced in the working sessions, during the week. A keen interest was generated among the participants who had been exposed to a number of educational and research activities that could be beneficially placed under the coordination of such a professional society.

The chairman opened the meeting by referring to the benefits for the profession and the region that could be derived from the SLAIA. Later, he read a document setting guidelines for the future constitution and invited discussion. Points related to the membership qualifications to be provided in the proposed constitution of the SLAIA were raised by the participants. Dr. P. Payne, Director of the National College of Agricultural Engineering, England, expressed his opinion that one of the

first duties of the SLAIA was to keep agriculture and engineering together, in order not to become an exclusive society which he considered would be very dangerous. Prof. T. Barañao, University of Buenos Aires, warned that care should be exercised in establishing selection criteria for membership, and that "ingenieros agronomos" showing contributions to the profession should not be excluded. Dr. N. Teter, University of Nebraska, a senior member of the American Society of Agricultural Engineering, pointed out that contributions were made by non-professionals to that society, and considered it would be a serious mistake to organize a society which did not permit their admittance. Mr. E. Sáu, University of Concepcion, Chile, said that only a few countries in Latin America had started Agricultural Engineering programmes at the professional level, and that the problems related to the profession in the majority of the Latin American countries are mostly being confronted by "Ingenieros Agronomos", and will continue to be for many years.

Based on the interest shown by participants, Mr. E. Blair, suggested that a concrete proposal should be made and if approved by the plenary it could become part of the formation document which would also orient the protem committee in establishing the constitution. Mr. Blair offered a proposal which was approved by acclamation, and is reproduced as follows:

"Membership of the SLAIA will be granted to all professionals having university education, especially to agricultural engineers and other engineers whom, through their academic formation or professional activity, show interest in Agricultural Engineering or express the desire of becoming a member. However, any admitted member shall comply with the objectives, requirements and responsibilities of the Latin American Society of Agricultural Engineering".

The plenary also approved the nomination of a protem committee consisting of Mr. J. Quiroz, Chairman, Mr. J. Quintero, and Mr. J. D. Berlijn. This Committee will prepare a constitution of by-laws embodying the broad objectives for presentation at a subsequent meeting of the newly formed society. The document forming the society was then signed by the participants in the meetings (Signers of the document are shown with an asterisk in Appendix C.)

3. RECOMMENDATIONS AND SUGGESTIONS

3.1. INTRODUCTION

Chairmen and reporters prepared and consolidated the recommendations of the themes which were pre-

sented for discussion and approval by the participants during the Panel closure session. The suggestions and comments presented by the participants were further consolidated by a committee selected by the Panel.

A summary of recommendations is given preceding the completed set of detailed recommendations and suggestions. These are presented in the following sections and grouped under the topics general, undergraduate, post-graduate and research.

3.2. SUMMARY AND RECOMMENDATIONS

The major objective of Agricultural Engineering is to effect improvement in social and economical conditions of rural communities. This can be achieved through the integration of studies in mathematics, physics and biology with engineering and agricultural sciences in the following areas:

- agricultural mechanization and automation;
- soil and water management, utilization and conservation;
- rural planning and construction;
- preservation, handling and processing of agricultural products

In order to insure effective service from the profession and to achieve undergraduate and graduate academic standards to serve Latin American agriculture, the participants of the Panel formulated recommendations which are summarized as follows:

1. The establishment of Agricultural Engineering Schools in those Latin American countries where human physical and capital resources can be made available. Academic requirements for 5-year undergraduate programmes should include 20% of mathematics, 20% of basic engineering sciences, about 20% of agricultural sciences, economics and humanities and at least one course in each of the main areas of specialization. Such an academic framework should permit a sound preparation in agricultural engineering and at the same time allow flexibility to obtain high quality university education. Institutions establishing either undergraduate or graduate programmes should make available:

- adequate library
- appropriate laboratories and equipment
- opportunity for the students to carry out field exercises, and to observe activities of industries and official agencies;
- adequate financial resources to attract faculty and support research projects;
- well trained sub-professional technicians,

- opportunity for faculty members to improve their capability with fellowships or other rewards for professional excellence, and
- ways and means to publish the results of research

2. That research projects be definitely and specifically related to problems and conditions of the region or country, and outlined according to regional or national priorities and resources available. The universities and other research organizations should direct their endeavours and studies to the establishment of these priorities based on current available information. That leadership qualities, ingenuity and problem solving attitudes be fostered among research faculty. Research projects should be developed as a team effort by agricultural engineers, "ingenieros agronomos" and other professionals.

3. That international agencies and in particular the Organization of American States, through IICA, provide and support:

- the establishment of additional schools of Agricultural Engineering in Latin America,
- greater communication between the institutions and the professionals by sponsoring panels, seminars, exchange of professors, etc.
- publication of text books and other professional and technical information, and
- the establishment of an accrediting system for Agriculture Educational Institutions, specifically for Agricultural Engineering programmes.

4. That Latin American Governments consider creating Agricultural Engineering services to participate in planning, evaluation and execution of projects designed to increase agricultural productivity, provide better housing and improve the conditions of rural living. Also, full support should be given to the Agricultural Engineering programmes by local governments and institutions in which they are to be established.

Further important suggestions offered by the Panel are included in sections of recommendations and suggestions which follow.

3.3. GENERAL RECOMMENDATIONS AND SUGGESTIONS

1. Based on the activities, experiences and suggestions of the participants of this Panel, there is a need for qualified professionals to solve agricultural problems by the application of engineering sciences. It is suggested that these professionals be called Agricultural Engineers.

2. Agricultural Engineering has a major objective to effect improvement of social and economic conditions of rural communities in agriculture. This can be achieved through a harmonious integration of mathematics, physical and biological sciences with engineering, in the following areas:

- agricultural mechanization and automation,
- soil and water management, utilization and conservation,
- rural planning and construction,
- preservation, handling and processing of agricultural products.

These areas will be applied in combination with other fields of study for the improvement of agriculture and related industry. The fundamental objectives of Agricultural Engineering are to provide adequate technical services for the development of rural society; to utilize the resources and forces of nature; to facilitate and improve working conditions of people in agriculture; to efficiently utilize natural resources; to raise economic standards and to improve rural living conditions of people.

Consequently, the Panel recommends:

3. That Agricultural Engineering Schools be established in those Latin American countries where needs exist and where human, physical and capital resources can be made available.

4. That human, physical and capital resources from universities and related institutions be united to form a single Agricultural Engineering School to provide the highest quality education feasible in the country.

5. That the physical facilities of future Agriculture Engineering Schools be located within agricultural centers offering close contact between the students and the working environment, and making possible collaboration with existing agricultural experimental stations.

6. That a minimum Agricultural Engineering curriculum based on suggestions of this Panel be adopted in order to assure an adequate education standard for the profession. This minimum curriculum would be complemented with courses required to meet specific needs of distinct countries. The terms credit, unit and others involving academic load should be standardized for all Latin America.

7. That in Latin America a broad based undergraduate programme be developed in Agricultural Engineering

and specialization be reserved for post-graduate studies.

8. That the designation of the undergraduate and post-graduate professional titles in Latin America be uniform.

9. That governments consider creating Agricultural Engineering services to participate in planning, evaluation and execution of projects designed to increase agricultural productivity, provide better housing and improve the conditions of rural living.

10. That International Organizations interested in the development of Agricultural Engineering in Latin America, and, particularly, the Inter-American Institute of Agricultural Sciences (IICA) of the Organization of American States (OAS), provide and support:

- greater communication between institutions and professionals working in Agricultural Engineering in different countries, by sponsoring seminars, conferences, etc. and by exchange of professors, publications and other information;
- publications (if possible yearly), containing the principal results of investigations being conducted in Agricultural Engineering in Latin America;
- annual publication of lists of institutions and professionals involved in work related to Agricultural Engineering;
- publication of textbooks and other teaching materials which can serve to orient programmes and courses in Agricultural Engineering;
- publish a Latin American Technical Dictionary of Agricultural Engineering, based on that prepared by the Latin American Seminar on Irrigation;

11. That the IICA of OAS sponsors another Panel in order to consider various problems, including the following:

- activities that could be carried out by the agricultural engineer other than those connected with University or Government, teaching, research and extension;
- the coordination, as much as possible, of academic programmes to define the minimum curriculum for agricultural engineers as related to other branches of engineering;
- the education of agricultural engineering technologists.

The Panel suggests:

12. With reference to item 6, that an accreditation

system be established among the Agricultural Engineering Schools, as soon as possible, in order to insure academic standards, effective service to agriculture and the international prestige of the profession.

13. That international organizations support the initiative of every Latin American country in establishing Agricultural Engineering Schools. This support should be provided in the first years of these schools by means of technical consultancies, laboratory equipment and programmes for improvement of the local staff.

14. That all professionals engaged or interested in Agricultural Engineering establish and support the organization and activities of a Latin American Society of Agricultural Engineering (SLAIA). Among the activities of the SLAIA, the following should be considered.

- periodic organization of congresses, e.g. biennial, to consider themes of high priority related to Agricultural Engineering. Each area of Agricultural Engineering should specify themes to be considered;
- periodic publication of an Agricultural Engineering Journal to circulate mainly in Latin America;
- appointment of an "adviser" to the Administration Councils of Universities in order to give opinions on their programmes.

3. 4. RECOMMENDATIONS ON THE UNDERGRADUATE PROGRAMME

1. Agricultural Engineering Programmes can be sponsored by Schools of Agriculture, by Engineering, or by joint sponsorship. However, the programme should be oriented to the field of engineering and comply with the minimum requirements of the following recommendations:

2. The undergraduate curriculum should satisfy the following requirements:

- a. That, at least 20% of the 5-year programme be basic sciences and mathematics, including Differential Equations either separate or in combination with other courses.
- b. That, at least 20% of the 5-year programme be basic engineering sciences, such as: Thermodynamics, Statics, Dynamics, Fluid Mechanics, Strength of Materials, Electricity, Heat Transfer, etc.
- c. Include Agricultural Sciences and Economic courses depending on the available courses in the country or region, the requisites of the University, the prevailing laws, etc.
- d. Include other courses in Humanities appropriate to the country, with special emphasis on the agricultural

sector.

e. Include at least one course in each of the main areas of Agricultural Engineering of importance to the country or region in which the programme is being offered. These courses should utilize the required Basic Sciences and Mathematics mentioned above.

Of the total undergraduate curriculum it was intended that approximately 60% be required subjects thus leaving ample flexibility for the formulation of the complete programme of study.

3. Institutions establishing Agricultural Engineering Education should consider the necessary minimum requirements indicated for such programmes. Qualitative evaluation should be established through professional engineering societies, Agricultural Engineering societies, or other acceptable local, national or regional institutions. Procedures to permit exchange of professors, to develop and publish textbooks, to evaluate teaching efficiency, to assess equipment, library and space requirements should be developed to strengthen qualitative aspects of all programmes.

4. Programmes which do not fulfill these minimum requirements should be identified by names other than Agricultural Engineering. These names could be: Farm Mechanization, Irrigation and Drainage, etc. and they should be considered as part of the general field of agriculture rather than that of Engineering.

5. In order to provide adequate support to the Agricultural Engineering teaching programmes, the following should be available:

- a. Library.
- b. Appropriate laboratories.
- c. Opportunities and facilities to carry out laboratory and field exercises under the supervision of the professors.
- d. Opportunity for the students to observe activities of industries and official agencies related to Agricultural Engineering, and to obtain practical experience in their programmes.
- e. Well prepared and experienced Agricultural Engineering professors, as well as others involved in teaching the supporting disciplines.

6. Full support should be given to the Agricultural Engineering programmes by local governments and institutions in which they are to be established.

7. It is furthermore recommended that the Inter-American Institute of Agricultural Sciences (IICA) publish

the minimum requirements to be used as a basis for the comparison of Agricultural Engineering programmes; the IICA should continue to support the establishment of accreditation systems for Institutions offering Agricultural Education in Latin America and begin promotion and development of a similar system especially for professional programmes in Agricultural Engineering.

3. 5. RECOMMENDATIONS ON POST GRADUATE PROGRAMME

1. Latin American graduate teaching and research programmes should be designed and conducted to solve Latin American problems in the environment of Latin America. Optimum use should be made of human and financial resources and physical facilities available in each country.

2. Graduate programmes should be oriented to solve problems rather than only to collect information. The training offered must provide graduate students with opportunities to develop sound judgement and to gain experience in the identification and solution of actual problems.

3. Graduate programmes should emphasize applied research to the solution of problems in agriculture and related industries. Team work should be encouraged with professionals of non-engineering disciplines.

4. Graduate programmes of teaching and research should emphasize cooperative effort to the solution of general agricultural problems. However, sufficient breadth and depth of training is desired in order that graduates will be able to solve, with little or no assistance, many of the problems that exist in his own area of specialization. Graduate students must understand the scientific methods of research and should apply these principles to the solution of all problems.

Students should understand the limitations of their research and the potential for improvement or expansion. They should be able to determine proper conclusion rather than simply comments on the results, which are in fact based on observed data and not influenced by opinion.

Graduate students should be encouraged to conduct research projects in the field to solve problems under practical conditions.

5. Graduate programmes should meet standards that will assure engineering proficiency in the area of specialization, but at the same time, be sufficiently flexible to satisfy specific needs of individual candidates.

They should also include training in teaching methods.

6. Graduate staff must hold advanced degrees, or have experience recognized as graduate level, in the areas in which they teach or advise graduate students. All graduate professors should be well-informed of the activities and problems of agriculture and related industries in their respective regions.

7. Graduate education must include adequate laboratory experience. Therefore, well equipped laboratories must be provided. These laboratories should include experiment farms with both crop and animal studies as well as access to nearby industrial facilities.

8. Graduate institutions should provide:

- adequate financial resources to attract faculty and support research projects,
- adequate physical facilities,
- well trained sub-professional technicians,
- opportunity for faculty members to improve their teaching and research capability, with rewards for professional excellence,
- ways and means to publish the results of research.

3.6. RECOMMENDATIONS AND SUGGESTIONS ON RESEARCH

There is a lack of economic and technical information on the needs for improvement of agricultural production and rural housing in Latin America. It is essential to make general, as well as specific studies of the relative importance of problems on which research may be conducted. Objectives and goals of projects should be outlined to determine priorities and resources required. It is recommended that research projects be definitely and specifically related to problems and conditions of the region. Research in the various areas of Agricultural Engineering must be based on a national priority of needs for the solution of agricultural problems in a country. In those countries in which such a priority scale has not yet been established, it is recommended that Universities and other research organizations direct their attention to problems which appear to be of major importance at the national or local level based upon current information available.

Agricultural Engineering research cannot be conducted without funds, equipment and facilities; however, it is not essential to have expensive and complex equipment before starting a basic or applied programme. The most important minimum requirement for research is a faculty with leadership qualities, ingenuity and de-

sire to solve problems to stimulate the environment for investigation.

It is equally important and recommended that research projects be developed as team effort of the Agricultural Engineer, "Ingeniero Agronomo" and other professionals.

The following suggestions were formulated by working groups in the different areas in which the activities of the Panel were divided. The statements prepared by these groups were discussed and approved in the closing session.

A. Agricultural Products Processing

This group suggested that:

A. 1. Common problems on Food and Agricultural Products Processing be defined for Latin America; and in order to facilitate their solution, international cooperative programmes be established by governments, universities or other research institutions.

A. 2. Research in the area of Food and Agricultural Products Processing be directed toward solution of the major problems of the country, which requires on the part of researchers a thorough knowledge of the country and its problems.

B. Farm Structures and Rural Planning.

Research in the area of Planning and Rural Construction should be based upon complete planning, in order to insure a utilization of natural and human resources of the region as sources of agricultural supplies. Regional aspects should determine characteristics for the planning of rural settlements. As to the aspects of physical infra-structure, there is a need in planning for feasibility studies of roads, canals, sewage disposal network, public and service buildings, etc. Therefore, the suggestions of this group are:

B. 1. It is urgent to carry out organic studies of the family cell as a complement of the development potential and geographical analysis of the medium, to better utilize natural and human resources.

B. 2. Rural planning and construction studies should not be restricted to the limits of the farm. They should include all the rural infra-structure of the region, such as analyzing the rural settlement and its projection, housing design, public and service buildings, sanitary aspects, etc.

C. Power and Machinery.

There is a need for market evaluation and projection of market potential for the new or different machines that are required for the wide variety of agricultural conditions existing throughout Latin America.

Many existing local or imported machines are not suitable or adapted to Latin American conditions.

There is, therefore, a great need for the development and support of programmes and organizations which could develop new machines or adapt existing ones to regional needs. This would make them not only appropriate and suitable for major areas of production, but also to those areas in which agriculture is practiced under more specific conditions of mechanization and labour, like the Andean region and other unusual areas.

Therefore, this work group suggested that:

C. 1. Machines which are developed through research should be manufactured and made available to farmers. It is important that manufacturers cooperate in research for the development of new machines, mainly at an early stage of the project.

C. 2. A set of standards for the manufacturing of tractors and machinery for Latin America be established under Government and Research control. This would permit interchangeability of parts and thus reduce costs of manufacturing, distribution, operation and servicing of machinery. This suggestion merits careful study in order to ascertain that standardization would not limit the progress and improvement of existing machines or the development of new ones.

C. 3. Development of testing techniques and methods for performance evaluation of farm machinery be under the responsibility of University or government institutions. Also, these institutions should be concerned with the development of new production techniques or

systems, as well as the development of new prototype machines for specialized crops.

C. 4. There is a need to include the following procedures in the development policies of different countries, in order to insure an effective role for mechanization:

- research in mechanization problems;
- credit expansion for investment in farm machinery;
- reduction or exemption of import duties on machinery which is for Latin American agriculture;
- development of cooperatives or other organizations which encourage collective use of farm machinery;
- establishment of teaching and training programmes at a sub-professional level for personnel engaged in the various areas of agricultural mechanization.

D. Soil and Water Engineering

This group suggested that:

D. 1. A priority study be made of the problems in Soil and Water Engineering for the different countries in Latin America.

D. 2. Research on Soil and Water Engineering be conducted insofar as possible, to seek solutions for the problems of the respective countries.

D. 3. More attention be given to methods of utilization of underground water, which is one of the major sources of water for most countries, but nevertheless, is not adequately studied in Latin America.

D. 4. Agricultural Engineering meetings among other priority themes, include the following: hydrology, irrigation, drainage, reclamation of saline soils, evapotranspiration, hydraulic structures, erosion control, groundwater and economic aspects of the projects.

APPENDIX A
PANEL COMMITTEES AND SECRETARIAT

Advisory Committee on Local Programme Execution
UNDP/SF 80

L. Marcano
C. Garcés
C. Vidalón
M. Arca
A. Comejo
P. Bemheim
H. Lapp

Panel Secretariat

H. Lapp
A. Cobra
A. Ibrahim
S. Roy
H. Barreto
A. Daker

Recommendations Committee

A. Cobra
E. Wiser
C. Ricci
A. Dagger

Travel Control, Reception and Lodging Committee

A. Ibrahim
A. Cobra
A. Amillas

Local Arrangements and Transportation

A. Cobra
R. Ledgard
A. Ibrahim

Themes and Technical Paper Control and Reproduction

S. Roy
A. Cobra

Press and Finance Committee

H. Lapp
C. Vallejo

Open House Committee

J. Quiroz
E. Escudero
R. Ledgard
J. Téllez

Ladies Committee

Mrs. J. Quiroz
Mrs. H. Lapp
Mrs. A. Ibrahim
Mrs. S. Roy
Mrs. A. Comejo

APPENDIX B
Panel Programme Schedule

Monday, August 4

- 9.00 Registration
10.00 Inauguration
Chairman: J. Quiroz
Speakers:
Local Programme Head, UNDP/SF 80
Rector, National Agrarian University, La Molina
IICA - Andean Zone, Director
Resident Representative, UNDP, Peru
Minister of Agriculture and Fisheries of Peru
11.00 Refreshments
11.15 Philosophy of Agricultural Engineering and Education Required for the Profession
C. W. Hall
11.45 Role of Agricultural Engineering in Meeting the Needs of Improved Rural Living and Agricultural Production
C. W. G. Downing
12.15 Discussion
12.30 Lunch

Theme 1. THE STATUS OF AGRICULTURAL ENGINEERING EDUCATION IN LATIN AMERICA

Chairman: H. M. Lapp
Reporter: J. Quintero

- 15.00 Country Statements by Delegates from:
- | | | |
|-----------|---------|-------------|
| Argentina | Chile | Puerto Rico |
| Bolivia | Ecuador | Trinidad |
| Brasil | Mexico | Venezuela |

- 17.15 Discussion
17.30 Adjourn

Tuesday, August 5

Theme 2. THE PATTERNS OF DEVELOPMENT OF AGRICULTURAL ENGINEERING IN LATIN AMERICA AND IN OTHER REGIONS OF THE WORLD.

Chairman: J. D. Berlijn
Reporter: J. H. Rodríguez-Arias

- 9.00 The Development of Agricultural Engineering in Peru
J. Quiroz
9.30 The Development of Agricultural Engineering in Colombia
J. Quintero

- 10.00 Discussion
10.30 Coffee
10.45 The Development of Agricultural Engineering in the Middle and Far East
H. F. McColly
11.00 The Development of Agricultural Engineering in India
S. E. Roy
11.15 The Development of Agricultural Engineering in Europe
C. Ricci
11.30 The Development of Agricultural Engineering in United Kingdom
P. C. J. Payne
11.45 Discussion
12.30 Lunch

Theme 3. THE SCOPE OF AGRICULTURAL ENGINEERING PROGRAMMES TO SERVE LATIN AMERICA - INSTITUTIONAL AND EDUCATIONAL REQUIREMENTS

Chairman: C. W. Hall
Reporter: F. Salas

- 14.30 The Potential of UNDP/SF 80 to Serve Latin America
H. M. Lapp
14.50 Institutional Requirements in Attaining the Capacity to Offer Programmes in Agricultural Engineering
R. Bainer
15.10 Discussion
15.30 Coffee
15.45 Experience in the Development of Accrediting Systems for Agricultural Institutions in Latin America
C. Garcés
16.15 Experience in the Development of Accrediting Systems for Agricultural Engineering in the United States
F. J. Hassler
16.45 Discussion
17.30 Adjourn

Wednesday, August 6

Theme 4. THE EDUCATION AND CURRICULUM OF THE AGRICULTURAL ENGINEER AND ITS RELATION TO THAT OF THE "INGENIERO AGRONOMO".

Chairman: E. Blair
Reporter: R. G. Yeck

- 9.00 The Education of the Agricultural Engineer and that of the "Ingeniero Agronomo"
J. D. Bedijn
9.30 Discussion
10.00 Coffee
10.15 A Suggested Undergraduate Curriculum in Agricultural Engineering for Colombia
F. Bustamante
10.35 A Suggested Undergraduate Curriculum in Agricultural Engineering for Peru
J. Quiroz
11.00 Discussion and Recommendations of a Core Undergraduate Curriculum in Agricultural Engineering for Latin America.
12.30 Lunch

Theme 5. GRADUATE EDUCATION IN AGRICULTURAL ENGINEERING IN LATIN AMERICA

Chairman: M. Arca
Reporter: J. Quiroz

- 14.30 Requirements for Graduate Study in Agricultural Engineering
R. G. Yeck
15.00 The Nature and Content of Graduate Agricultural Engineering Programmes in Latin America
W. Hobbs
15.20 Discussion
15.40 Coffee

Theme 6. FINANCING AND ADMINISTRATION OF AGRICULTURAL ENGINEERING TEACHING AND RESEARCH PROGRAMMES

Chairman: R. Bainer
Reporter: A. Tosello
Experience of Speakers on Theme

- 16.10 A. Cornejo
16.20 P. C. Payne
16.30 J. Quintero
16.40 L. L. Boyd
16.50 Discussion
17.30 Adjourn

Thursday, August 7

Theme 7. RESEARCH IN AGRICULTURAL ENGINEERING AND ITS APPLICATION TO SERVE LATIN AMERICA

Chairman: A. Cornejo
Reporter: T. Baraflao

- 9.00 Philosophy and Methodology of Research in Agricultural Engineering
L. L. Boyd
9.30 The Value of Agricultural Engineering Research in Enhancing the Economy of Developing Countries
E. Blair
10.00 Discussion
10.15 Coffee
Concurrent Group Sessions on Research:
A. Agricultural Products Processing
Chairman: J. Téllez
B. Farm Structures and Rural Planning
Chairman: J. Quiroz
C. Farm Power and Machinery
Chairman: G. Carrera
D. Soil and Water Engineering
Chairman: E. Escudero
10.30 Research in the Specialization
Speakers:
A. F. J. Hassler
B. L. L. Boyd
C. P. C. J. Payne
D. E. H. Wisner
10.50 Discussion and Formulation of Recommendations
11.00 Problems of Vital Importance in Latin America
Speakers:
A. H. Barreto
B. N. Teter
C. J. Bedijn
D. J. Quintero
11.20 Discussion and Formulation of Recommendations
11.50 Minimum Requirements for Establishing Effective Research
Speakers:
A. F. Salas
B. R. G. Yeck
C. H. F. McColly
D. J. E. Christiansen
12.10 Discussion and Formulation of Recommendations
12.30 Lunch
14.30 Technical Papers in Each Specialization
16.15 Coffee
16.30 Plenary Session
Presentation and Adoption of Recommendations on Research
Chairman: L. L. Boyd

Friday, August 8

AGRICULTURAL ENGINEERING OPEN HOUSE

- 9. 00 Inauguration
Chairman: J. Quiroz
Speaker: H. M. Lapp
- 9. 30 Power and Machinery
G. Carrera, Staff and Students
- 9. 50 Planning and Rural Works
J. Quiroz, Staff and Students
- 10. 10 Land and Water Resources
E. Escudero, Staff and Students
- 10. 30 Agricultural Products Processing
J. Téllez, Staff and Students
- 10. 50 Tour of University Facilities
- 12. 30 Lunch
- 14. 40 Meeting to Explore Initiation of a Latin Ame-

rican Society of Agricultural Engineers (for those interested).

Chairman: J. Quiroz

16. 30 PANEL CLOSURE

Chairman: F. Anavitarte

Reporter: J. Quiroz

Presentation for Adoption of Recommendations from Reports by Chairmen of Respective Themes

Speakers:

C. W. Hall

H. M. Lapp

F. Anavitarte

Minister of Agriculture and Fisheries of Peru (Representative).

APPENDIX C

LIST OF PARTICIPANTS

ARGENTINA

- * Barañao, Teófilo V.
- * Bonino, Arigo Francisco
Chiesa, Carlos Alberto
- * Rearte, Alejandro E.
Vecchiotti, Raúl C.

BOLIVIA

- * Torrico, Oscar
- * Urquidi Zambrana, Jorge

BRASIL

- * Cobra, Anivaldo Pedro
Tosello, André

CANADA

- Downing, C. G.
- * Lapp, Herbert M.

CHILE

- * Ibáñez Cifuentes, Mario
- * Sáu Fuentes, Eliseo
- * Valenzuela A., Alejandro

CHINA

- * Ma Fengchow C.

COLOMBIA

- * Blair Fabris, E.
- * Bustamante B., Fabio
- * Citelly Padilla, Francisco
Durán Vargas, Alvaro
Garcés Orejuela, Carlos
- * Quintero, Jorge E.
- * Villa Villegas, Luis G.

ECUADOR

- * Jarre Vinces, Rafael J.

EGYPT

- * Ibrahim, Amin Aly

EL SALVADOR

- Chorro, José Salvador

HOLLAND

- * Berlijn, Johan D.
- * Olivier, Hendrik
Zylstra, Gerard

INDIA

- * Roy, Shunil E.

ITALY

- * Ricci, Corrado

MEXICO

- * De La Garza, José A.
- * Del Valle, Francisco R.
Mora Blancas, Edgar Ezel
Takeda Inuma, Jesús

PERU

- * Anavitarte C., Federico
- * Aguila-Pardo Fernández, E.
Alayza Grundy, Luis
Aliaga Osorio, Jorge
Almanza Ocampo, Benjamín
Arca, Manuel
- * Arnillas Ugás, Alberto
Barrantes Rangel, Luis
Barreda, Alberto
Barreto Boggio, Hernán
Benavides Matarazzo, O.
Braschi Roncagliolo, G.
- * Calderón Johanson, Camilo
Calisaya Medina, Juan M.
- * Camacho de la Riva, Víctor
Campusano Espinoza, Hugo
Cárdenas Vela, Truman
- * Carrera Ñañez, Guillermo
Castillo Cortez, Raúl
Colchao Novoa, Roberto
Corcuera Rodríguez, Marco
Cornejo T., Arturo
Cueto Duthurburu, Luis

Chang Navarro, Lorenzo
Chong Chappa, Hernán
Dourojeanni Ricordi, Axel
* Escudero O., Enrique
Fernández García, Angel
Flores Castro, Francisco
* Franco Morante, Enrique
* Fuentes Vizcarra, Luis A.
* Gilardi Rodríguez, Jaime A.
Gutiérrez Quintana, C.
Gutiérrez Olórtgui, A.
Haro Córdova, Julio
Hurtado Pascual, Fernando
* Ibarra Morelli, Juan
Joo Chang, Alberto
Lafosse Denedetti, E.
Lama Romero, Jaime
* Lazo Hilario, Hernán
Ledesma Rebaza, Alvaro
* Ledgard Jiménez, Reginald
Lescano Anadon, Carlos
* Maezono Yamashita, Luis
Maraví Sáez, Jorge
* Márquez L'Honneur, Juan
Martínez, Fernando
* Molleda Villaizán, Oscar
* Montes Gutiérrez, Augusto
* Muñante Sanguinetti, Rodolfo
* Nonone Medrano, Carlos
Ortega N., Luis F.
Pérez Pancorvo, Guillermo
Pizarro Carbone, Rodrigo
* Prieto Celi, Matías
Quiñones A., Ricardo
Quiroz Rivas, Jorge
Ramberg, Klaus G.
Ramírez Mejía, Máximo
* Rodríguez Flores, Víctor
Salas Arango, Freddy
Salas Arango, Néstor
* Saldarriaga M., César G.
Silva García, Elquín D.
Solano, Jorge A.
Téllez Villena, José G.
Torres Pérez, Luis
* Urbina Barreto, Juan
Urefia Castellano, Carlos F.

Valdivieso Barra, Rafael
Valencia Castro, Eusebio
Valverde Torres, Alfredo
Vargas Rodríguez, Enrique
* Velasco Linares, Jaime
Vidalón Gandolini, Carlos
Villanueva Carbajal, Lincoln
* Yap Salinas, Humberto
* Zacarías, Eleodoro
* Zarauz V., Fernando
Zúñiga, Bernabé

PUERTO RICO

* Rodríguez-Arias, Jorge H.

TRINIDAD

* Campbell, Lewis G.

UNITED KINGDOM

Johnson, Ian M.
* Payne, Peter C. J.

UNITED STATES

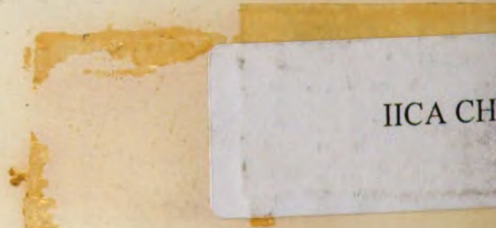
* Bainer, Roy
* Boyd, L. O.
* Collins, William H.
* Christiansen, J. E.
* Hall, Carl W.
Hassler, F. J.
* Hobbs, W.
* Johnson, Lloyd
* McColly, Howard F.
* Teter, C., Norman
Wiser, Edward H.
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VENEZUELA

* Dagger De Sánchez, A. C.
* Key Sánchez, Fernando
* Yáñez, D., Edgar J.

* Signers of the forming document of the SLAIA.





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