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AGRICULTURAL RESEARCH AND HIGHER EDUCATION IN PANAMA

A Report to the

Agency for International Development

and the

Government of Panama

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September 1971

Foreword

The Technical Secretariat for the Coordination of the Agricultural Sector was established in Panama by Executive Decree No. 219 on December 14, 1970. The Secretariat was set up in the General Directorate of Planning and Administration which reports to the Office of the President of the Republic. Responsibilities of the Secretariat were "to coordinate a program for the analysis of the agricultural sector, and the preparation and recommendation of programs, plans and projects to be carried out in this sector by the various national organizations entailed by law." The Secretariat includes representatives of the various national agricultural agencies and is responsible for the National Plan for Agricultural Development.

At the request of the Ministry of Agriculture and Livestock and the University of Panama, the Agency for International Development invited the University of Florida to send a team to aid the Secretariat in the development of a program for research and higher education in agriculture. The specific objectives of the request were to "to assist the Ministry of Agriculture and Livestock to evaluate the present agricultural research and higher agricultural education programs in Panama and make recommendations for a five year program designed to accelerate the development of new farm level technology in Panama and to improve the related educational function of the University of Panama College of Agriculture."

The scope of work was given as follows:

1. Evaluate and analyze the present agricultural research program conducted by the Faculty of Agronomy at University of Panama. This analysis

will give special attention to the following questions:

a) What are the limiting factors affecting the productivity of researchers at the Faculty?

b) How can Faculty research be organized and conducted in order to maximize the early availability of economically useful technologies at the farm level?

c) What inputs are required for a rapid expansion of the applied research capacity of the Faculty of Agronomy?

2. Evaluate and analyze the present Ministry of Agriculture and Livestock (MAG) agricultural research program. The analysis should give special attention to the following questions?

a) What are the research capabilities of MAG?

b) What are the limitations affecting MAG's output of economically viable farm technologies?

3. Provide recommendations for improving and expanding applied research in Panama. These recommendations should be addressed to the following points:

a) How should Faculty of Agronomy and MAG research activities be related? What role in agricultural research should be defined for each?

b) What research strategies should be utilized by the Faculty of Agronomy and MAG for accelerating the development of new farm level technologies?

c) What financial assistance and technical assistance are required to expand the research activities of the Faculty of Agronomy? How much assistance can be absorbed by the Faculty?

d) How should assistance be time-phased to maximize its value to the Faculty?

4. Evaluate the curriculum and educational program of the Faculty of Agronomy. Attention should be given to:

a) The objectives established by the Faculty with respect to:

i) Desired type of graduate.

ii) Course objectives and their contribution to the overall objectives.

b) Curriculum

c) Teaching methods

d) Adequacy of physical facilities - laboratory equipment, visual aids, classrooms.

5. Recommendations for improving and expanding the educational function.

Consequently, the authors of this report visited Panama in September 1971 to carry out the proposed study. The team included Dr. John Sites, Dean of Agricultural Research, Dr. Charles Browning, Dean of Resident Instruction and Dr. Hugh Popenoe, Director of International Programs of the Institute of Food and Agricultural Science of the University of Florida.

Background studies had previously been prepared by the Interamerican Institute of Agricultural Sciences and several agencies of the Government of Panama, including self-studies by the Ministry of Agriculture and Livestock and the College of Agriculture. These documents were most useful in preparing this report.

The period of time allocated for the study was quite short. The team has made recommendations on the assigned topics. However, if these are acceptable, more details will be needed for an implementation plan.

The team would like to express its appreciation for the excellent cooperation received from both the College of Agriculture and the Ministry of Agriculture and Livestock. We thoroughly enjoyed working with these organizations and we developed a tremendous admiration for their remarkable growth in recent years in spite of limited resources.

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I. AGRICULTURE IN PANAMA

Agriculture is the single largest contributor to the Panamanian economy although its relative contribution has been declining in recent years. It now supplies 18.5% of the Gross National Product, down from 24.7% ten years ago. About 38% of the economically active population is engaged in agriculture which is a decline from the figure of 49% a decade ago. The total population in agriculture has only increased 8% in this same period. Nevertheless, agriculture has had an average rate of growth of 6.2% for the last ten years but is not growing at as rapid a rate as the economy in general.

Agricultural products accounted for approximately two-thirds of the country's exports. Bananas accounted for more than half of all exports which indicates a need to diversify the export economy.

A. Physical Resources

According to a study made in 1966, Panama had 2.2 million hectares of farm land, approximately 22% of which was in crops and 54% in pastures. The amount of land in agriculture had almost doubled in the fifteen years since 1950. Two-thirds of the farms occupied 10% of the agricultural land. One percent of the farms are larger than 500 ha. and occupy more than one-third of the agricultural land. A much larger percentage of the small farms are under cultivation than the large farms. Approximately 30% of the area of farms under 5 ha. were cultivated whereas less than 7% of farms larger than 200 ha. were under cultivation.

Panama still has relatively large areas of land which could be used for agricultural purposes but at present lacks adequate transportation facilities. Most of these areas are on the Atlantic coast and in Darien. However, at present, the major effort should be directed towards increasing agricultural production in those regions which have already developed the appropriate infrastructure.

B. Human Resources

The National Population Census of 1970 estimated 1,425,343 inhabitants in Panama of which 471,480 were economically active. Agriculture was the sector with the largest employment with a total of 181,000 workers. Approximately 58.5% of the population was rural. The annual rate of population growth is approximately 3%. Population density for agricultural land is approximately 1.78 ha/person for the entire population or 4.0 ha/person for the rural population.

C. Agricultural Enterprises

Tables 1, 2 and 3 show the trends in the production of major agricultural commodities. Changes in the production of these commodities reflect a very significant pattern.

Much of the increase in crop production has been through the expansion of areas planted. Corn and rice yields have also increased through the introduction of new varieties and techniques as well as the use of support prices. The decline in bean production is primarily due to the lack of sufficient price support. Most staple food crops are produced at considerably higher costs than world prices and, therefore, would not be competitive in foreign markets. Although considerable research has been done on corn, and most experiment stations report yields of 60-80 qq/ha., average yields for farmers are not much higher than when Columbus first discovered America - an

TABLE 1. INDICES OF AGRICULTURAL PRODUCTION IN PANAMA, 1960-69

(1957-59 = 100)

Year	Total	Per Capita	Total Food	Per Capita Food
1960	92	87	91	86
1961	103	94	101	92
1962	102	90	101	90
1963	107	92	105	90
1964	118	98	119	99
1965	133	107	135	109
1966	133	104	133	104
1967	142	107	142	107
1968	149	109	150	110
1969	154	109	156	110

TABLE 2. COMMODITY PRODUCTION IN PANAMA, 1960-69

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
					1000 Metric Tons					
Rice, paddy	97	110	111	113	128	154	140	151	160	162
Corn	60	75	73	77	82	86	86	89	96	96
Beans, dry	5	7	5	5	4	7	7	6	5	5
Bananas	432	452	417	422	485	583	590	600	650	700
Coffee	4	5	4	5	4	4	5	5	5	5
Cocoa, beans	1	1	1	1	1	1	1	1	1	1
Sugar, raw (centrifugal)	24	27	27	36	49	49	41	62	69	78
Sugar, noncentrifugal	5	2	4	5	5	5	4	4	4	5
Beef and veal	19	23	26	27	27	27	31	30	30	30
Milk	43	48	54	57	70	70	78	85	84	84

TABLE 3. CHANGES IN YIELDS AND AREA MAJOR CROPS IN PANAMA BETWEEN THE YEARS 1960 AND 1968

	Total Yield		Increase	Area (ha)		Increase	Average Yield/ha		Increase
	1960	1968	%	1960	1968	%	1960	1968	%
Rice (qq)	2,117,800	3,594,400	69.7	88,800	128,600	44.8	23.8	28.0	17.6
Corn (qq)	1,295,500	1,846,100	42.5	77,300	100,300	29.8	16.8	18.4	9.5
Beans (qq)	114,700	111,200	3.1	19,000	16,600	12.6	6.0	6.7	10.9
Sugar Cane (short tons)	627,900	936,300	49.1	16,300	19,730	21	38.4	47.4	23.4

indication that much more needs to be done in taking new technology to the farmer. Per hectare production of most crops in Panama is lower than neighboring countries in Central America.

Rice is certainly the most important crop in Panama for domestic consumption. Rice is grown by 75% of the farmers and is the primary source of income for 42%. About 50% of the farmers depend directly on this crop for subsistence. The biggest problem at present which prevents increases in yields is rice blast disease.

Acreage devoted to the cultivation of crops is 498,300 ha. which is 22% of the total land used in agriculture. On the other hand, pastures occupied 1,200,000 ha. or 54% of the total. Although crops occupied a much smaller acreage than pastures, the total value was three times more than livestock. The largest area in cultivation is the Province of Chiriqui, whereas the smallest amounts were in the Provinces of Colon and Darien.

Between 1960 and 1970 cattle numbers increased from 665,000 to 1,156,800 or 73.8%. Poultry increased by 54.9% but swine decreased 20.9%. This decline in swine numbers was caused by the implementation of a confinement law.

During the last ten years the average annual increase in the production of crops for internal consumption was 2.9%, slightly below the rate of population growth. Forestry, export crops and cattle averaged an annual increase of 9.5% for the same period.

Panama is now importing 70% of its requirements for vegetable and animal oils and fats. Therefore, the increased internal production of cooking oils has a high priority by the Ministry of Agriculture to cut down on the needs for imports.

From the foregoing discussion one can see that the agriculture of Panama should be very responsive to national support of the agriculture sector. As will be discussed later, government efforts to support agricultural education and research are relatively recent but are beginning to show substantial effects. However, the fact that only 4% of the national budget is devoted to the agricultural sector would indicate that up to now agriculture has not had a high priority.

II. ANALYSIS AND EVALUATION OF PRESENT AGRICULTURAL RESEARCH AND EDUCATIONAL PROGRAMS IN PANAMA

A. Agricultural Research

Only the programs of the College of Agriculture, University of Panama and the Ministry of Agriculture and Livestock are included in this brief review.

1. University of Panama

Organization of Research - The research program of the College of Agriculture of the University of Panama is loosely knit. The Dean is the administrative head and excercises approval of research programs of the individual members of the faculty. Projects must also be approved by the research council.

The faculty is not departmentalized but members of the faculty work in groups formulated largely through similar academic training and research interest. This kind of organization for the number and academic training diversity of the faculty is good and for a small faculty is preferable to a more formal type of organization. A further benefit derived from this kind of organization is that it tends to encourage interdisciplinary research approaches and functions which are most desirable.

Scope and Planning of Research Programs - The individual member of the faculty, for the most part, determines the nature and the character of the research program in which he engages himself. These determinations are made as a result of his contacts with members of the Ministry who may have brought problems to his attention, his contacts

with former students working in the field, members of Agrarian Reform programs, and contact with larger farm operators and others. There appears to be no system of feedback or priority assignment by any competent group with regard to recognition of problems or classification of their importance as a guide for organized research.

Complete freedom in choice of research programs is highly desirable where research programs are pure and largely basic. This kind of freedom is neither necessary nor desirable in applied research, however, where inputs should be channelled into those areas most critical to the effective production of crops and commodities of greatest importance. Consequently, under the present system, there are many gaps in available information to the Panamanian farmer due to the smallness of the research faculty and the lack of organization in evaluation of critical research needs and priority in research attack.

Quality of Research Performed - It would be naive to assume that a really correct value judgement in this area could be made following so short a visit. Members of the faculty we have met and discussed programs with were well trained and highly competent. The depth of the research programs with the possible exception of those for rice and corn would leave considerable to be desired. This in our opinion is not due to the competence of the individual faculty members but to his need to do something for the many areas of need which exist. Frankly most personnel are "spread too thin." The animal science program is limited to nutrition laboratory evaluations of feedstuffs.

Space Limitations - Space for effective use of the research faculty of the College of Agriculture seems to be critical. The faculty were working in crowded conditions and were adapting space to their needs which was not well suited either to conducting research or to teaching or training of students. Provision for office, laboratory and servicing of personnel must be a part of any consideration for additional inputs into the research program.

Funding of Research Needs - Considering that the faculty is relatively small, funding of the present research program seems to be reasonably adequate. The enterprising efforts of Dean Ensenat has obviously resulted in much better instrumentation and better laboratory and servicing facilities for University personnel than is available for their counterparts in the Ministry. There is a very considerable inadequacy in breadth of the research program but the existing program and personnel are reasonably well provided for except as indicated above with respect to the critical space problems.

2. Ministry of Agriculture and Livestock

Factors Limiting the Effectiveness of Research Productivity - Since this will be discussed in considerably more detail under Section V as rationale for our recommendations for the organization of an Institute, only two of the most critical problems will be mentioned at this time. These problems stated simply are the need for the assignment of responsibility in determining research needs for specific crops and commodities, and a much closer working relationship between the development of research results and placing these in the hands of the Panamanian farmer. In our opinion, correction of these two factors will do much to more effectively develop agricultural production in Panama.

Organization of Research - The research program of the Ministry of Agriculture and Livestock is well organized and presented in "Plan Nacional de Educacion", Investigacion y Extension Agropecuaria 1972-76 and a brief presentation of work presently in progress is reviewed in the Informe Anual 1970 Ministerio de Agricultura y Ganaderia. It is evident that personnel of the Ministry have devoted considerable time to studying and working out a logical and practical presentation of the organization of their "Investigation Program". The Ministry personnel are to be complimented for the development of their five year plan and the clear and concise manner of presentation. Assuming this publication is widely distributed within the Ministry organization (everywhere we went we found it available) there is little excuse for personnel charged with responsibility for research not knowing what has been planned, both nationally and regionally. This sort of organization and presentation should be of tremendous help to field personnel in keeping their local programs relevant to the national plan.

Scope and Planning of Research Programs - The research which we have found within the Ministry consists almost entirely of applied research and for the most part major emphasis has been placed (in the plant science area) on bringing together the available lines and varieties which would seem to have the most possibilities for success here in Panama. Our sample for review was not large but we were quite impressed with the efforts which have gone into this program, especially for rice and, to a lesser extent, corn. There is a considerable quantity of valuable rice germ plasm available throughout the world at this time and the right places and people seem to have been contacted for their help. There is every reason

to believe that the program presently started will be very helpful to Panamanian agriculture if it is carried forward from the beginning stage in which it is now. There was much less evidence of this kind of a good beginning having been made with all other crops except rice and corn. Plans call for similar programs for other field crops, vegetables and fruits, but we saw little actual evidence of this taking place on a large scale. The vegetable work at the field station at Cerro Punta was most interesting but even here their program did not provide for detailed variety evaluation or comparison, but was a demonstration to show that the crop would grow, what it looked like and the value of terraces in that very lovely mountain area.

Briefly the planning has been good but the plans have not been carried out fully and the program lacked depth in all areas.

Quality of the Research Performed - There were several areas where very commendable programs of research were observed. The tomato breeding program of Dr. Lasso and Mr. De Leon at Divisa is especially commendable considering the very modest backing and facilities which were available to support their program. They commented about having breeding programs in rice, pumpkins and papaya but we were not shown any of these. The rice introduction and evaluation program at Alanje was also most commendable. The tomato grafting program being carried on jointly between the Ministry and the College of Agriculture, University of Panama at the Field Experiment Campo Llanos, Zone 2 was most interesting. Of special concern was the student participation in this program. We found the students extremely interested in their work and quite well informed. Other programs attracting our attention

were the rice program at Campo Llanos, Zone 4, the rice and corn program at Alanje and the beef cattle program at Gualaca.

In spite of these commendable efforts there remains a tremendous reservoir of needs which are not covered at this time. Thus the most significant deficiency in the Ministry investigational programs appears to be in the numbers of people involved and the depth of their technical training. Although in our opinion the Ministry program of research should continue to be definitely oriented toward applied research and deal with relevant problems of the farmer, greater depth of technical training for the people involved in these programs would be highly desireable.

Factors Limiting the Effectiveness of Research Productivity - Ministry personnel almost without exception who were engaged in the various programs of investigation we visited were found to be highly industrious, dedicated, concerned people doing the best that their resource supply and training made possible. More resources, better facilities and more highly trained people are badly needed.

Of some concern to us was the amount of time which the present personnel with research responsibilities are actually spending on the research job. Inquiry into this through personal interview indicates that usually less than 50% of their time is actually being given to the research job, other major demands are made on their time. This is an obvious major limitation upon their effectiveness as a research worker.

In discussing the procedures for the handling of research information with research personnel it was explained that the usual procedure was for their notes and records at the conclusion of a test

to be sent to Panama City for interpretation by the Statistics Department. At this time the information presumably becomes a part of the national or regional data bank and is permanently filed in Panama City. This system would appear to have considerable merit. It also would seem to have the weakness of not sustaining the interest of the researcher in the field if he does not at least have a copy of his records and a copy of the analysis which was made.

This information should be available to him for future study interpretation and use if he is to develop his own capabilities to the fullest extent. He may also be quite useful in helping to interpret the statistical analysis.

We were pleased to observe in most Ministry research personnel an appreciation of the need to be involved in an extension program. Farmer interest was being encouraged through field days and inviting visitation on Saturdays and Sundays. More imagination could be used in these programs, but the Ministry appears to be appreciative of the fact that no amount of applied research will be valuable unless it gets to the farmer and he is induced to use it.

In our opinion greater cooperation and participation needs to take place between the College of Agriculture faculty and personnel of the Ministry engaged in research. The University faculty as a group are more highly trained and therefore their expertise must be made to play a more important role, both in the planning and in the conduct, of the field program of agricultural research in Panama.

B. Agricultural Education in the University of Panama

Development of an effective program of agricultural research and higher education for Panama where the aim is to accelerate the development of new farm level technology demands that certain economic and political conditions be met. In addition, proper quantities of budgetary and human resources must be assigned to the endeavor. Vital parts of such a program of agricultural research and education are vocational agricultural education (secondary and post secondary) professional education, extension (including adult education) and research.

History has shown that an integrated program encompassing at least the professional education, extension and research parts of this system is superior to a fragmented program where barriers to communications inevitably exist. It is important that an overall policy-making "institution" is charged with the responsibility of the total program.

A viable and effective system is one where all three parts, research, education and extension, recognize the importance and value of the other. Professional education programs are dependent on research for up to date information for the classroom and laboratory. Extension is dependent on research for knowledge of the important problems existing and research and extension are dependent on education for professional manpower.

Such a system should have organizational and operational autonomy free from the changes and demands brought about by political pressures; continuous internal evaluation; rapid and effective communication of new knowledge to the classroom, extension workers, and rural economy; and understanding and appreciation by all parties of the philosophy of service to agriculture and the rural sector.

History and Objectives - The Faculty of Agriculture (Facultad de Agronomia) is a part of the University of Panama. The University

was established in 1935 and a specialized group designated the School of Agriculture (Escuela de Agronomia) was formed within the "Sciences" program in 1959. In 1965 the College of Agriculture (Facultad de Agronomia) was established as a separate program. In 1969 the general agricultural education program was restructured to give two specializations, Plant Science (Fitotecnista) and Animal Sciences (Zootecnista). The College is not departmentalized. In 1971 a program in Home Economics was added to the College of Agriculture. The first semester of this program had 174 students enrolled. The first two years work will be primarily general education and basic sciences.

The objectives of the College of Agriculture as stated on page 195 Organizacion Administrative del Sector Agropecuario de Panama. Vol. II, are as follows:

1. "To prepare Agronomists, and Livestock and Crop Specialists with sufficient sound knowledge and capability that will enable them to contribute towards the solution of the problems related to the Panamanian agricultural sector.
2. To accelerate scientific agricultural research and advanced studies of the agricultural problems confronting the country.
3. To assist and give service to the community."

Further indication of the purpose of the agriculture program comes from a recent statement prepared by the Dean.

"University studies are not directed to the formation of field foreman but of leaders and agricultural entrepreneurs of the highest level with sound scientific training. If there is a choice between the emphasis on science or the emphasis on practice, the

former is the one which corresponds to the higher university level, while the latter is more in the field of vocational type training. Naturally the most adequate solution is that which is based on the solid foundation of a scientific training whereby the student is put in contact through practical and laboratory work, with agricultural technology in respective fields of study in his program."

Faculty - The faculty are budgeted by the University of Panama for the academic programs in the College of Agriculture, however the average class and laboratory teaching contact time for each faculty member averages less than six hours per week. The balance of their time is devoted to research including the supervision of thesis work of fifth year students. A list of current faculty positions, educational status and present responsibilities of the faculty is given in Table 4. There are nineteen faculty positions including the Dean's position. At present fourteen of these are full time and five part time. Five faculty members hold the Ph.D degree, ten the Masters and four the BS or Ingeniero Agronomo degree.

Support Staff - There are four secretaries, a librarian, six teaching and research assistants, nine research helpers and the Dean's Executive Secretary supporting the faculty.

Facilities - The teaching facilities for Agriculture are crowded and barely adequate for the existing number of students. The library reading and study room has been converted to a classroom to accomodate classroom needs for one or two Home Economics courses. Classrooms are small and poorly suited for innovative teaching procedures. The laboratories are small, generally poorly equipped for teaching and crowded with research equipment and instrumentation. The space devoted to library use is limited and the library is small and the holdings (as per visual inspection) appear inadequate.

TABLE 4

LIST OF PROFESSORS, RESEARCHERS, ASSISTANTS & HELPERS

FACULTY OF AGRONOMY

Professor		University	Specialization	Title
Enrique Ensenat	T.T.C.	L.S.U.; Univ. of Geneva	Agrarian Policy	B.S.
Rodolfo Aleman	T.T.C.	Univ of Arkansas; Ohio Sta.	Soils	Ph.D.
Rodrigo Tarte	T.T.C.	Univ of Calif., Riverside	Horticulture	M.S.
Reinmar Tejeira	T.T.C.	Ohio State University	Soils	Ph.D.
Diego Navas	T.T.C.	Univ of Arkansas	Entomology	M.S.
Gilberto Ocana	T.T.C.	Univ of Calif., Riverside	Phytopathology	Ph.D.
Pedro Gordon	A.T.C.	Interamerican Institute of Agricultural Sciences (Turrialba, C.R.)	Ag. Extension	M.A.
Raul Cisneros	A.T.C.	Louisiana State Univ.	Economics	M.S.
Augusto Zambrano	Ax.T.P.	Michigan State Univ.	Forestry	B.S.
Ricardo Farrugia	Tm.T.P.	Univ of Sao Paulo, Brazil	Veterinary	D.V.M.
Hermel Rosas	T.T.C.	Univ of Tennessee	Animal Sci.	Ph.D.
Cesar Von Chong	Ax.T.C.	Univ of Calif., Riverside	Plant Prod.	M.S.
Truman Cardenas V.	Tm.T.C.	Univ de la Molina, Peru	Agr. Eng.	Agr. Eng.
Carlos Lam Jr.	Ax.T.C.	Univ of Clemson	Animal Sci.	Ph.D.
Rogelio Cuellar	Ax.T.P.	Univ of Rhode Island	Horticulture	
Maria de los S. Villarreal	Tm.T.C.1	Univ of Southwestern La.	Home Econ.	M.E.
Eudoro Jaen	Tm.T.P.	Arkansas University	Poultry	M.S.
Salvador Sanchez	Tm.T.P.	Iowa State University	Hydrology	M.S.
Hector Roux	A.T.C.	Univ of Maryland, IICA	Animal Sci.	M.S.
Assistants				
Alfonso Alvarado		Tecnologico Monterrey	Plant Prod.	Agr. Eng.
Jorge Jonas		University of Panama	Soils	Agr. Eng.
Ruben D. Reyes		University of Panama	Horticulture	Agr. Eng.
Edgardo O. Cortes		University of Panama	Plant Prod.	Agr. Eng.
Sergio O. Quintero		University of Panama	Ani. Nutrition	B.S.
Gaspar Silvera		I. I. C. A.	Phytopathology	M.S.
Helpers				
Kleber Rodriguez		National Inst. of Agric.	Soils	
Felipe Ballesteros		National Inst. of Agric.	Animal Sci.	
Juan Gomez		National Inst. of Agric.	Animal Sci.	
Eric C. Reyes		National Inst. of Agric.	Plant Prod.	
Reynaldo Jimenez		National Institute	Soils	
Jorge Baxter		University of Panama	Ag. Eng.	Agr. Eng.
Emigdio Chea		University of Panama	Plant Prod.	Agr. Eng.
Metodio Rodriguez		University of Panama	Soils	Agr. Eng.
Wilfredo Chavarria		University of Panama	Animal Sci.	Agr. Eng.

T.T.C. = Professor, Full time
Ax.T.P. = Asst. Prof., Part time
Tm.T.C. = Temporal, Full time
A.T.C. = Assoc. Prof., Full time
Ax.T.C. = Asst. Prof., Full time
Tm.T.P. = Temporal, Part time

September, 1971

The field laboratory facilities are located to Tocumen, approximately 10 miles from the University. There are adequate research field plots to furnish practical experiences for the plant sciences laboratories. It was not possible to definitely assess the amount of use being made of these facilities for teaching. Research facilities for beef cattle are also available, however, there are no laboratory facilities or animals for swine, poultry or dairy cattle teaching. Laboratory facilities for courses in agricultural mechanics appear marginal.

Courses and Curriculum - Listed in Table 5 are the courses, credits and contact hours for the two specializations in the curriculum of Agriculture. The primary objective of the program is to train and educate a professional agriculturist to the Ingeniero Agronomo level in a five year program. This program involves 188 semester credits for the Animal Sciences program and 186 for the Plant Sciences. The program has an average of 13.6 contact hours per week (range, 10-17) of class and 15.3 contact hours per week (range 6-24) for laboratory time.

The first two years of the program are devoted almost entirely to general and basic sciences education. This includes 21 credits of Chemistry and Physics; 10 credits of Calculus; 16 credits of Botany and Zoology (not including 8 credits of Plant Physiology and Genetics); and 6 credits of English (use of scientific literature). Agriculture courses during years one and two are limited to 9 credits.

A research problem with thesis is required for the completion of the Ing. Agronomo degree. The student must have fifth year standing before starting on this research. Six credits are assigned

TABLE 5

College of Agriculture

University of Panama

Plant Sciences

First Year

Botany,Gen.	4*	2	6	Zool., Gen.	4	2	6
Math.,Calculus	5	5	0	Math.,Calculus	5	5	0
Chem., Gen.	4	3	3	Chem., Gen.	4	3	3
Physics, Gen.	5	4	3	Drawing	2	1	3
English	3	3	0	English	3	3	0
	21	17	12		18	14	12

* Credits, contact hours p r week class and lab.

Second Year

Chem., Organic	4	3	3	Chem.Anal.Quant.	4	2	6
Botany, Bact.	4	2	6	Botany, Systematic	4	2	6
PlantSci.,Intro.	3	2	3	Surveying	5	3	6
Geology, Intro.	3	2	3	Zool., Genetics	2	2	0
Botany, Plant Physio.	3	2	3	Botany, Plant Physio.	3	2	3
	17	11	18		18	11	21

Third Year

Entomology, Gen.	3	2	3	Ag.Eng.Tractors	3	2	3
Ani.Sci., Intro.	3	2	3	Ento., Applied	4	3	3
Hort.,Veg.Crops	3	2	3	Pt.Path.,Intro.	3	2	3
Statistics,Meth.	3	2	3	Pt.Sci.,Past. & Forages	3	2	3
Pt.Sci., Crop Improvement	3	2	3	Hort., Fruits	3	2	3
Ag.Eng., Hydrol.	3	2	3	Soils, Gen.	4	3	3
	18	12	18		20	14	18

Table 5 (con't.)

Animal Sciences

First Year

Botany, Gen.	4	2	6	Zool., Gen.	4	2	6
Math., Calculus	5	5	0	Math., Calculus	5	5	0
Chem., Gen.	4	3	3	Chem., Gen.	4	3	3
Physics	5	4	3	Drawing	3	3	0
English	3	3	0	English	2	1	3
	21	17	12		18	14	12

Second Year

Chem., Organic	4	3	3	Chem.,Anal.Quant.	4	2	6
Botany,Bact.	4	2	6	Botany,System.	4	2	6
Pt.Sci., Intro.	3	2	3	Surveying	5	2	6
Geology	3	2	3	Zool., Genetics	2	2	0
Animal Sci.,Intro.	3	2	3	Vet.Sci., Anatomy	3	2	3
	-	-	-	Vet.Sci.,Physiol.	3	2	3
	17	11	18		21	12	24

Third Year

Entomology, Gen.	3	2	3	Ag.Eng., Tractors	3	2	3
Vet.Sci.,Physiol.	3	2	3	Ag. Econ.,Intro.	3	3	0
Botany,Plant Phy.	3	2	3	Plant Path.	3	2	3
Statistics, Meth.	3	2	3	Pt.Sci., Past & Forages	3	2	3
Ani. Sci.,Poultry	3	2	3	Soils	4	3	3
	-	-	-	Ento., Applied	4	3	3
	15	10	15		20	15	15

Table 5 (con't.)

Fourth Year

Ag.Eng. Equip.	3	2	3	Statistics,Exp.Design	3	1	6
Ag.Eco.,Frm.Mgt.	3	3	0	Forestry	3	2	3
Ani.Sci.Beef Ctl.	3	2	3	Soils, Conserv.	4	3	3
Soils,Fert.& Anal.	5	3	6	Food Sci.,Technol.	3	2	3
Ag.Eng.,Hydrol.	3	2	3	Ani.Sci.,Dairy	3	2	3
Ani.Sci.,Feeds	3	2	3	Rural Sociology	3	2	3
	20	14	18		19	12	21

Fifth Year

Thesis	3	3	0	Thesis	3	3	0
Vet.Sci.Ani.Hlth.	3	2	3	Ag.Pol.,Lnd.Stlm.	5	5	0
Ag.Policy,Tenure	5	5	0	Vet.Sci.Ani.Hlth.	3	2	3
Ag.Eng.,Blgs.	3	2	3	Ag.Eng.,Irrig.	3	2	3
Ani.Sci.,Swine	3	2	3	Ac.Eco.,Mkt.&Coops.	3	3	0
Agr.Ext.,Methol.	3	2	3		-	-	-
	20	16	12		17	15	6

Total Credits	188
Hrs. Class	136
Hrs. Lab	153

Table 5 (con't.)

Fourth Year

Ag.Eng.Equip.	3	2	3	Stat.Exp.Design	3	1	6
Pt.Path.Diseases	3	2	3	Forestry,Ecology	3	2	3
Pt.Sci.Comm.Crops	3	2	3	Soils, Conserv.	4	3	3
Forestry,Intro.	3	2	3	Food Sci.,Technol.	3	2	3
Soils,Fert.Anal.	5	3	6	Ag.Eco.,Intro.	3	3	0
	-	-	-	Rural Sociology	3	2	3
	17	11	18		19	13	18

Fifth Year

Thesis	3	3	0	Thesis	3	3	0
Ag.Policy,Tenure	5	5	0	Ag.Pol.Settlem.	5	5	0
Ag.Eco.Farm Mgt.	3	3	0	Ag.Eng.,Irrig.	3	2	3
Ag.Eng., Bldg.	3	2	3	Ag.Eco.,Mkt.Coops.	3	3	0
Ag.Ext.Methods	3	2	3	Pt.Sci.,Weeds	4	3	3
Pt.Sci.,Indus.Crp.	3	2	3		-	-	-
	20	17	9		18	16	6

Total Credits	186
Hrs. Class	136
Hrs. Lab.	150

Approved by Faculty May 1970

to the research and thesis work. The research is expected to be an extended time beyond five years for the degree.

Students - Shown in Table 6 is a breakdown by year of students in the College of Agriculture from 1959-71. Visual inspection shows a high dropout rate. For the years 1959-68 the average percentage dropout between the first and second years was 39.4, for second to third 29.9, third to fourth 10.8 and fourth to fifth 23.3. The year 1968 was selected since the enrollment figures for 1969-70 reflect changes as a result of the University being closed for an extended period during one of the regular semesters.

Since the Ing. Agronomo degree is a five year program, the number of students entering from the inception of the program through 1966 would indicate the theoretical number that could have completed the course of study and graduated by 1970. Of this total of 326 students, only 73 or 22.4%, have completed the requirements and graduated. Since the program generally takes more than five years, several more of the 1966 class may finish, but this would not make a significant change in the percentage figure.

The majority of the students enrolling in the College of Agriculture are not from the rural areas. A publication by the University of Panama, Programa de Desarrollo Institucional, 1970, p. 199, as quoted in a report by El Colegio de Ingenieros Agronomos, March 1971, indicates that for 1967-68, 77.2% of the students came from the province of Panama, which is the City of Panama, whereas only 5.7% came from Los Santos, 6.5% Chiriqui, 5.7% Cocle, 3.3% Herrera, 0.8% Bocas del Toro, 0.8 Veraguas and none from Colon and Darien.

TABLE 6

STUDENTS ENROLLED BY YEAR IN THE COLLEGE OF AGRICULTURE, U.P. 1/

Year	Total	YEAR 1	2	3	4	5
1959	27	27				
60	40	23	17			
61	62	35	15	12		
62	75	2[illegible]	26	13	10	
63	97	46	19	17	15	
64	90	45	22	11	12	
65	123	63	24	17	8	11
66	145	61 2/	38	20	20	10
67	127	45	33	22	14	13
68	126	42	30	25	19	10
69	100	18	26	20	24	12
70	116	40	20	10	29	17 3/
71	162	78	27	18	16	23

1/ From table 30, p.94 Plan National de Investigacion y Extension y Educacion Agricola Panama. Education MAG, May 1971.

2/ Through 1966 there were no restrictions on first year enrollment from 1967-70, placement scores used to restrict, 1971 no restrictions.

3/ Fifth year figures through 1970 represent 73 graduates. Graduates to September 17, 1971 total 82.

As further indication of the area of the country from which students come, listed below are the provinces and the number of graduates from each.

Graduates to date by province		
Panama	30	(4)
Chiriqui	14	(2)
Cocle	11	(2)
Los Santos	7	
Veraguas	4	
Herrera	3	(1)
Colon	2	
Darien	1	
Bocas del Toro	1	
Foreign	2	
	75	(9) *

* These have not yet presented their thesis.

One source of rural students is from the Agriculture High School (ENA) located at Divisa. Between 1959-70, 40% of the Divisa graduates enrolled in the College of Agriculture. A total of 90 entered between 1959-1966, but of the 73 graduates of those classes only 7 were former Divisa students. These figures indicate that only 7.7% of those entering from Divisa graduated whereas 28% of all others graduated.

The Ing. Agronomo graduates seem to be in strong demand. An indication of the jobs held by the graduates is given in Table 7. At the present time only about 12 students per year are graduated; Dean Enrique Ensenat indicated that at least 40 per year could be placed if they were available.

TABLE 7

Industries or Organizations	No.
"Ofelina" Sugarmill	3
"Santa Rosa" Sugarmill	2
Agrarian Reform	10
Ministry of Agriculture & Commerce	35
Bank of America	1
University of Panama	2
Ministry of Education	1
Presidency Plannification	1
SHELL	1
Water Commission	1
FERTICA	1
I.F.E.	4
"Istmena" Tobbacco Co., S.A.	2
National Guard	1
Own Business	5
Abroad	3
Thesis	7
TOTAL	80

Government Organizations	51
Private Organizations	19
Abroad	3
Thesis	7
TOTAL	80

September, 1971

Some of the more important aspects of a good educational program to prepare professional agriculturists are:

1) Efficiency - adequate teaching methods including textbooks, up to date research results and library resources; proper balance of theory and practice; and selection of qualified students with ideals and motivations in line with the objectives and goals of the program.

2) Relevant course and curricula materials - obsolete or poorly chosen concepts, principles, educational materials, etc. are a waste of time and money and turn out a graduate poorly prepared to do the job expected of him. It is important that those agencies, businesses and enterprises expected to employee the graduates have an opportunity to review programs of study and offer suggestions.

3) Adequate faculty and support personnel to do the job.

Evaluation and Recommendations

1) Courses and curriculum - Additional study should be given to the length of the educational program, intensity of course load per semester (18.6 credits for plant specialization and 18.8 credits for animal specialities) and purpose of thesis. Assuming the need is to produce more graduates (no one interviewed expressed an opposite view) then everything possible should be done to speed up the process and to increase the rate of success of students. These things must be done without decreasing the quality of the educational program in terms of the job entry skills, experience, and knowledge requirements placed on the students in the job market. It is difficult or perhaps impossible to design a series of courses or even a number of sets of series that will insure that students will be

adequately prepared for the variety of jobs that await them upon graduation. It is even more difficult to project into the future and determine what the requirements on students will be and to translate these future requirements into present day programs of study. However, awareness of these two difficulties does not justify maintaining a "traditional" program from the standpoint of length, sets of courses, specific courses, thesis requirements, etc.

A College of Agriculture committee should review a detailed topic outline and stated objective for each course in the curricula. The outlines and statements of objectives should cover activities proposed for laboratories so that there is no question regarding objectives in relation to practical skills and experiences to be obtained. The courses listed in the curricula should cover the subject matter required to accomplish the goals of the program. However, it appears that little time has been used to establish objectives by course and to review and determine that courses are not unnecessarily duplicative, are covering all necessary subject matter and contributing to the overall objectives of the program.

2) Intensity of Program - The program of 186-188 credits (18.6 - 18.8 per semester range 17-21) is high for the average student if mastery of an acceptable amount of the material presented is expected and if the intent is to have a higher rate of success than failure. In a report by Dr. Stanley Seaver (Agricultural Economics, University of Florida) on the University of Costa Rica, the credits required for graudation and contact hours for the agriculture program at the Technical Institute, Monterrey and University of Costa Rica were compared. This information

along with comparable figures for the University of Panama agricultural program, are shown below.

	Credit	Lecture Hrs.	Lab Hrs.	Total Hrs.
Tech. Institute, Mexico	212	2,646	1,694	4,330
School agronomia, C. Rica	212	2,700	2,322	5,022
College of Agric., Univ. of Panama	188	2,176	2,448	4,624

As can be seen, progress has been made at the University of Panama to reduce the number of credits required, however, the total contact hours is greater than at Monterrey and only slightly less than at Costa Rica. In addition the contact hours in lab are greater than either other program. Further effort should be made to reduce the number of contact hours required. The designation of specializations at the University of Panama should make possible the reduction in contact hours required.

The present curricula adequately covers the basic sciences courses necessary to prepare a student to pursue a graduate level research oriented program of study. However, as will be discussed later, the lack of advanced level biological (including agriculture) courses and the rigidity of the course schedule with survey level courses does not permit the development of a graduate level research trained scientist at the end of five years. If the intent is to turn out a research scientist at the Ing. Agronomo level, then reorganization of the course work requirements during years 1-4 with a reduction of the general survey type courses and more opportunity to specialize is needed. The fifth year would need to be devoted to specialization with advanced level courses.

The types of professional agriculture manpower needed in Panama should be determined. If it were found that there was a need for graduates without research experience then a program should be designed to insure an adequate physical and biological science foundation and a more effective use of the agriculture and the associated economical principles. The effective use of labs would eliminate the thesis requirement as an attempt to "insure exposure to some phase of agriculture." The program should also involve seminars for teaching the processes of literature review and use and also to help make students aware of agricultural research being conducted.

Most agricultural educators would probably agree that a program designed to prepare a college graduate for most jobs, other than research, in the agricultural sector does not require 10 credits of calculus, 18 credits of botany and bacteriology plus 13 credits of zoology, 17 credits of chemistry and physics and 6 credits of statistics. Even for the student preparing for graduate education and a research career there is ample evidence to indicate 10-12 hours of the above indicated courses could be eliminated if care were used in selection of courses and duplication of principles taught in the various courses was avoided. This discussion relative to the possible elimination of several general sciences courses does not suggest an inferior science base for agricultural education nor does it suggest a vocational emphasis. It simply recognizes the impracticability of overloading a student's program to the point where duplication must exist and where the course loads and contact hours are so demanding that only the superior

student can achieve at a reasonable level. It appears that the agricultural sector would be better served by (1) a less rigorous program in terms of general science education and required contact hours -- A program that turned out a more science-based agriculturist and turned away fewer of the interested students at the end of the first or second year. The present program probably "over educates" many of the graduates for the positions they should be filling and "under educates" many or all for careers as research investigators and (2) a program that selected those highly motivated and acedemically capable students for additional graduate work that would prepare them for research and research supporting roles.

An undergraduate teaching program should produce graduates to meet the needs of the agricultural sector such as government services, extension education, secondary agricultural school teachers, agricultural supply and services, agricultural production <u>or</u> for post graduate study. The post graduate program produces a more highly educated scientist for various research and higher education positions. An educational program that attempts to do both things with one program probably does not effectively achieve either.

Some indication of the success of an academic program can be obtained from a study of the attrition rate of students, the number of students in the program in relation to the demand for graduates and the growth of the program. The most important factor, however, is the demand for graduates from the program. In the absence of evidence regarding the demand for graduates we have assumed that more graduates are needed for positions in MAG, private agricultural

production firms, and various segments of agribusiness. However, an accurate demand analysis should be initiated as soon as possible. A study such as that conducted by D. E. Alleger, Manpower Demands of Agriculture in Costa Rica should be referred to for reference. The study should include a survey of professional agriculturists in Panama as well as the demand for additional trained manpower and should determine the type of positions available from the standpoint of the degree that is necessary, skills and experiences required, education demanded, etc.

The information obtained from such a study would have many uses. One of the most important uses would be by the faculty of the College of Agriculture to aid them in decisions regarding the number of graduates needed, facility needs, need for effective recruitment efforts and to more effectively determine the primary goals and meaningful educational requirements of their program in order to meet the needs of Panama.

Informational materials such as brochures, radio announcements, etc. should be prepared and used in an effort to attract more qualified students that are motivated by the goals, objectives and opportunities of the educational program. Every effort should be made to publish a College "catalog" listing important information relating to courses, curricula and requirements.

Since relatively few rural students enroll in the College of Agriculture, special efforts should be made to inform them about agriculture and to attract them into the program. Since there are no living facilities on campus, students from areas other than the City of Panama have housing problems and their living costs are greater. Special scholarships should be designated for rural students. Efforts should also be made to increase the level of the scholarship program.

As previously indicated, the dropout rate is very great. A special study to determine the reasons for this problem should be conducted. Based on interviews and discussions it is apparent that some students drop out for economic reasons. However, a review of the grades of one recent first year class indicated that during semester one and two, 31% of all grades received were D and F and only 3% were A. There is little doubt that the academic program is too difficult for most of the students in line with their secondary school preparation in the basic sciences. As has been previously pointed out, the heavy class and lab load also must be considered a contributing factor to this problem. It would appear that meaningful placement exams should be established and used to determine academic areas of deficiency for entering students. Students with academic deficiencies should, through preparatory courses, be brought up to a satisfactory level of competence. Student counseling and academic advising should begin prior to the student's first semester. Each student should be assigned an advisor to assist him with his academic program in an effort to help the student stay free of academic problems and failure. The faculty of agriculture should be involved in this academic advising so that they will be familiar with the student's program and problems.

Clearly things need to be done to increase the number of graduates from agriculture, if the need for graduates exists. If there is not a need for more graduates there can be little justification for expanding faculty, staff and facilities insofar as the teaching program is concerned. It appears that a higher percentage of faculty time should be concerned with an evaluation of the teaching programs, the problem of attracting and keeping good students and the educational and training needs of the graduates.

III. RESEARCH, TEACHING AND EXTENSION RELATIONSHIPS AND THE NEED FOR THEIR INTERACTIONS IN PANAMA

Considerable evidence exists to indicate that agricultural research, teaching and extension may exist, operate and develop as either completely integrated or autonomous functions in all combinations. The effectiveness of these functions, however, appears to be positively correlated with the degree of integration and coordination, rather than autonomy. Under any conditions there is always a certain amount of overlap and duplication between these functions. Under the most effective new programs, which in our experience are completely integrated programs, it is possible to take advantage of this overlap and direct it toward designated objectives. In programs where these three functions operate independently, without common goals and objectives, the overlap usually becomes needless and expensive duplication. In these cases there is usually not good communication between functions, and mutual goals and objectives are not evident. This is a luxury Panama cannot afford.

In a well integrated program, the three functions of research, teaching and extension complement each other to a considerable extent. Active research personnel usually make better teachers for they teach from their own experience as well as from general knowledge. This adds interest to the lectures, and the student himself develops more interest for he knows his professor is a warm, knowledgeable, interested person. Laboratory facilities necessary for research, may with coordination, also be used for laboratory instruction, especially for the more advanced students. This tends to lower somewhat these

expensive facility costs. Research workers who are aware of the extension needs and objectives may report their findings in ways more easily understood and with suggestions for application to specific problems rather than as strictly scientific literature. Equally important is the opportunity for agricultural extension personnel to keep the research constantly apprised of grower and producer problems so that he can keep his research current and relevant to the needs of the farmer. These are but a few of the advantages of a closely integrated program involving these three functions.

It is apparent from our study of these functions in the agricultural program of Panama that no mechanism presently exists for close coordination of research, teaching and extension. We could see little evidence that the University faculty had great interest in, or felt any real responsibility for aiding the Ministry in their "Extension Program" efforts. This seems unfortunate, for the University has on its faculty a larger number of well trained professional personnel and they are in the best position to make significant research contributions. These contributions are, of course, going to be more meaningful if this expertise can be effectively applied to critical farm production problems as well as in college teaching and professional school programs.

We have not observed any feelings among either the University faculty or Ministry personnel of antagonism or unwillingness to become a part of a more integrated program, but no mechanism or organization presently exists which makes this possible. In Section V, recommendations are made for organization of research personnel so that a more closely integrated program of teaching, research and extension may take place.

IV SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS

If agriculture in Panama is to fulfill its ultimate public purpose, its research personnel must pay close attention to their vital role in developing knowledge for the advancement of:

Plant Production
Animal Production
Capitalization
Agricultural Marketing
Improving the Well-Being of the People

History may well record that agricultural scientists in the United States contributed greatly to the economic growth of the nation through the development and use of improved production technology. It will also have to record however that insufficient attention was given to the total implications of the technology which was developed. Through improved technology and use of mechanization great changes have been brought to North American agriculture. Farm size has greatly increased, efficiency in production has been vastly improved and production capacity has increased to the extent that thousands of acres of tillable land has now been retired from cultivation while national production capacity continues to increase. Many of these contributions to production by agricultural technology were made from public investments in research and education. At the same time little attention was given to the distribution of the gains and losses which have occurred from the technological transformation which has taken place; the assets of some have been greatly increased whereas others have been rendered obsolete. The process has left in its wake a great mass of displaced persons who are unable to compete in mechanized agriculture and who have been given no opportunity for training for other vocations or ways of becoming useful citizens.

Out of desperation many of these people have gone to the cities only to find they could not compete there either. They have added to the over-crowding of the cities, making demands for already overburdened services and housing, lost respect for themselves and become disgruntled with their country for permitting their dilemma to have taken place.

What has happened in the United States may well happen elsewhere. In our opinion provisions for evaluation of the ultimate effects of adopting improved practices should be a part of the agricultural research program and careful attention should be given to it. It may not always be in the best national interest to adopt more efficient agricultural practices until some provision is made for the readjustment of those who may be displaced in the process. It may in some cases be better to develop national incentive programs enabling the small farmer to compete on some kind of a reasonably comparable basis than to adopt programs where he is completely displaced and ultimately adds pressure to Panamanian cities which may be already overcrowded and plagued with inadequate facilities.

We feel that now, while Panamanian agriculture is still in the developing stage, is the time to give some attention to these problems. For this reason, the research team's organization recommended under Section V includes personnel with training in sociology to provide some research inputs into this timely and critical problem.

Further, we feel it is important that more attention be directed to the problems associated with the marketing of agricultural crops and commodities in Panama. The full implications of Panama's agricultural program in relation to import and export potentials, their influence on the total Panama balance of payments position and the need for developing market potentials in step with research indications for new crops, commodities or processes, are good and sufficient reasons for extending research

expertise to study this part of the Panamanian economy. Thus, provision is also made under Section V for the inclusion of personnel with training in agricultural economics to handle this part of the agricultural research need.

V. ORGANIZATION TO MAXIMIZE EFFECTIVENESS OF RESEARCH AND EDUCATIONAL INPUTS

A. Introductory Statement

After studying the agricultural research in Panama, we strongly feel that central administration or a strong coordinating function would provide much more efficient use of the limited available resources. One approach which has worked well in other countries is the use of a semiautonomous (or autonomous) institute to provide leadership for research programs. However, apparently this approach is not politically feasible in Panama.

Therefore, we are recommending an administrative unit that would provide national leadership to agricultural research programs and which would have some budgetary control. The main participants in this organization would be the research components of the College of Agriculture and the Ministry of Agriculture and Livestock. We are also recommending that the research programs be organized on a commodity basis with backstopping by a group of supporting disciplines.

Such an approach would maximize the research inputs which are now available as well as provide an efficient mechanism for the development of a national strategy. Emphasis would be on a team approach to commodity problems by cooperating investigators. Priorities for commodity research would be developed at the national level and be a part of the annual budget requests. Since Panama cannot afford the luxury of duplication of research efforts, or major research gaps or the uses of resources on relatively unimportant problems, the budgetary process would have a salutory effect.

Agricultural research must be assured continuity. Although much research may produce useful results in one growing season, other types cannot. Examples of production-oriented research which need longer periods of time would be: the evaluation of residual effects of fertilizers, improved pasture programs for cattle, development of improved varieties and tillage effects on soils. In addition, a research organization must have an inhouse capability to immediately handle new problems which constantly appear, such as the incidence of new or mutated disease and insect problems and the testing of new crop varieties and chemicals that have been developed elsewhere. Researchers that are constantly threatened with replacement as political winds change cannot serve their country to the best of their capabilities. A good research team must have a certain amount of insulation from political processes.

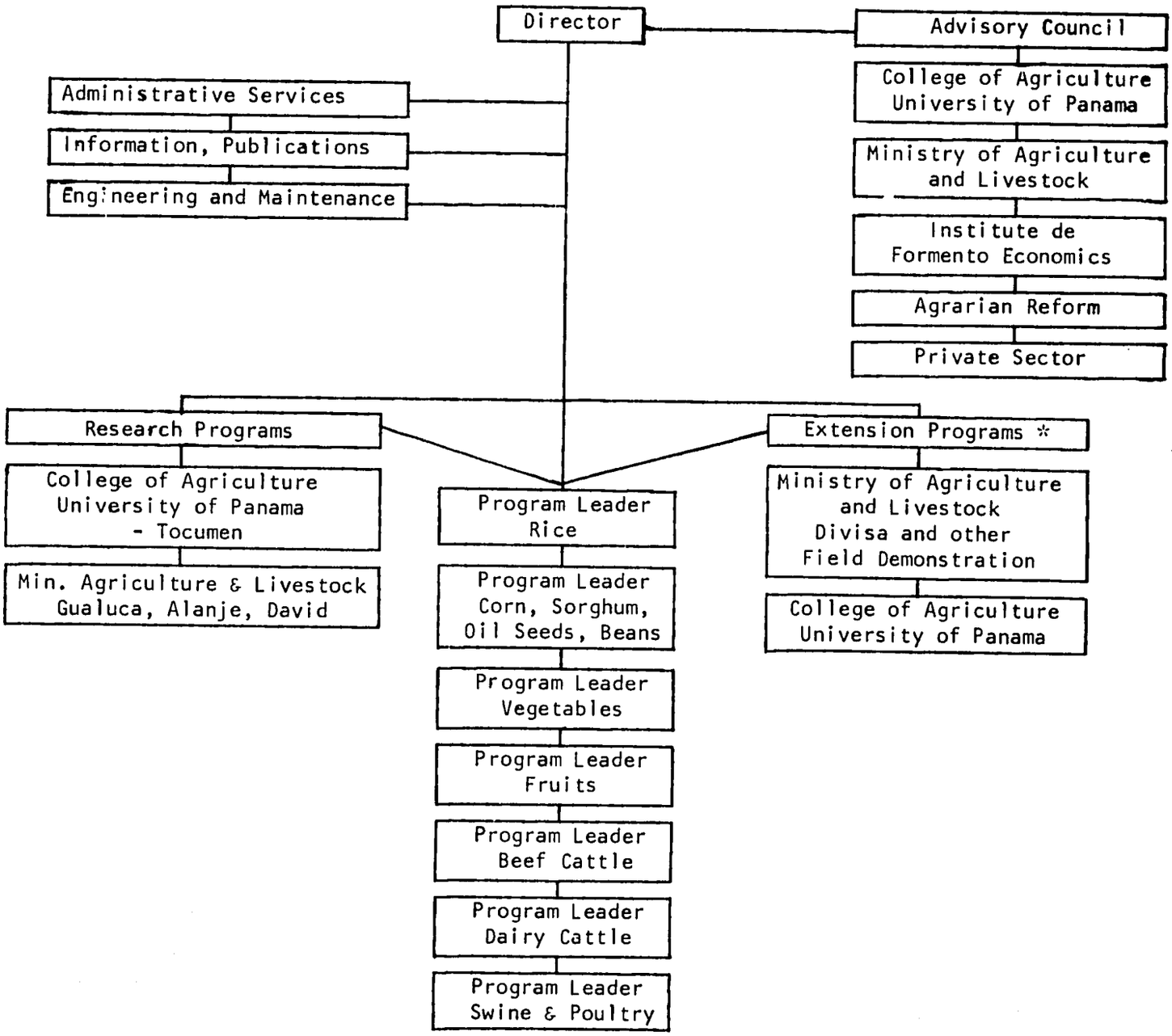
To maximize the effectiveness of research, it should be quickly guided into educational and extension channels. In many cases, the three functions are not separable.

B. Organization of the Institute

The organization of the institute should be such that a minimum administrative group will be required built around a strong professional framework. Specific considerations as to location, manpower and personnel, physical facilities required and other important features are discussed in some detail under separate sections of the discussion on organization. The flow chart in this section diagrams the important features of the organization of the institute and indicates the respective lines of responsibility and authority. Figure 1 shows the organizational plan for the institute.

Figure 1

PROPOSED ORGANIZATION
OF THE INSTITUTE



1. Location - The national headquarters of the institute should be at Tocumen. Since the personnel and responsibilities of the institute are chiefly research it is rational, in terms of minimum duplication of offices facilities and most effective use of secretarial help, to locate the national office where the program leaders will be working and headquartered. Also this puts the program leader in constant contact with many of the other members of his professional team and this is most important. Table 8 shows a listing of the professional personnel and their program responsibilities located at Tocumen; Table 9 shows the administrative personnel to be associated with the National Institute.

The institute concept also calls for a strong research organization to be located at Alanje in the Chiriqui Province. This would bring together the existing research programs of the Ministry at Alanje, Gualaca, Cerro Punta and Boquete into a strong unified program, coordinated with the program at Tocumen and has the advantage of adding strength to the strongest programs already in existence. Table 10 shows the professional personnel and their program responsibilities by specific location in the David area.

In considering the most effective use of personnel and facilities at Divisa, we concluded that research should be deemphasized and the program there be demonstrations and of an "extension" nature. Our concept would be that the qualified research programs and personnel become a part of the Tocumen or David programs and faculty. Research programs at Divisa are not now properly supported, research personnel are not needed for the instruction program there at its present level

TABLE 8

PERSONNEL FLOW CHART BY LOCATIONS FOR RESEARCH AND EXTENSION

INSTITUE FOR RURAL DEVELOPMENT -- TOCUMEN

Positions	Research	Extension	Research	Extension	Research	Extension
Agronomic Crops	Rice		Corn Sorghum		Oil Seeds Beans	
1. Plant Breeding & Selection	X		X		X	
2. Agronomist (Management)	X	X				
3. Plant Pathologist	X		X		X	
4. Entomologist	X		X		X	
5. Agronomist (Weeds & Rice Grain Processing)	X		X		X	
6. Agronomist (Management)			X	X	X	X
7. Plant Breeding & Selection			X		X	
Horticultural Crops			Vegetables		Fruits	
8. Plant Breeding & Selection			X			
9. Plant Breeding & Selection					X	
10. Horticulturist (Management)			X	X		
11. Plant Pathologist			X		X	
12. Entomologist			X		X	
13. Horticulturist (Weeds)			X		X	
14. Horticulturist					X	X
Animal Production	Beef Cattle		Dairy Cattle		Swine & Poultry	
15. Animal Breeding & Management	X	X				
16. Agronomist (Pasture & Forages)	X		X		X	
17. Animal Nutritionist	X		X		X	
18. Animal Physiologist	X		X		X	
19. Animal Diseases	X		X		X	
20. Animal Breeding & Management					X	X
21. Animal Breeding & Management			X	X		

TABLE 8 (cont.)

SPECIALIST RESEARCH TEAM
TO BE ASSIGNED TO WORK WITH
ALL CROPS AND COMMODITIES

Tocumen

Positions	All Crops and Commodities	
	Research*	Extension**
22. Analytical Chemist	X	
23. Soil Chemist	X	X
24. Agricultural Economist	X	X
25. Sociologist	X	X
26. Agricultural Engineer	X	
27. Statistician		

* R - Research Responsibility
** E - Extension Responsibility

As is indicated many of the research faculty of the Institute will have a research - extension responsibility. Most of these personnel may also participate in the teaching program as they may be most expeditiously used. It is anticipated that some may be involved in formal classes whereas others may only be involved in helping advanced students with their research work. Some faculty may wish to participate in both these activities.

TABLE 9

PERSONNEL FOR NATIONAL OFFICE

OF

INSTITUTE FOR RURAL DEVELOPMENT

Tocumen

Positions	Responsibility	
	Research	Extension
1. Director		
2. Secretary	X	X
3. Business Manager	X	X
4. Clerk - Purchasing		
5. Clerk - Property		
6. Clerk - Budgets & Records		
7. Secretary - (B.M.)		
8. Editor - Office of Information	X	X
9. Assistant Editor	X	X
10. Assistant Editor	X	X
11. Illustrator	X	X
12. Secretary		
13. Engineering & Maintenance	X	X
14. Secretary		
15. Secretary for each Program	X	X
16. - 22. Leader - position (7)		

TABLE 10

PERSONNEL FLOW CHART BY LOCATION FOR RESEARCH AND EXTENSION

INSTITUTE FOR RURAL DEVELOPMENT DAVID COMPLEX ALANJE

Positions	Research	Extension	Research	Extension	Research	Extension
			Corn		Oil Seeds	
Agronomic Crops	Rice		Sorghum		Beans	
1. Plant Breeding and Selection	X		X		X	
2. Agronomist (Management)	X	X	X	X	X	X
3. Plant Pathologist	X		X		X	
4. Entomologist	X		X		X	
	Cerro Punta & Boquete					
Horticulture Crops			Vegetables		Fruits	
5. Plant Breeding and Selection	X		X			
6. Horticulturist (Management)	X	X				
	Gualaca					
Animal Production	Beef Cattle		Dairy Cattle		Swine & Poultry	
7. Animal Breeding & Management	X	X	X	X	X	X
8. Agronomist (Pasture & Forages)	X		X			
9. Animal Nutrition	X		X		X	
10. Animal Diseases	X		X		X	

	All Crops and Commodities	
Specialist Research Team	Research	Extension
11. Analytical Chemist	X	
12. Soil Scientist	X	X
13. Agricultural Economist	X	X
14. Agricultural Engineer	X	X
15. Sociologist	X	X

and we feel there is much to be gained by adding more strength to the extension programs already in existence. The FAO program and most of what are called research (except for genetics) are really programs more largely of an extension or educational nature. The organization of personnel for the Divisa program is shown in Table 11.

Table 11

PERSONNEL FLOW CHART BY LOCATIONS

FOR RESEARCH AND EDUCATION

Divisa

Positions	Teaching	Rice		Corn, Sorghum		Oil Seeds	
		R*	E**	R*	E**	R*	E**
Agronomic Crops							
1. Agronomist (Mgm.)	X	X		X		X	
Horticultural Crops		Vegetables		Fruits			
2. Horticulturist (Mgm.)	X	X		X			
3. Plant Pathologist	X	X		X			
4. Entomologist	X	X		X			
Animal Production		Beef Cattle		Dairy Cattle		Swine, Poultry	
5. Agronomist (Past. & For.)	X	X		X		X	
6. Animal Scientist (Mgm.)	X	X		X		X	

* Research
** Extension

2. Manpower and Personnel

The real key to the sucessful accomplishment of the research objectives through the institute organization will lie in securing the most competent and best trained personnel for the professional research positions. Much care should be taken in filling the seven program leader positions for these are the cornerstones of the whole institute organization. All leadership positions should be carefully selected. If competent leadership is not available at first, the position should be left vacant or filled with temporary personnel. A Ph.D. degree with emphasis in their area of responsibility should be considered minimum for the director and the seven program leader positions. Personnel with Ph.D. training should be selected for all professional positions wherever possible but during the initial stages it is realized that people with an M.S. or Ingeniero Agronomo degree may have to be used in several positions. It must be remembered that the agricultural research program in Panama can be no better than the caliber of the people who are selected to fill these positions.

Staffing - Under the institute concept the most highly qualified personnel from the faculty of the College of Agriculture of the University of Panama and from the Research and Extension function of the Ministry of Agriculture and Livestock should be selected to fill the institute positions in so far as is practical and possible.

Consideration should also be given to the possibility of securing interim outside help from other institutions where people highly qualified in specific areas may be brought in for an interim basis to develop programs until capable permanent people can be found or trained to the Ph.D. or desired level.

Training - The rapidity by which the institute is able to staff with competent personnel will depend upon the numbers of people which are trained by the College of Agriculture and the ability of the institute to successfully compete with industry and others for their services. Much of the support personnel and personnel for added graduate training will need to come from the college program.

The faculty of the institute will primarily have a research responsibility but they will be expected to assist the program leader in developing extension information coming from the research program.

Teaching responsibilities may be a part of the total work load of any of the institute professional faculty through appropriate arrangements between the institute director, the Dean of the College of Agriculture and the faculty member involved. The teaching load should be a part of the total work responsibility and should not be in addition to a full time appointment elsewhere within the institute. The college should reimburse the institute appropriately, based upon the number of student contact hours per semester spent in the teaching program. These funds would then be available for securing added personnel needs of the institute.

It is expected that the College of Agriculture faculty associated with the teaching program and primarily responsible for classroom and laboratory teaching and student advising and counseling will be housed in the academic area. These responsibilities go beyond meeting a class and returning to their research. If this were permitted or encouraged by office and laboratory space assignments they would become little more than "part-time faculty" from the standpoint of these students contacts outside the classroom.

Institute faculty should also play an important complementary role to the college through participation with the college in direction of student thesis programs during the final year of training. This has the benefit of providing needed council and direction for students while at the same time it is possible to stimulate student interest in agriculture as a vocation and in acquiring added training for advanced degrees.

Extension - The Extension program within the institute will not duplicate or replace the existing program in MAG. The responsibilities of this section will be to help interpret, publish and disseminate research results. They should be charged with the responsibility of insuring that new farm level technologies are made available to the various MAG extension personnel working with producers, agribusinesses, and other elements of the agriculture sector. Their methods will include, but not be limited to, publication of bulletins, information sheets, field days and short courses.

This section will also be responsible for effective communications from extension worker in the field to the researcher. This will help establish effective goals and priorities for research programs aimed at improving farm level technology.

3. Physical Facilities

a. Tocumen

Land - Land available for the research program of the College of Agriculture would be used in carrying out the research requirements for the Institute at Tocumen.

Buildings

(a) Major buildings - Two major laboratory buildings, one a "Plant Science Laboratory" and the other an "Animal Science Laboratory", will be needed to carry out the major building needs

for faculty at Tocumen. These buildings may be combined into a single unit if economics of construction use can be realized in so doing. The buildings would provide major laboratory needs for the two major areas of plant and animal, plus refrigerated storage space, a controlled temperature area for instruments and vitamin assay work, hot space for higher temperature analytical work, modest library facilities, faculty and staff offices and other needed workrooms for sample drying and storage.

(b) Minor Buildings

Equipment maintenance and storage building

Plant house - agronomic

Plant house - horticultural

Sample grinding, ball milling, and preperation

Steer feeding pens

Animal nutrition pens and feeding and digestion facilities

Feed mixing and storage building

Modest miling installation and associated facilities for a small dairy herd

Installation of facilities for a modest swine program including farrowing and swine feeding pens

Facilities for housing layers and broilers and necessary handling of poultry products except brioler processing

Equipment - Provision should be made for equipping laboratories and other facilities to perform analyses in crop, feed, product and soil analyses and other analytical work as must be a part of an applied agricultural research program.

It should be understood that funds for both laboratory and field equipment should be used to complement and round out f facilities and equipment already present in the College program to realize a reasonably complete, modern research facility at

Tocumen, capable of fulfilling the needs for carrying out a modern applied agricultural research program.

b. David Complex

In the use of the term "David Complex" it is understood to include tje land and present facilities being used by the Ministry for Agriculture and Livestock which are considered vital to a complete agricultural research program for the Chiriqui and other similar areas. Included specifically as indicated in the discussion under "Location" are the present operations at Alanje, Gualaca, Cerro Punta and Boquete. Expansion of these facilities into larger components is recommended whenever this is feasible and practical as dictated by soil, climatic and political conditions.

Land - Land available for the research program of the Ministry would be used in carrying out the research requirements of the administration plus such other additional requirements of the administration plus such other additional requirements as may be practical and desirable. No provision is made in this program initially, however, for the purchase of land for the David Complex program.

Buildings

(a) Major buildings - Adequate laboratory facilities must be a part of this program. No determination is made here whether these need to be at the Zone headquarters at Alanje or whether it would be more practical to make fuller use of the F.A.O. laboratory at Gualaca plus such added facilities as may be required. This needs an early decision but should be determined locally. Our opinion is that the FAO laboratory at Gualaca can be used effectively by the animal science team and that a main laboratory and headquarters building for the research program should be constructed at Alanje.

Laboratory facilities should eventually provide for refrigerated storage, controlled temperature space for instruments, hot space for higher temperature analytical work, faculty and staff office space and other needed workrooms for sample drying and storage and supply storage for both the plant and animal research programs.

(b) Minor Buildings

Equipment maintenance and storage buildings

Plant house - agronomic

Plant house - horticulture

Sample grinding, sieving & preperation

Feed mixing & storage building

Modest milking installation and associated facilities for a small dairy herd

Installation of facilities for a modest swine program including farrowing and swine feeding pens

Facilities for housing layers and broilers and necessary handling of poultry and poultry products

Equipment - Provision should be made for equipping laboratories and other facilities to perform analyses in crop, feed, product and soil analysis and other analytical work as must be a part of all applied agricultural research programs.

It should be understood that funds for both laboratory and field equipment should be used to complement and round out facilities and equipment already present in the Ministry program to realize a reasonably complete, modern research facility in the David complex capable of fulfilling the needs for carrying out a modern applied agricultural research program.

4. Operations

Coordinating or Advisory Council - Major policy decisions to be adopted by the "Administration" would be considered and approved by the coordinating or advisory council. The council would consist of the Dean of the College of Agriculture, University of Panama, the Director of Research and Extension, Ministry of Agriculture, plus designated members of the Instituto de Fomento Economico, the Reforma Agraria and the Banco Nacional. The Director of the "Administration" would serve as an ex-officio member of the council.

In addition to serving to review and approve major policy decisions of the "Administration" it would also have the responsibility of reviewing and approving its budget, the priority assignments for the annual programs of work of the seven program leaders and the respective program contributions of the College of Agriculture and the Ministry of Agriculture and Livestock.

Program Review and Priority Assignments - Annually, each of the seven program leaders shall conduct a review of the program of his responsibility and, in conjunction with other members of his research team, develop an assessment of work completed and establish a priority listing of work to be accomplished during the coming year. The priority listing shall be reviewed and approved by the advisory council since these recommendations become the basis for budget requests. The program review, analysis and priority assessment should be timed so as to have the information for budget preparation.

Program Development - One of the charges of our review team in evaluating the work at the College of Agriculture and the Ministry was to provide recommendations for research strategies for maximizing "the early availability of economically useful technologies at the

farm level." Our recommendations for organization of the College and Ministry faculties into "research teams" with specific crop and commodity responsibilities is designed (1) to utilize the present faculties for accelerating the development of new farm level technologies, (2) to give Panamanian agriculture more complete research coverage than it has ever previously had and (3) to fix lines of authority and responsibility so that should any programs not progress, the reason can be quickly ascertained and the problem corrected.

Team Concept for Crops and Commodities - The research expertise and the specific charges for research teams are listed in Tables 8 and 10. This kind of organization should be followed throughout the entire organization of research personnel. It begins at the national level in Table 9 and carries through to the specific location and responsibility of each team member in Tables 8 and 10.

Coordination of the whole national program rests with the "program leader". He is responsible for the entire national program for his specific assignment; the research and the extending of the research to the farm operations or producer. For example the "program leader" on rice is held responsible only for the rice program but his is held fully responsible for this. Administration therefore knows exactly where to go if the rice program isn't working. With these specific and fixed areas of responsiblity, the program leader and other team members know exactly what their job is and that they are held wholly accountable for its development.

Composition of Team Units - The grouping of research personnel in teams for program development has been demonstrated as an effective and useful way of organization. Although the composition of the research teams by location as shown in Tables 8 and 10 are not as

comprehensive as would be desired, there are practical limitations on how much Panama will put into agriculture research. Thus the personnel assignments represented in these Tables are in our opinion the minimum research coverage which should be provided for the crops and commodities in question. Many gaps presently exist in this coverage. For example no provision is made anywhere for food processing except for a very modest program in processing grain rice. No program is shown for slaughtering and carcass evaluation for beef, swine or poultry products, although this is highly desirable in completely understanding the effects of recommended animal nutrition and management programs. It is recognized that there are limitations beyond which Panama cannot go at this time without making large resource commitments. The teams suggested are our best estimates of minimum requirements for the crops and commodities in question. Although in our opinion these are minimum resources which should go into agricultural research, these allocations are appreciably greater than Panama is presently putting into their agricultural research program.

The team concept is important in rounding out complete program responsibilities. Recommendations must be developed for the crop or commodity as a system of completely integrated operations, not just as bits and pieces of related but unintegrated information. For example, if the recommendations of an investigator working on insect control for corn includes a control measure which may be effective for the insect but cannot be fitted into the most effective rotation then different control measures will need to be found. It is the responsibility of the program leader to design the best complete system for the area and crop involved, and to direct his team member's programs so that they contribute in the most effective way possible.

Overlap of Discipline Expentise for Crops and Commodities Closely Related - A study of the composition of the team organization of personnel as shown in Tables 8 and 10 will reveal that personnel trained in such disciplines as plant pathology, entomology, animal nutrition, veterinary sciences and others will provide their knowledge and support in these disciplines on more than one team for closely related groups of crops and commodities. This is done solely in the interest of keeping the total number of personnel involved at a minimum level. It would be desirable not to have this overlap for this limits personnel effectiveness and when Panama is able, it would be desirable to staff each team with no overlapping personnel.

Field Experiments and Demonstrations - The development of the recommendations presented here call for two main research units for Panama. The largest and most complete unit would be in Tocumen where it can, in addition to its research function, also complement the teaching program. It is especially necessary for those students securing the Ingeniero Agnonomo degree, where a thesis problem is required during the fifth year of training.

Provision is made for a second research unit through developing what is called the David Complex. This will make possible the full use of facilities presently in use by the Ministry as well as additions which they anticipate adding at Alanje, Gualaca, Cerro Punta or Boquete.

In addition to these two main units and the facilities they will provide, field stations in other locations will also be required (1) for conducting demonstrations, (2) for testing selected crops and varieties on specific soil types, (3) for confirming fertilizer recommendations under specific conditions and for many other reasons.

The present facilities at Divisa are being suggested as being considered largely for this kind of use and that the qualified research personnel there be moved to either Tocumen or the David Complex. It is understood that the field experimental locations will largely serve the extension function of demonstrating and verifying research results.

Integration of College of Agriculture and Ministry Personnel into the Crop and Commodity Team Concept - The fullest possible use should be made of all qualified research personnel presently in the College of Agriculture and in the Ministry in filling the required positions on the various crop and commodity teams. This should not be done indiscriminately and only qualified people should be considered. Panamanian agriculture has many difficult problems to solve and this can only be done by competent, well trained people. The research program can be no better than the people conducting it. The most capable people will need to occupy the program leader positions. Whether they come from the College of Agriculture or the Ministry should make no difference and the salary should be comparable for comparable training and experience no matter in which organization their salary is budgeted.

VI. SCHEDULE OF INPUT REQUIREMENTS

A. Personnel

A schedule of inputs into the administration program is itemized by year and by location in the following summaries. Estimates are also shown of the Panamanian inputs into fulfilling the personnel needs for the administration organizations, Tables 12 and 13.

B. Buildings and Equipment

Presented in Table 14 is a summary of the rational for building and equipment estimates and the dollar assignments for these items which are included in the "Funding Schedules" shown on the following pages.

C. General Summary

The dollar estimates shown in this schedule are dollar estimates required by the sector study program during the five year implementation period. At the conclusion of the five year period the fully implemented program should be assumed by the Panamanian Government or the program should not be undertaken. This program is designed to produce benefits to Panama over a long range period and maximum benefits cannot possibly be realized in five years, therefore the adoption of the program is not recommended unless the Panamanian Government is willing to continue it. It is, in our opinion a program to receive the highest priority for them, for previous experience has demonstrated that it will pay for itself many times.

TABLE 12. PROFESSIONAL POSITIONS

	REQUIRED	SUPPLIED*
Tocumen		
Agronomic Crops	7	3
Horticultural Crops	7	2
Animal Production	7	2
Specialist Corp	6	2
Total	27	9
David		
Agronomic Crops	4	2
Horticultural Crops	2	1
Animal Production	4	2
Specialist Corp	5	2
Total	15	7
Administration	3	2
Grand Total	45	18
Net Added Positions	27	

*Personnel listed as supplied are presumed to become available to the administration either from the faculty of the College of Agriculture or from the Ministry of Agriculture and Livestock.

TABLE 13. SUPPORT POSITIONS

	REQUIRED	SUPPLIED*
Technical Program		
Agronomo or approximate equivalent*	45	18
Program Leaders	7	3
Tocumen	5	2
David	3	2
Total	60	25
Administration		
Editorial		
Assistant Editor	2	1
Illustrator	1	0
Secretary	1	0
Engineering Maintenance		
Secretary	1	1
Business Manager	1	1
Secretary	1	1
Clerical	3	2
Director		
Secretary	1	0
Total	11	6
Grand Total	71	31
Net New Positions	40	

*See Table 12

TABLE 14. SUMMARY OF THE RATIONAL FOR BUILDING AND EQUIPMENT ESTIMATES

Operating Budget

Approximate Cost per Professional Unit:

Professional salaries	$14,000	
Support salaries	9,000	
Operating expense	4,500	Per 1 Professional Unit
Other capital outlay	2,000	
Hourly labor	500	
	$30,000	

Tocumen - Total 27 Professional Units x $30,000 per Unit = $810,000

Building Budget

Major Laboratory Building	8,100 sq. ft. x $12 = approx. $100,000		
Laboratory space	125 sq. ft.		
Office space	100		
Support space	75		
	300 sq. ft. x 27 positions		
Equipment Storage 20' x 100' = 2,000 sq. ft. x $3			6,000
Plant Houses (2) 20' x 40' = 1,600 sq. ft. x $6			9,600
Sample House and Storage 20' x 30' = 600 sq. ft. x $6			3,600
Steer Feeding Pens			5,000
Animal Nutrition Pens and Feeding Facilities			15,000
Feed Storage and Mixing plus Equipment			40,000
Swine Facilities			30,000
Milking Installation Including Equipment			50,000
Poultry Facilities			
Layers			15,000
Broilers			15,000
		Total	$289,200
Laboratory and Other Equipment			60,000
		Grand Total	$349,200

David Complex

Laboratory Building 15' x 300' = 4,500 sq. ft. x $12		$ 54,000
Equipment and Storage 20' x 80' = 1,600 sq. ft. x $ 3		4,800
Plant Houses (2) 20' x 40' = 1,600 sq. ft. x $ 3		9,600
Sample and Storage House 20' x 30' = 600 sq. ft. x $ 6		3,600
Feeding, Mixing and Storage		40,000
Swine Facilities		25,000
Poultry Facilities		
Layers		15,000
Broilers		15,000
	Total	$192,000
Laboratory and Other Equipment		40,000
	Grand Total	$232,000

TABLE 14. SUMMARY OF THE RATIONAL FOR BUILDING AND EQUIPMENT ESTIMATES (cont.)

Tocument Building Budget	$ 349,200
David Complex Building Budget	232,000
Total Building Budget	$ 581,200
Farm Equipment	
Tocumen	$ 50,000
David Complex	40,000
Total Farm Equipment	$ 90,000

FUNDING SCHEDULES

1st Year - 1972

Personnel

Professional Positions (new)

Director (1 unit @ $30,000)		$ 30,000
Program Leaders		
2 - 12 months		60,000
2 - 6 months		30,000

Administration (new)

Director		
Secretary - 12 months		5,000
Editorial		
Assistant Editor - 6 months		5,000
	Total	$ 130,000

Buildings and Equipment

Tocumen

Buildings - 70% of $289,200		$ 202,440
Equipment - 70% of $60,000		42,000
Farm Equipment - 50% of $50,000		25,000

David

Buildings - 70% of $192,000		134,400
Equipment - 70% of $40,000		28,000
Farm Equipment - 50% of $40,000		20,000
	Total	$ 451,840

Total Personnel for Year 1 - 1972	$ 130,000
Total Buildings and Equipment for Year 1 - 1972	451,840
Total Funding for Year 1 - 1972	$ 581,840

FUNDING SCHEDULES (continued)

2nd Year - 1973

Personnel

Professional Positions (new)

Program Leaders	
2 - 12 months	$ 60,000
2 - 6 months	30,000
Professional staff - 5 units @ $30,000	150,000
	$ 240,000
1972 Budgeted positions at full time ($150,000) plus 3% increase	154,500
	$ 394,500

Administration (new)

Business Manager	
Clerical - 12 months	$ 4,000
Editorial	
Illustrator - 12 months	5,000
Secretary - 12 months	5,000
	$ 14,000
1972 Budgeted positions at full time ($15,000) plus 3% increase	15,450
	$ 29,450
Total Personnel Cost	$ 423,950

Buildings and Equipment

Tocumen	
Buildings - 30% of $289,200	$ 86,760
Equipment - 30% of $60,000	18,000
Farm Equipment - 50% of $50,000	25,000
David	
Buildings - 30% of $192,000	57,600
Equipment - 30% of $40,000	12,000
Farm Equipment - 50% of $40,000	20,000
Total	$ 219,360

Total Personnel for Year 2 - 1973	$ 423,950
Total Buildings and Equipment for Year 2 - 1973	219,360
Total Funding for Year 2 - 1973	$ 643,310

FUNDING SCHEDULES (continued)

3rd Year - 1974

Personnel

Professional Positions (new)

Professional staff - 21 units @ $30,000	$ 630,000
1973 Budgeted positions at full time ($424,500) plus 3% increase	437,235
Administration	
1973 Budgeted positions at full time ($29,450) plus 3% increase	30,333
Total Funding for Year 3 - 1974	$1,097,568

4th Year - 1975

Personnel

Professional Positions

1974 Budgeted positions ($1,067,235) plus 3% increase	$1,099,252
Administration	
1974 Budgeted positions ($30,333) plus 3% increase	31,243
Total Funding for Year 4 - 1975	$1,130,495

5th Year - 1976

Personnel

Professional Positions

1975 Budgeted positions ($1,099,252) plus 3% increase	$1,132,229
Administration	
1975 Budgeted positions ($31,243) plus 3% increase	32,181
Total Funding for Year 5 - 1976	$1,164,410

Total Funding for Years 1 - 5	
Personnel	$3,946,423
Buildings and Equipment	671,200
Total	$4,617,623

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