PB-219 751

EVALUATION OF PERUVIAN AGRICULTURE RELATIVE TO USAID ASSISTANCE. VOLUMES I AND II

Agency for International Development
Washington, D.C.

June 1971

D. Catan
Rm 2237

PB 219 751

MINISTRY OF AGRICULTURE

AND

AGENCY FOR INTERNATIONAL DEVELOPMENT

JUNE 1971 — LIMA PERU

347

PREFACE

The United States Agency for International Development (AID) and its predecessors since 1943 have assisted Peru in developing its Agricultural Sector. The programs jointly carried out by AID and the Peruvian Government in seeking this goal have remained almost unchanged despite the fact that Peru has ha changes in its government along with radical changes in objectives and goals during the period. Although it is agreed that these programs have served a useful purpose it was mutually decided between AID and the Minister of Agriculture of the of the Government of Peru that they should be evaluated to determine if they were appropriately related to Peru's present country development goals. It was also agreed that the study should be a joint effort and should evaluate the USAID/Peru Mission agricultural program in relation to country agricultural performance and development goals and to recommend, as appropriate, changes in the Mission program within existing and anticipated funding availabilities.

To do this the study would examine recent performance of the agricultural sector and relevant government policies to determine the main reasons for success or failure. In this regard all the major commodities would be included in the study. Particular emphasis would be given to the commodities in short supply, and possibilities for import substitution.

The scope of work of the study was to concentrate upon the areas believed to be most critical with respect to resource allocation, and the effective equating of demand and supply. For these critical areas the study would recommend changes in Mission agricultural assistance as appropriate, and identify corollary GOP actions necessary to maximize the effectiveness of such assistance.

Douglas Caton Ph. D. Economics, Senior Agriculturist of the Technical Assistance Bureau (TAB) of AID Washington was assigned as leader of the study.

Luis Paz M. S. Economics, Director General of Office of Sectoral Planning of Agriculture (O. S. P. A.) Ministry of Agriculture, Lima, Peru was named as co-leader.

Other members assigned to the evaluation study were:

Howard Sprague Ph. D. Agronomy, Private Consultant and former head of the Agronomy Department of the Pennsylvania

State University U.S.A.

Michael Nelson Ph.D. Economist, "Resources for the Future" sponsored by Ford Foundation, Santiago, Chile.

Miguel Carmen Cuba Ph.D. Agronomy/Economics. Sub-Director of Planning O.S.P.A. Ministry of Agriculture, Lima, Peru.

Curry C. Brookshier, M.S. Agronomy, Food and Agriculture Officer USAID, Peru.

George Gebhardt, Ph.D. Economics, Economist USAID, Peru.

Consultants -

Nels Konnerup, DVM, Livestock Specialist, (TAB), AID Washington.

Stephen Eberhart Ph.D. Plant Breeder USDA Ames, Iowa.

CONTENTS

VOLUME I

VOLUME II

BIBLIOGRAPHIC DATA SHEET	1. Report No. PE-63Ø.985-A265	2.	3. Recipient's Accession No. PB-219 751

4. Title and Subtitle

"Evaluation of Peruvian Agriculture Relative to USAID Assistance"

5. Report Date June 1971

6.

7. Author(s)

~~USAID/Peru~~

8. Performing Organization Rept. No.

9. Performing Organization Name and Address

USAID/Peru .
[redacted]

10. Project/Task/Work Unit No.

11. Contract/Grant No.

[redacted]

12. Sponsoring Organization Name and Address

Department of State
Agency for International Development
Washington, D.C. 20523

13. Type of Report & Period Covered Sector Study 7/70 - 6/71

14.

15. Supplementary Notes

16. Abstracts

The purpose of this inquiry is to evaluate the Peruvian agricultural sector plan in or to identify areas where the technical or financial resources at AID's disposal could b most effectively brought to bear in support of the policies already established. In this undertaking the primary requirement is isolation of those elements which are the primary or sole responsibility of the government and at the same time essential to th success of any attempt by a foreign or international agency to contribute to the deve ment process.

The study provides an indication of the historic performance of Peruvian agriculture, including land area and use, and land potentials, and human and technical resources re quirements for improved production and marketing. Specifically, the questions addres are:

1. What could AID effectively work upon?

2. What strategies provide the best opportunity for AID assistance?

3. What kind of constraints must be removed for the assistance to be effective?

17b. Identifiers/Open-Ended Terms

(*Evaluation, Agriculture) [redacted], (*Sector analysis, Agriculture) [redacted],
*Agricultural development, [redacted]

17c. COSATI Field/Group 63Ø

18. Availability Statement	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages ~~325~~ 347
	20. Security Class (This Page) UNCLASSIFIED	22. Price $19.50

ii

CHAPTER I

SUMMARY AND CONCLUSIONS

A. Introduction

The purpose of this enquiry has been to evaluate the Peruvian agricultural sector plan in order to identify those areas where the technical or financial resources at AID's disposal could most effectively be brought to bear in support of the policies already established. In this undertaking the primary requirement is isolation of those elements which are the primary or sole responsibility of the government and at the same time essential to the success of any attempt by a foreign or international agency to contribute to the development process. In consequence throughout the study it has been necessary to maintain an integrated systems approach to the agricultural sector which, of necessity, went far beyond the bounds which may be contemplated for AID assistance. At the same time it was essential to keep in mind the proposals and capabilities of other international organizations in the field of agriculture, as well as the competence already generated by on-going AID programs. Forestry and fisheries are specifically excluded from the study.

In addition, no consideration has been given to the sugar industry since it is highly developed and specialized with few linkages to the rest of the sector and also is outside the scope of AID activities.

B. Peruvian Agricultural Performance 1960/70.

Available statistics over the decade of the sixties give a discouraging picture of Peruvian agricultural performance, the worst of any country in Latin America. Agricultural output has remained virtually stagnant (in constant S/.) since 1960, while the non-agricultural sectors have increased at an average of 5.6% annually; agricultural output per capita declined by 20% during the period, and productivity of rural workers have been declining at about 2% per year.

On the export side Peru has faced relatively weak international markets for the four staple items sugar, cotton, coffee and wool. As a result total volume of exports has shown no tendency to increase. At the same time imports of wheat, meat and oils showed an upward trend; however, considerable progress has been made since 1965 in substituting rice and dairy imports. Total agricultural imports have been between $100 and $130 million annually.

The causes of the above unsatisfactory outcome are rooted in a complex of factors such as the agrarian structure, prices and marketing, and the flow of capital and technical knowledge to producers, all of which reflect on the individual farmer's motivation to invest labor and capital to produce more. At the same time evidence supports the contention that income has become less equitably distributed; the average per capita income gap between agriculture and the non-agricultural sectors has widened; within agriculture the gap between the Costa and Sierra has widened. Further at least prior to 1968 few policies were effectively applied to improve income distribution within regions through such mechanisms as taxation, land distribution, water pricing or credit allocation. Price policy has fixed resources in certain commodity, and, in general has not provided producer incentive.

In the formulation of future policy for agricultural development it is essential to have a clear understanding of why the development efforts of the Government in the sixties failed to improve income distribution or induce higher and more efficient production in agriculture. In the first place the goals for agriculture were ill-defined, which in itself may be interpreted as a lack of sufficient priority of policy. It is axiomatic that there will be competing claims on public financial and technical resources. Urban consumers will not be overly concerned with agriculture as long as foreign exchange earnings are sufficient to import food and keep prices at "acceptable" levels. The industrial sector sees little prospect in the potential of the rural market; mining and fisheries are oriented to the export market; the former agricultural structure was not conducive to the flow of capital and knowledge to subsistence farmers. Accepting the foregoing as an approximation of the structure within which agriculture was expected to develop, it is no surprise to find that the public sector was unable to influence agricultural performance. A case in point is physical and biological research which virtually has covered the spectrum of possible problems without real focus or specificity with respect to priority production needs of the country. Similarly economic research on production and marketing have little relationship to the policies actually applied, such as price control, foreign trade regulations, credit or investment in highways and irrigation.

Even accepting sector goals which were to vague for effective implementation, no mechanism existed whereby the farmer's needs for biological or economic research could be transmitted to the research administrators. The lack of focus and coordination is equally evident in the case of extension, credit, marketing, price control and irrigation and highway programming. Extension has operated independently of research and marketing; the service was re-organized four times with constantly changing personnel. Accordingly there was little continuity of program. No correlation exists between extension expenditures and agricultural output or productivity, which suggests that any attempt to measure effectiveness would be confounded by the random influence of other factors such as availability of credit, economically attractive technology or price incentives.

In the case of credit the focus of the Banco de Fomento Agropecuario (BFA) has been on the small low-income farmers without access to commercial sources of capital. However, since sectoral guidelines were unavailable no attempt could be made to orient credit to support other agricultural development programs, specific priority commodities, or selected beneficiaries or regions. Nor was there any basis to establish the real credit needs in terms of both long-term and short-term requirements.

Deficiencies in the marketing system which result in price uncertainty to producers, heavy spoilage rates, wide seasonal price fluctuations, high marketing and excessive consumer prices, have long been recognized. In spite of this recognition the state was unable to come to grips with the problem. Decrees were issued setting up marketing agencies, maximum consumer prices and minimum producer prices in a few cases, which failed to provide producer incentives and improve the efficiency of the system. Of the 14 commodities examined in depth in this study[1/] about 74% of production

1/ Bananas, broad beans, canary beans, cotton, corn, rice, potatoes, tomatoes, onions, wheat, beef, milk and milk products, pork, poultry (meat) and mutton.

enters the marketing system in volume terms. This figure serves to underscore the critical importance of marketing and explains the stress which has been laid on the activity throughout the study.

Historically many deficiencies have existed with respect to distribution of irrigation water rights which have undoubtedly led to economically inefficient and socially unjust distribution of this scarce resources. In addition, the pricing of water at about 0.002 soles per M^3, far below its opportunity cost, provided no economic efficiency criteria for selection of crops and production intensity levels on the Costa. Inevitably this is prejudicial to farmers in the Sierra and Selva. With respect to irrigation in the Costa, and highway construction in the Selva it would appear that additional analysis is needed in order to determine whether other alternatives have been considered in terms of social and economic benefits and whether beneficiaries as well as bearers of cost have been taken into full account. The availability of financing is only one among the many considerations to be examined. While settlement has been promoted in support of these expensive infrastructure ventures, the colonization itself has proved to be costly in terms of state financing, and results in production, number of beneficiaries and social impact have been disappointing; realization of benefits has been much slower than expected.

In summary, agriculture's stagnation over the past decade may be attributed largely to institutional failure to establish a firm policy commitment to agricultural development, and, in consequence failure to recognize the need for a systematic approach. If this was recognized, there was a failure to put into practice effective coordination of the state agencies involved. One indicator of the level of producer confidence or expectations over the period is the declining use of fertilizer.

C. Agriculture - Present Status and Prospects

(1) Natural resource potential

From a technical viewpoint Peru posesses a vast potential for agriculture. On the Costa it is estimated that there is sufficient water and land to increase the irrigated area by 600,000 Ha., almost double present irrigation. In the Selva about 2.7 million Ha. are said to be suitable for cropping relative to 1.9 million Ha. cropped in the whole country in 1967. Virgin lands suited to pasture in the Selva are placed in excess of 10 million Ha. In the Sierra indicators are that the crop area should be reduced by 10-15% for soil conservation reasons, with replacement by pasture or forestry. Extrapolation of past trends in new land and water development over the period 1971-90 would occupy only 30% of the Costa potential and 10% of the Selva.

It is evident that agricultural potential is not determined solely by the existance of natural resources. The costs of developing these resources may well become limiting. In addition to bringing in new lands, the alternative is always available of intensification on existing farm areas to achieve production or other goals for agriculture. The cost functions associated with land expansion become crucial. In the case of irrigation on the Costa, indications are that new area will not be obtained except at sharply increasing marginal costs. Expansion in the Selva is expected to be at constant costs (infrastructure and land preparation); however, unless local urban consumption centers develop (closer to the Selva) marginal costs of production and marketing will increase with distance.

The questions of intensification may be viewed within a production function context, where output per unit of land is plotted against progressive increments of capital and labor. The crucial elements are improved management and improved inputs, i.e., technology, which manifest themselves in increased yields per acre, increased output per year through multiple cropping, and a higher percentage of land actually in production through reduction of fallow. Area in fallow in 1967 amounted to 600,000 Ha., over a quarter of total area available for cropping. The question of available technology in relation to realizing of potentials through land expansion and intensification are discussed below.

(2) Immediate opportunities

On the Costa available technology supported by other essential elements of a production - marketing package (credit extension, price incentives on inputs and products) appears to offer considerable scope for (a) use of feed grains, forage and by-products from cotton cane and cereals, for intensive development of poultry, hogs, cattle fattening and dairying, and (b) increasing yields of rice and canary beans. It is estimated that yields of irrigated corn and sorghum could be doubled economically. In the case of rice, it appears that land leveling, timely sowing, and application of 320 kilograms of nitrogen fertilizer per hectare (double the customary application) can increase yields by 50%; introduction of the IR varieties may raise this to 100%. Similar increases may be expected for canary beans with improved varieties, fertilization and double cropping. The potential for rapid increases with both per unit and total output of livestock products is enormous, if the improved nutrition is accompanied by elementary precautions with respect to animal health and husbandry. Breed improvement offers the possibility of expansion over the long run. In the cases cited here, the requirements for seeds, fertilizer, cultural practices, plant protection, animal nutrition and health, are known and tested.

In the Sierra, except for potatoes, technology is not as well developed as in the case of crops suited to the Costa. However, sufficient knowledge is available to permit considerable advances to be made in the productivity of potatoes, wheat, corn, barley, broad beans, sheep, beef, and dairying. In the case of crops, expanded yields can readily be obtained through the same procedures as outlined above for the Costa; however, the response in absolute terms is considerably lower due to the less favored natural environment. Nevertheless, the location of production and adoption of technology should be guided by inter-regional comparative advantage, and the social consequences of the relative immobility of the Sierra population.

Selection and testing crop varieties and practices is required in some areas, but implementable results should be expected within two years. Corn is of particular significance since it is well adapted to Sierra conditions, provides an essential supplement to natural pasture in livestock production, responds well to fertilizer, suitable high yielding hybrids are available, and it is expected that high protein hybrids will be available in the near future, and, thus improving the nutritional content of a staple food among the highland population.

Adoption of known practices for improved pasture establishment, fencing, and animal health would show marked increases in wool and mutton production per sheep and per Ha. within 1 or 2 years. Over the longer run it will be important to introduce breed characteristics which emphasize meat rather than wool. Opportunities to improve beef production in the intermediate and lower altitudes are similar to sheep, where they would graze in association. For both cattle and sheep there appears good reason to foster integration of the industry with specialized intensive fattening undertaken in the Low Sierra and Costa. The potential for dairying in the lower altitude regions of the Sierra is comparable with the Costa.

The opportunities in the Selva depend largely on expanding area rather than intensification, as has been suggested above for the Costa and Sierra. The Selva Alta appears to offer the most immediate promise due to its proximity to existing infrastructure and markets relative to the Oriente. The status of technology is in no way comparable to the Costa and Sierra. Thus, it may be expected that much of the knowledge will be gained at the expense of farmers. Prime candidate products appear to be rice, corn, yuca, palm oil, and beef cattle on improved pasture.

(3) Projections based on past trends

The basis of the agricultural plan [1/] is provided by the projections of supply and demand of agricultural commodities in Peru. These were made from an examination of past trends and behavioral charachteristics of consumers and producers, plus qualified assumption with respect to continuance or changes in past policies [2/]. This study provides a benchmark against which the impact of normative changes of policy, public administration, or producer and consumer behavior with respect to elasticities of supply and demand, may be appraised. The principal conclusions of this study are (i) that agricultural output

1/ "Resumen del Plan Agropecuario a Mediano Plazo 1971-1975," OSPA, Ministerio de Agricultura, Lima, Octubre 1970.

2/ "Long Term Projections of Demand for and Supply of Selected Agricultural Commodities through 1980 - Peru," Universidad Agraria, La Molina, Lima, June 1969.

will expand at 3% annually (1% through yield improvement and 2% through area expansion), (ii) that the value of the deficit commodities will increase to $104 million by 1975 and to $156 million by 1980, and (iii) income distribution will be regressive with respect to total population in the Sierra and Selva regions, and with respect to the rural population in all regions.

The supply projections are predicted on both major expansion of irrigated land (20,000 Ha annually) and intensification from existing irrigated in the Sierra (15,000 Ha per year receiving improved irrigation), and coloniztion of 15,000 Ha. annually in the Selva. The relatively slow expansion of the import deficit is due to the low projected rate of increase in per capita consumption, particularly in the Sierra (38% of total population in 1980). A highly significant aspect of the projections is the implicit regression income distribution. The ratio of per capita income in the Sierra to the Costa plus Selva declines from 1:3.5 in 1970 to 1:5.1 in 1980. Comparing the same index for the rural urban population the ratio declines from 1:4.2 to 1:5.6, and taking the comparison between the

Sierra rural population (24% of total in 1980) and the "rest of the country" the ratio changes from 1:7 to 1:13 over the 10 year period.

D. The Sector Plan

As already indicated the objectives and program of the agricultural sector plan provide the framework within which alternatives AID programs have been evaluated. In the discussion in section (b) and (c) above an attempt has been made to identify the technical, economic, social and institutional factors which the government took into account in formulating the plan, and which, at the same time, are equally relevant to the identification of those areas where AID may expect to make the most useful contribution in furthering implementation of the plan. The unsatisfactory performance of agriculture from 1960 to 1970, and the undesirable consequences of the 1970-80 projections set the stage for the plan.

One of the primary objectives is to progressively reduce disequilibrium between per capita incomes in rural areas and those in the urban sector, and also improve income distribution in agriculture itself. Parallel with this goal is the promotion of active campesino participation in the market economy of the country.

All other objectives, while subordinate to distributive and employment aspects, are production oriented as being the only basis for improved stability and levels of rural incomes and nutrition levels. The fundamental production aim is simultaneously to increase total output and efficiency of production and marketing. Lowered consumer prices should alleviate the market constraint on agriculture. A similar situation applies to the import substitution (and export where possible), which also contributes to the objective of saving foreign exchange.

The institutional structure for implementation of the development plan centers on agrarian reform. Under the law the entire country must be incorporated in reform zones by the end of 1972. Of the 1,022,000 families who are potential direct beneficiaries of reform, 370,000 must have received some 15 million Ha. by 1975. It appears likely that communal operation will be the form of organization used. At the same time communities and small farmers surrounding reform units will be encouraged either to join the central unit or form their own associations. All state institutions connected with agriculture will be mobilized in support of this effort.

The action programs of the plan center on 14 commodities, and groups of commodities. Priority is placed on import substitution: - wheat, expanding production at 13.8% annually over the period - vegetable oils (peanuts, soya, olive oil and oil palm) expanding at about 20% annually - beef at 10.5%, and potential beef substitutes, mutton at 9.3%, and pork at 25% - and milk at 10.8%. Of second order importance are the basic domestic consumption commodities: - rice, corn, potatoes and beans increasing 6-9% annually - and poultry meat and eggs at 14.9%. The final category is export - cotton increasing at 4.6% - sugar at 2.2% - coffee at 8% - sheep wool at 14% - and alpaca wool at 3.3%. These relatively ambitious increases are sought through yield improvement in the range of 3-8% annually and area expansion (in the significant crops) of 1-3% annually.

Major infrastructure investments over the 1971-75 period in the rural sector for highways, marketing facilities and irrigation are not detailed in the plan.

E. Sector Evaluation

(1) Analytical framework for specification of the problem

Drawing on the plan and recent history of performance of agriculture the two basic premises upon which the sector is evaluated are as follows:

- If development programs are to be effective they must have a specific commodity focus with regional concentration, and they must encompass for each commodity a systematic procedure which integrates the principal production and marketing elements within a viable institutional framework.

  The institutional vehicle for implementation of the development program will be agrarian reform; therefore operations of institutions which service agriculture or provide basic infrastructure must be restructured within this context to maximize probabilities of success of the selected programs.

The first step in evaluation involves placing the agricultural plan within the context of an internally consistent system from which constraints may be identified, and from which sub-systems may be abstracted for more detailed study. Chart 1, is an attempt to diagramatically represent the plan and the inter-relationships between multiple goals and the strategy, programs and policy instruments or mechanisms used for implementation. The two pivotal points in the chart maybe identified as "development planning" which establishes the priority commodities and regional concentration (within the constraints of goals and budget)[1/] plus the selection and integration of various policy instruments for implementation, and "agrarian reform" as the primary implementing agency.

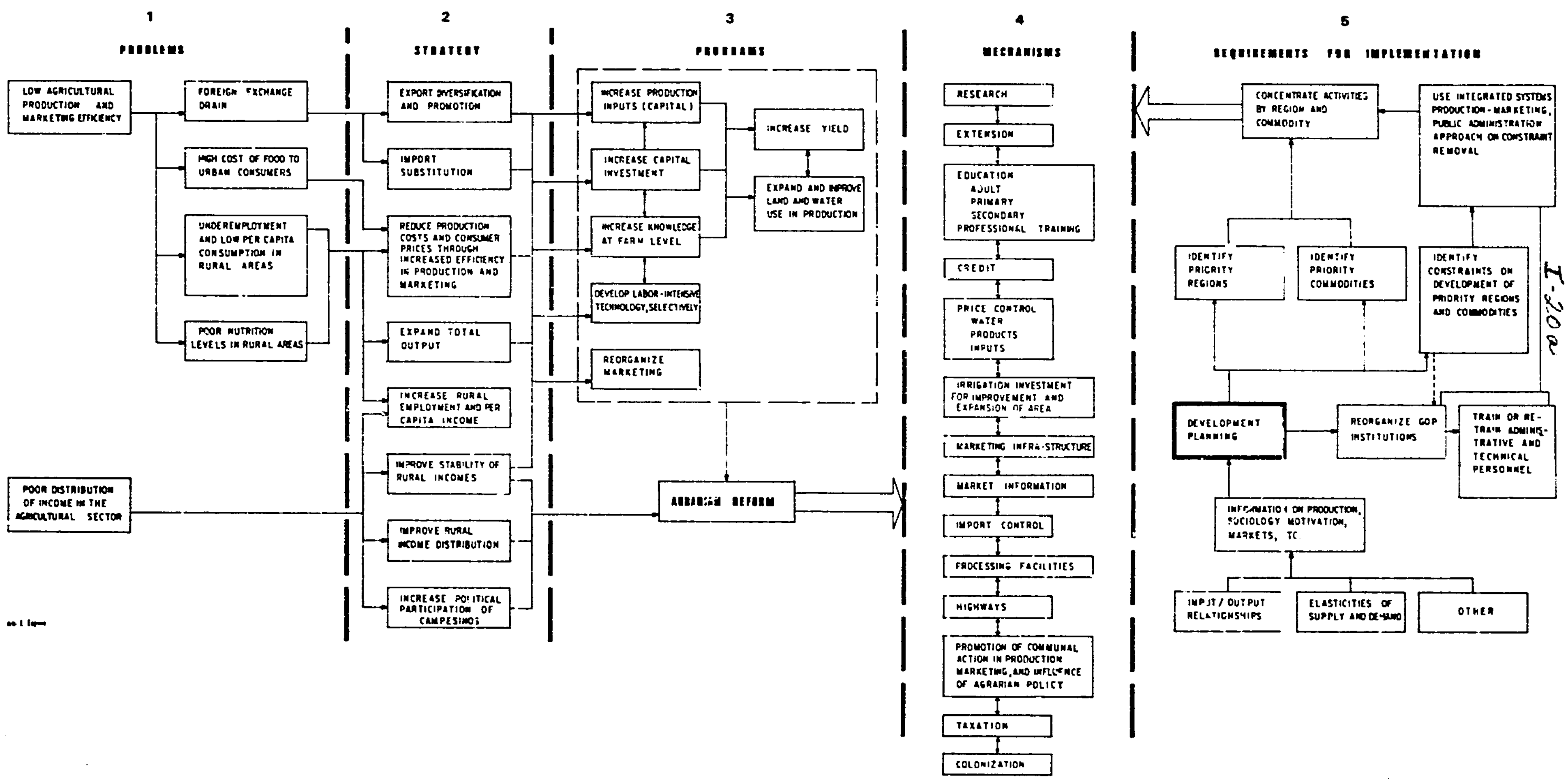
As the second stage in the evaluation, the implementation component (i. e. column 5, and execution of mechanisms - Column 4, in Chart 1) is identified as the critical constraint

1/ The selection of commodities and regions is discussed in Section E-2 below.

CHART Nº 1

USAID AGRICULTURAL PROGRAM EVALUATION

ANALYSIS SCHEME BASED UPON GOP AGRICULTURAL DEVELOPMENT PLAN



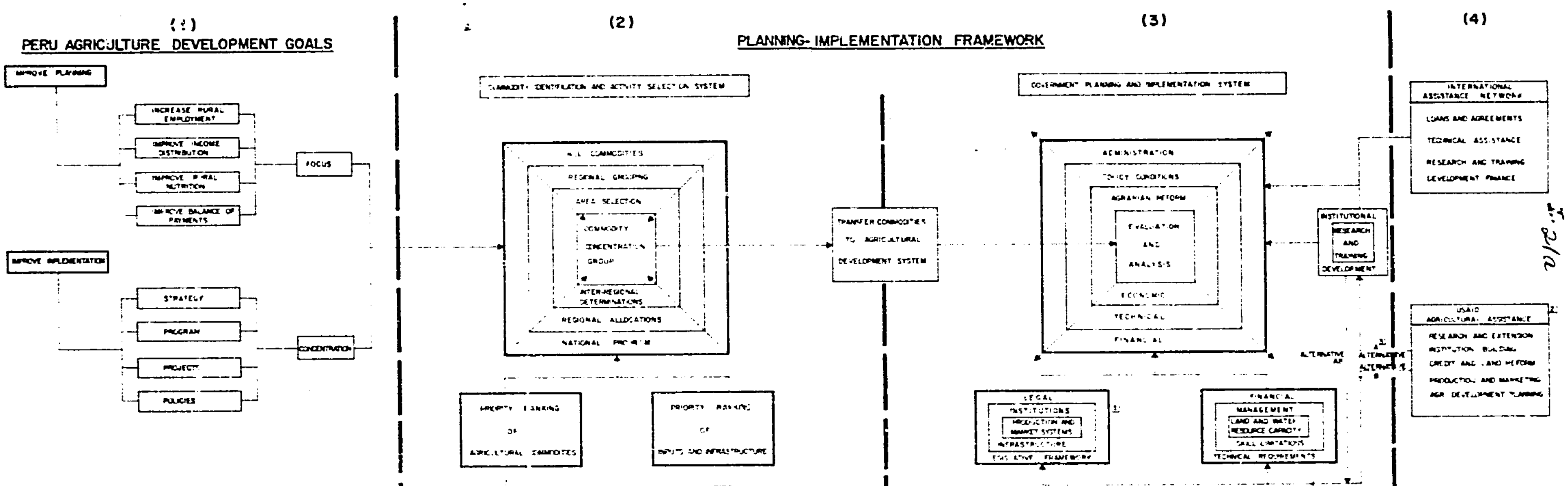
and shown graphycally in Chart 2. Column 2 of Chart 2 deals with the procedure for identifying and ranking priority commodities and the regions of concentration. Once identified, the specific development programs are transferred to the implementation system - column 3 of Chart 2 - where details of the production - marketing system must be derived and the institutional arrangements for execution worked out consistent with technical, administrative and financial constraints. Column 4 of Chart 2 has been added to show the relationship of AID and other international assistance to the implementation phase - this aspect is taken up in Section F, below.

Since the basic premise above is implementation of the production - marketing system through agrarian reform, the third stage in the evaluation involves definition of the institutional and technical needs in relation to the existing situation. This is depicted in Chart 3. Two major gaps are identified in the existing system:[1/]

1/ The integration gap (column 1) between AID assistance and government requirements for program implementation is discussed in Section F.

CHART Nº 2

RELATIONSHIP OF GOALS AND INTERNATIONAL ASSISTANCE TO AGRICULTURAL PLAN IMPLEMENTATION



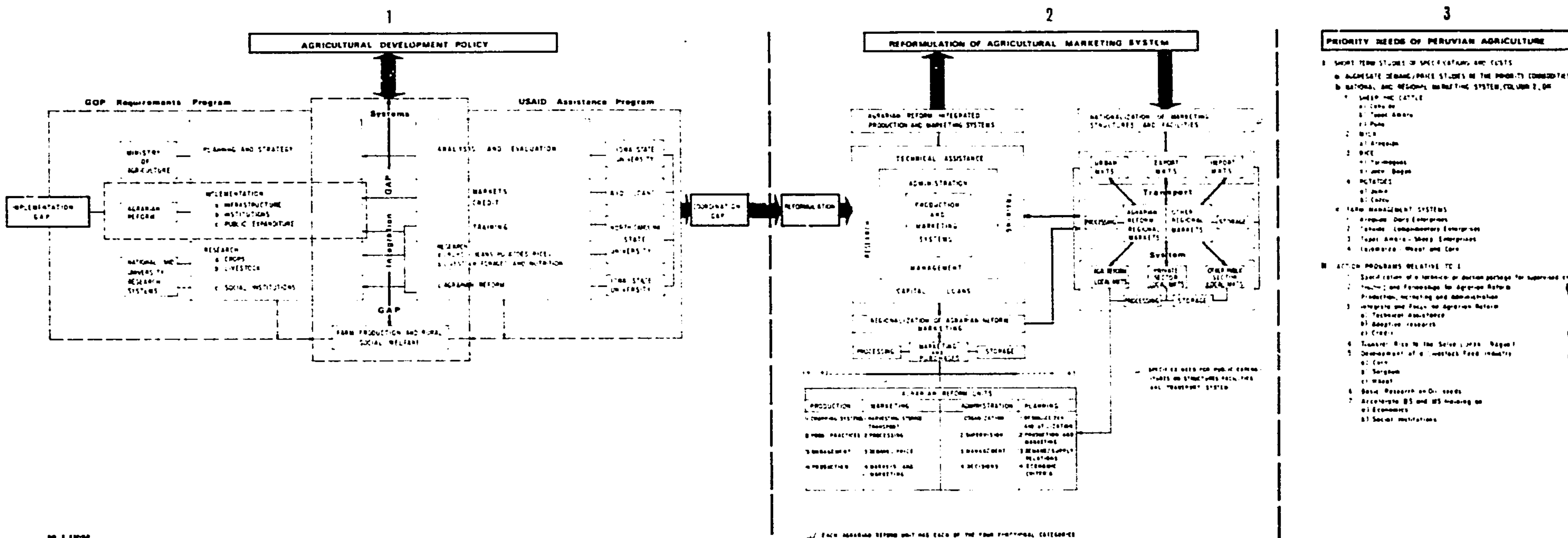
1/ RESTATEMENT OF REQUIREMENTS SECTION, METHODOLOGY FROM CHART Nº 1
2/ ILLUSTRATIVE OF POSSIBLE TYPES OF ASSISTANCE
3/ PROGRAM OF ALTERNATIVES DISCUSSED IN TEXT

- The implementation gap which comprises the lack of definition of how the various institutions concerned with infrastructure and agricultural development will be integrated through agrarian reform for execution of the development plan; this is shown on the left hand side of column 1, Chart 3.
- The production - marketing systems gap (column 1 Chart 3) relating planning and implementation procedures to both farmers and consumers simultaneously; the linkage is incomplete from the policy goals through training, research, credit, extension and marketing to the farm level where production decisions are made and social welfare achieved.

Column 2 of Chart 3 shows in general terms how the structure may be reformulated to bridge these two gaps by building up the production - marketing systems on priority commodities working from the local situation (agrarian reform unit or district) through the region (s) of concentration to the national level. The procedure has been elaborated in more detail for the marketing

CHART [illegible]

Evaluation of Peru's Agricultural Development Program Relation to Production Marketing Systems and Agrarian Reform



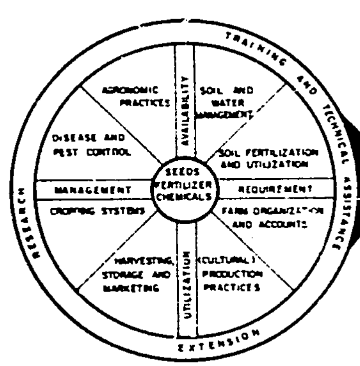
component (right hand side of column 2, Chart 3) which is regarded as the critical bottleneck in the whole process, and where it is essential to find operative policies and efficient administration at the national level as soon as possible. Column 3 of Chart 3 illustrated where AID programs may contribute to bridging the production - marketing gap - it is assumed that the implementation gap is not amenable to extra - national assistance (discussed in Section F below).

The fourth step in the evaluation involved illustration of the analysis needed to develop an integrated production - marketing system for one crop and one livestock commodity. Rice was selected as the representative crop and used to illustrate a program of intensification of land use. The livestock commodity chosen was beef, which was applied to illustrate the case of land expansion. Diagramatic formulation of the system for rice is shown in Chart 4. The principal elements of the system are: identification of all technical requirements to increase productivity per Ha; the production function, i. e. the yield response to various inputs (fertilizer

CHART Nº4

DIAGRAMATIC RELATIONSHIP OF RICE PRODUCTION AND MARKETING IN PERU, 1970 WITH NATIONAL WEIGHTED AVERAGE YIELD ESTIMATED AT 4528 Kg/Ha AND AVERAGE NET FARM COSTS OF FERTILIZER.

FARM LEVEL INTEGRATED APPROACH FOR INCREASED PRODUCTIVITY



EVALUATION OF PROFITABILITY

LEGEND
P = PRICE
P_1 = PRICE OF COMMODITY BEING PRODUCED
P_2 = PRICE OF AN ALTERNATIVE COMMODITY
Δ = AMOUNT OF CHANGE IN PRICE

NOTATION THIS TYPE OF EVALUATION APPLIES ONLY TO COMPETITIVE RELATIONS, NOT TO COMPLEMENTARY OR SUPPLEMENTARY CROP ROTATIONS

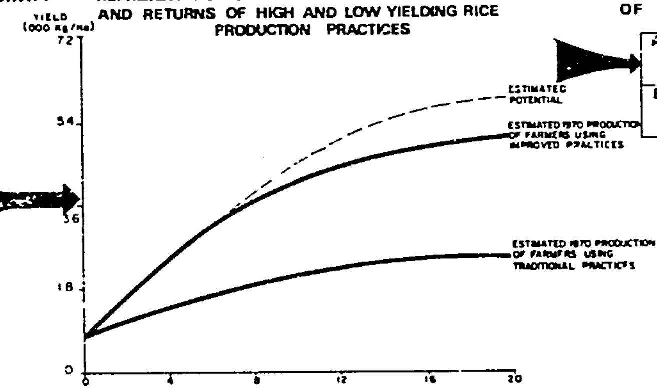
1 FOR A SINGLE CROP $\frac{\text{COST (Ha)}}{\text{Kgs./Ha}} - \frac{P}{Kg} =$ (PROFITABLE IF RATIO IS LESS THAN 1)

2 FOR ALTERNATIVE CROPS

A) AT THE MOMENT $\frac{\text{Kgs/Ha}) P_1}{\text{Kgs/Ha}) P_2} =$ (NO CHANGE IF RATIO IS GREATER THAN 1)

B) OVER TIME $\left(\frac{\Delta P_1}{\Delta P_2}\right)\left(\frac{P_2}{P_1}\right) =$ (NO CHANGE IF RATIO IS GREATER THAN 1)

REPRESENTATION OF TOTAL AND MARGINAL COSTS AND RETURNS OF HIGH AND LOW YIELDING RICE PRODUCTION PRACTICES



FERTILIZER INPUT (BAGS OF 46 Kg) PER Ha.

A RETURN WITH IMPROVED PRACTICES

UNIT OF FERT INPUT KG/HA 1/	TOTAL YIELD KG/HA	Δ YIELD (KG/HA)	TOTAL COST (SOLES)	Δ COST (SOLES)	TOTAL RETURNS (S/ 2.02 = KILO)	Δ RETURNS (SOLES)	ΔR/ΔC
0	1,545 0	727 7	50	—	3,121 00	—	—
83 6	2,272 7	1,409 1	550	500	4,591 0	1 470	2 94
167 2	3,681 8	863 7	1100	500	7,437 0	2 846	5 69
250 8	4,545 5	454 5	1600	500	9,182 0	1,745	3 49
334 4	5,000 0	250 0	2100	500	10,100 0	918	1 83
418 0	5,250 0		2600	500	10,504 0	404	81

B WITH TRADITIONAL PRACTICES

UNIT OF FERT INPUT KG/HA 1/	TOTAL YIELD KG/HA	Δ YIELD (KG/HA)	TOTAL COST (SOLES)	Δ COST (SOLES)	TOTAL RETURNS (S/ 2.02 = KILO)	Δ RETURNS (SOLES)	ΔR/ΔC
0	900 0	—	50	—	1,818 0	—	—
83 6	1,496 0	596	550	500	3,021 9	1204 0	2.40
167 2	1,946 0	450	1100	500	3,931 0	909 0	1 81

1/ UREA 46 % AVAILABLE N

AGGREGATE PRODUCTION ESTIMATES OF RICE FOR PERU 1970

A WITH IMPROVED PRACTICES

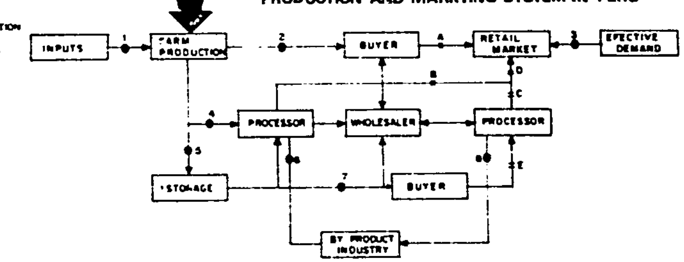
Nº FARMS	AVERAGE Kg/Ha	AVERAGE MT/Ha	AVERAGE Ha/RICE	TOTAL/MT
10,000	5 700	5 7	10 2	581,400

B WITH TRADITIONAL PRACTICES

Nº FARMS	AVERAGE Kg/Ha	AVERAGE MT/Ha	AVERAGE Ha/RICE	TOTAL/MT
4,000	1,800	1 8	5 0	32,000

1/ 1970 ACTUAL = 612,7 7 MT
2/ ESTIMATE = 613,400 MT, AV YIELD 4,528 MT / Ha

DIAGRAMATIC REPRESENTATION OF THE RICE PRODUCTION AND MARKTING SYSTEM IN PERU



● PRIMARY CONSTRAINT POINTS

1 INPUTS NOT AVAILABLE, OR NOT UTILIZED
2 PRICE TO FARMER DOES NOT REFLECT TRUE VALUE
3 DEMAND RESTRICTED BY INCOME
4 IMPERFECT MARKET TO FARMER
5 STORAGE NOT AVAILABLE
6 VALUE OF BY PRODUCTS NOT INCLUDED IN FARM PRICE
7 IMPERFECT MARKET TO FARMER

■ SECONDARY CONSTRAINT POINTS

A NO ROADS
B NO MARKET FACILITIES
C. IMPERFECT COMPETITION
D. PRICE DOES NOT COVER COST
E TRANSFER EFFECT FROM D

I-23a-

CHART Nº5

DIAGRAMATIC RELATIONSHIP OF A BEEF CATTLE PRODUCTION - MARKETING SYSTEM INVOLVING LAND DEVELOPMENT AND RESTOCKING *

Factor Relations

A CAPITAL INVESTMENT COSTS

1 ADD 300,000 HEIFERS
PLUS 10,000 BULLS

2 CLEAR AND IMPROVE LAND
AT 7826 SOLES PER HECTARE
150,000 HECTARES = 1,173'900,000 SOLES

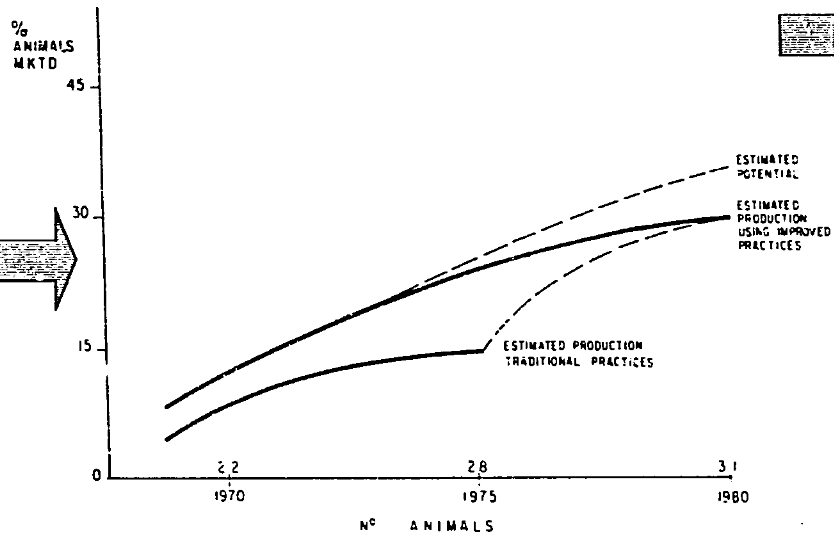
B. ANNUAL RECURRENT COST

3 FERTILIZE PASTURES
AT 43 SOLES PER HECTARE
HECTARES = 6'450,000 SOLES

4 PASTURE MAINTENANCE
AT 600 SOLES PER HECTARE
HECTARES = 90'000,000 SOLES

5 REPRODUCTION
a) BREEDING CONTROL
b) HEALTH
AT 43 SOLES PER HEAD

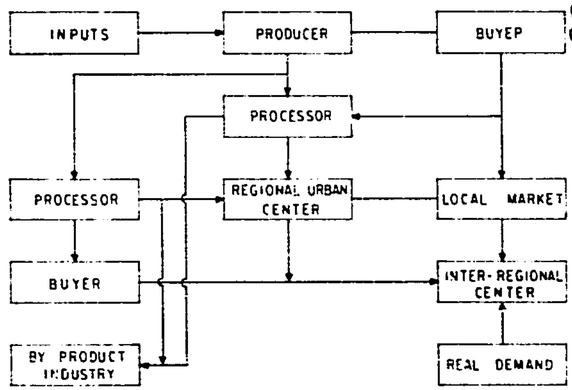
Input - Output Relations - 1980



Influence of Land Development and Restocking on Number of Animals Marketed

YEARS	Nº ANIMALS (TRADITIONAL)	Nº ANIMALS (IMPROVED)	TOTAL ANIMALS	TOTAL PRODUCTION MT	INCREASE IN PRODUCTION M.T.
1970	308,000	—	308,000	22,400	—
1975	357,500	99,700	457,200	35,063	12 663
1980	375,500	124,800	500,300	38,654	3 591

Marketing



I - 236 -

CIB E ESPINO

* SIMILAR INCREASED PRODUCTION CAN BE PROJECTED FOR DAIRY AND SHEEP

in this case); estimation of the profit maximization point through equation of marginal costs and revenues; and identification of the constraint points in the supply of inputs and marketing of output. The case of beef production from expansion on new lands in the Selva with import of basic breeding stock is shown in Chart 5. The elements are similar to those shown for rice.

(2) <u>Priority commodities</u>

A primary requirement of the foregoing methodology is identification of the priority commodities to which the production - marketing approach to development will be applied on a selective regional basis. The principal agricultural commodities currently produced in Peru number 62. In the plan this was reduced to 23 plus 14 non-traditional crops with export potential, primarily fruits and vegetables. From the list 12 commodities were selected on the basis of their present relative importance, representativity of at least one major product for each region, their specific relationship to the development objectives (beneficial to low income farmers, employment

TABLE 1

PRIORITY RANKING CRITERIA AND RANKING OF PERU AGRICULTURAL COMMODITIES RELATIVE TO GOP AGRICULTURAL DEVELOPMENT GOALS.

COMMODITY	LAND IMPROVEMENT OR LAND EXP. POT	HIGH RATIO OF BENEFICIARIES TO CAPITAL	HIGH RATIO OF LOW INCOME BENEFICIARIES	IMPORT SUBSTI- POTEN- TIAL	IMPROVED NUTRITION POTENTIAL	POTENTIAL TO HAVE MULTI TIPLIER AFFECT	PRODUCTION CONSTRAINED BY CAPITAL	PRODUCTION CONSTRAINED BY TECHNOLOGY	PRODUCTION CONSTRAINED BY MARKETING	HIGH RATE OF RETURN ON PUBLIC INVESTMENT	RANK	
											NUMERICAL	PORCENT
WEIGHT (BASIS = 100)	(15)	(10)	(17)	(8)	(10)	(10)	(15)	(5)	(10)	(10)		(100)
RICE	15	10	8	0	2	8	5	0	10	10	9	(68)
WHEAT	10	5	17	8	10	10	10	2	8	10	4	(90)
MILK	15	8	10	8	10	10	15	2	10	10	1	(98)
SHEEP	15	10	17	0	8	5	15	3	8	10	3	(91)
CHICKENS/HOGS	15	10	17	8	10	10	15	4	8	8	2	(92)
BEEF	15	5	10	8	10	5	15	2	10	7	6	(89)
POTATOES	5	10	17	0	5	2	10	1	5	10	10	(65)
BEANS	10	10	12	0	8	2	10	1	5	4	11	(62)
COTTON	5	10	10	0	0	10	15	2	10	10	8	(72)
CORN	10	10	13	8	10	10	15	4	10	10	5	(90)
FRUIT	10	5	6	0	5	5	10	5	10	5	12	(61)
VEGETABLES	15	5	10	0	8	10	10	2	10	10	7	(80)
COLUMN RANK (NUMERICAL AND PERCENTAGE)	3 (9.8)	2 (9.8)	4 (8.6)	6 (5.0)	4 (8.6)	4 (8.7)	2 (9.6)	5 (5.6)	1 (10.4)	1 (10.4)	—	

generation, nutrition, import substitution, expectation of rapid social and economic impact). As an exercise in priority ranking these 12 commodities were then scored on the basis of 10 weighted criteria in Table 1. While no claim is made as to the appropriation of the weights applied, nevertheless, the procedure provides a point of departure if the development program must focus on less than 12 commodities simultaneously for budget, technical or staffing reasons. The rank order established is: 1. milk, 2. chickens and hogs, 3. sheep, 4. wheat, 5. corn, 6. beef, 7. vegetables, 8. cotton, 9. rice, 10. potatoes, 11. beans, 12. fruit.

The analysis of these commodities was carried one stage further to illustrate the requirements (inputs and infrastructure) to mount a development campaign. In Table 2 eight of the commodities are scored on 10 weighted input criteria. Those with the highest scores have the least number of prequisites to launch a development progam under the existing situation. As in Table 1, no claim is made as to the coverage or weighting of the input criteria. However,

TABLE 2 ILUSTRATION OF PRIORITY RANKING CRITERIA AND RANKING OF ADDITIONAL INPUT AND INFRASTRUCTURAL REQUERIMENTS FOR ACCELERATED CROP PRODUCTION 1/

ENTERPRISE (WEIGHT) 2/	IMPROVED GENETIC MATERIALS (10)	SOIL FERTILIZATION (10)	IMPROVED PRODUCTION PRACTICES (15)	FARM MGT (10)	DISEASE AND PEST CONTROL (5)	STORAGE AND/OR PROCESSING (10)	IMPROVED MARKETS & MARKETING (15)	MINIMUM PRICE SUPPORT (5)	FARM LEVEL TECH. AND MGT. ASST. (10)	RESERARCH AND/OR TRAINING SUPPORT (10)	ENTERPRISE RANK (100)
WHEAT	X	X	X	X	X	X	X	X	X	X	100
CORN	X	X	X	X	X	X	X	?	X	X	95 5/
RICE	?	X	X		X	X	X	X	X	X	80
POTATOES		X	X		X	X	X	X	X	X	70
SHEEP	X	X 4/	X	X	X	X	X	X	X	X	100
BEEF	X	X 4/	X	X	X	X	X	X	X	X	100
MILK	X	X	X	X	X	X	X	X	X	X	100
FRUIT / VEGETABLES	X	X	X		X	X	X	X	X	X	95
PRACTICE RANK	6	8	8	5	8	8	8	6	8	8	92.5 / 7.2

1/ CRITERIA ARE BASED UPON TABLE 1 CHECK-MARKS INDICATE PRIORITY EMPHASIS

2/ WEIGHTS BASED UPON RELATIVE IMPORTANCE.

3/ IMPROVED PASTURES.

4/ ALSO SUPPORTS LIVESTOCK PRODUCTION.

if Table 2 is accepted as reasonable approximation this suggests the following hypotheses about past agriculture policy:

- inadequate analysis of the crucial technical inputs.
- piecemeal approach in terms of the commodities selected, and the production - marketing requirements within each commodity chosen for special attention.
- no systematic consideration of input - output relations and capital formation.
- uncritical reliance on traditional approaches with lack of specificity in planning; in consequence little continuity and a lack of on-going re-evaluation.

The conclusion drawn with respect to the priority commodity group is the need to examine the state of technical knowledge, the effectiveness of transfering research findings to the farmer, the capability of the infrastructure and marketing system to handle inputs and output, and the institutional capacity to provide needed services and incentives.

(3) Strategy alternatives

The fundamental issue is how the multiple goals for agriculture may be reconciled and achieved. No optimum can be identified; the path will be via sequential decisions and succesive approximations. The aim is to isolate a few manageable priorities and adequate mechanisms which will lead to improved public administration and decision making resulting in improved performance on goal achievement.

With focus on the priority commodities identified in the previous section, the evaluation of technical alternatives centers on 5 characteristics of Peruvian agriculture; the natural resource potential, cost functions related to expansion onto new lands, input - output relationships in intensification of land use, and the distribution of population and income plus location preference and mobility of labor. With either assumptions or estimates of these aspects, the base is laid for a first approximation of some alternative ways of approaching the sector goals in terms of-location of production of the priority commodities, inputs and infrastructure needs and costs.

If improved income distribution is to be regarded seriously as the number one objective of agricultural development, then it must be assumed that deliberate policies will be implemented to minimize or reverse the trend projected in Section C-iii above. Nutrition and employment relate directly to income distribution. The need to generate foreign exchange does not appear to be critical. At the same time when urban markets are constraining on a priority low income group in the rural economy, the case can readily be made for import substitution. Opportunities for major expansion in export commodities are not encouraging; nor are there export items (with the exception of wool) which would benefit the truly marginal rural population. The issue is how to focus public investment, services and controls (prices and foreign trade) in such a way as to elicit expanded production from identified groups to be benefited.

The foregoing discussion provides a framework for exploration of possible consequences of some programs currently under review by the Peruvian government, and introduction of one or two illustrative alternatives, with no attempt to be exhaustive. Among the more notable programs is the proposal to invest $550 million in the Olmos, Majes and Chira-Piura irrigation projects with a total of 290, C00Ha. The construction period will be 9-12 years, thus any significant benefits will not be forthcoming in less than 15 years. While construction employment will be generated, it is by no means assured that the group benefited has high priority in social terms - certainly the marginal rural population will be unaffected for a decade. While substantial urban development may be expected within 20-25 years, these potential long term benefits must be weighted against alternative uses of $550 million which may yield improve productivity and incomes of marginal farmers or agricultural workers within a year or two. While there are undoubtedly social arguments in favor of coastal irrigation schemes, there are equally compelling arguments for alternative investments which offer higher economic as well as social returns.

From the viewpoint of production statistics and probable economic returns, the temptation is always to promote increased agricultural output in the Costa. Taking import substitution as a single objective the case would no doubt be made for intensification of the coastal valleys for beef, milk, oil-seeds and wheat. An alternative might be: - promotion of improved wheat production in the Sierra; advanced technology for Sierra crops which compete with wheat lands to release more Has. for wheat; or adopt price policies which may favor wheat substitutes from the Sierra. A similar procedure might be applied to milk. Another possibility could be improved corn production in the Sierra as a feed grain for hogs or poultry associated with price policy and import controls to substitute pork and poultry for beef.

The axis for the sector development program, agrarian reform, has been underway for two years. Alternatives exist as to how to proceed - one may be to disperse efforts some of which may be related directly or indirectly to the reform process - another may be to organize institutions and major financing behind the program in order to improve the probabilities of success on the areas already launched, and seek mechanisms to permit replication of viable units at an accelerating rate.

(4) Suggested areas of concentration

At the outset mention may be made of those areas where de-emphasis may be considered in order to free resources for the priority areas. There appear to be good reasons to re-evaluate the timing and extent of major new irrigation investments on the coast. If expanded production from the coast is desired,prospects are excellent for introducing advanced technology, improved water distribution and irrigation practices, and improved water supply to existing areas. In fact, there may be reason to de-emphasize coastal development if alternatives opportunities exist to expand output in the Sierra which are not seriously prejudicial in economic terms. In terms of the income distribution objective there appears little to be gained in the short run from promoting export crops, and import substitution should not be regarded as an over-riding factor in allocating resources to agriculture. Self-sufficiency in wheat is probably neither an economically nor socially desireable goal.

The point of departure, around which to expand successively into related activities, would appear to be the development of production-marketing systems for agrarian reform units in the Sierra, in sheep and cattle, (pasture, forages and nutrition), corn, potatoes, and hogs. This would lead into regional marketing improvement which would integrate the Costa and Sierra with respect to inputs, milk, and milk processing, inter-regional livestock movements of dairy calves, beef yearlings and lambs, plus a feed grains program in corn and sorghum on the Costa. The feed grains program then leads into second order priority activities - production - marketing programs for associated rice, wheat, hogs and poultry on the Costa and the gradual transfer of rice production from the Costa to the Selva. In the same category would be an integrated pasture and cattle program in the Selva.

Certain supporting activities will be required for the evolving programs. Notably research which will have both short and intermediate term application in: pasture - livestock relationships in the Sierra and Selva; crops and animal disease and pest control; production of oilseeds, irrigated vegetables, tropical fruits, wheat and corn. Training will be necessary in farm management and public administration and the university capability should be strengthed in social institutions, economics, extension, marketing, and applied research. An on-going program of special studies will be required in such areas as: ex-post program and policy evaluation; planning an integrated production - marketing system; the role of agri-business; employment; technology and income distribution; employment multipliers; and inter-regional comparative advantages.

F. Guidelines for AID Programs

The general framework, within which constructive AID assistance may be provided to further agricultural development in accordance with the government plan, was established in Section E-1 above - and specifically introduced into Chart 2 and 3. In the future AID should think in broader and more imaginative terms with regard to the type of activity supported, the nature of the assistance, and the strategy for its implementation in a dynamic melieu. It is axiomatic that all AID programs address priority needs of the government; at the same time the explicit nature of present agricultural policy dictates that these programs take due account of social as well as economic processes.

The relationship of AID programs to current public institutions and activities in the agricultural sector are shown in Chart 3, column 1. <u>The institutional implementation gap</u>, <u>the systems marketing - production gap</u>, and <u>the integration gap</u> identified in this chart become the focus of both the government and AID in seeking to reformulate a more meaningful assistance package. The suggested approach is to integrate and concentrate the program in such a way as to improve the chances of achieving a measurable impact plus potential multiplier effects.

The recommendation is that AID technical and financial assistance can be most effectively applied in supporting selected aspects of the agrarian reform program related to priority commodities working from the reform unit or zone through the region to the national level using an integrated production - marketing systems approach to achieve short-term impact. The expectation is that such an approach could be replicated to accellerate achievement of the Government's economic and social development goals for agriculture. If AID efforts are focused on the 15 million Ha. and 370,000 families to be involved in the reform process by 1975, plus some of the planning and administrative processes related to implementation - the scope is sufficient to occupy the resources available. Success of the agrarian reform is seen as vital if Peruvian agriculture is to become a dynamic sector of the economy; if it fails the prospect, at best, is a repeat of the sixties in the forthcoming decade. In any given area where AID may plan assistance it is essential to assess the degree of policy commitment which governs the extent to which Ministry decisions will be implemented.

Aside from programs directly tied to the public sector AID may also have a role in retaining a focus on the contribution of the private sector in support of the agrarian reform in such areas as seeds, fertilizer, equipment, transport requiring specialized inputs or management. It would be a mistake to underestimate the potential contribution of a private sector subject to a degree of public regulation.

With respect to existing AID programs the criteria for evaluation are: critical mass; relation to other inputs (external and internal); the constraints at all levels from planning, policy determination, teaching and research through implementation reflected in the production - marketing system; and relevance of present inputs to the evolving needs of development.

The present AID and GOP agricultural programs does not have critical mass with regard to the gaps identified in Chart 3. There is a clear lack of focus and coordination among the AID programs of technical and financial support to agriculture, which in large part is a consequence of the Government's failure to systematically structure the sector development program. However, AID has made no real effort to seek solutions, with respect to moving towards a more closely integrated set of programs.

There is need to re-orient the NCSU projects to be more responsive to the revised goals, particularly with research, training and technical assistance on production - marketing systems backing up the agrarian reform. The ISU program can be said to be indirectly related to policy but requires more integration with micro-analysis associated with implementation of the agrarian reform. The credit progam needs to be recast to focus on the priority commodities, and it is evident that any activities in marketing should be firmly established within the systems approach outlined above, i.e. the scheme for developing integrated local markets at the regional level, and expanding to the national level in some instances, as outlined in Chart 3, column 2.

Chart 2, column 4 shows the options open to AID in the provision of technical assistance. Alternative A is continuation of the present program of NCSU and ISU with progressive adjustment to the priority activities connected with implementation of the plan identified above. Alternative B is a "package" of activities supporting the Government's planning and implementation system, where the "package" has a core staff for technical direction and on-going re-evaluation in conjunction with Ministry of Agriculture. Alternative AB would call for a major re-orientation of the NCSU and ISU programs to perform the role of the core staff in B, and at the same time assume an active problem-solving orientation. This would involve working through priority projects with specific application to: development of production - marketing systems, project planning and implementation, and farm management and adoption of the production technology packages.

Alternative A is rejected. Alternative AB would be regarded as a fall-back option if staffing of a core group for B were to prove difficult or suffer excessive delays. Thus, Alternative B is the prime recommendation. Consideration should be given to forming a core group of 5-7 senior technicians - one or two in sector analysis, one in macro - economic studies of supply and demand, one or two in production - marketing systems, one in public administration, and one in private sector development. This group in association with the Government would develop projects, implementation procedures, and staff requirements.

Thereafter the work would require studies, coordination of technical assistance and loan projects, continuous program evaluation and re-orientation (with the Government and in accord with other sources of international assistance), and new project development. In exercising these functions it is to be expected that use would be made of consultants, plus international research and technical assistance organizations (e.g. CIMMYT, CIAT, IRRI, IICA, and FAO) and AID funded research in the U.S. or elsewhere applicable to Peruvian agricultural problems. At this stage there is no reason to believe that the total number of contract positions under the NCSU and ISU programs would be materially affected.

Recommendations

The recommendations section of Chapter 6, provides for a "set of projects within areas of concentration."

A. General

Projects are grouped by area of concentration in each of two periods: 1971-1975 and 1976-1980. In each time period the projects are then grouped as: action, training, studies, and research.

Illustrative project tecommendations are then made for USAID. In the illustrations the frame of reference is broadened to include social as well as economic processes in the context of Policy and Agrarian Reform. In these regards assistance strategy is applied with specific reference to GOP agricultural objectives on courses of action which will insure the most immediate problem solving impact.

To accomplish these ends, guidelines for development of an integrated program of assistance to agriculture are presented. These guidelines emphasize an analysis framework, a master plan strategy and a staffing innovation.

B. <u>USAID</u>

It would be premature to identify, the order of priority for projects in which AID assistance should be considered. Chart 3, column 3 gives an illustration, based on a first approximation, of some of the apparent higher priority areas drawn from the "areas of concentration" discussed in Section E-3 above. Examples are:

1. Subregional production-system in support of agrarian reform in the Sierra, possibly based initially on Cahuide and Tupac Amaru. This may be supported by research on farm management, capital formation, and project administration.

2. Pasture and feeding improvement for dairy and sheep production in the central and southern Sierra; with support of IVITA, the University of Florida animal nutrition project and the Texas A and M animal disease project.

3. Planning for a program of land development for improved pasture in the Pucallpa region with importation of heifers for beef production; with support of CIAT.

4. Programming for integrated development in the North Costa, with partial transfer of rice production to the Selva and introduction of a crop rotation built around corn, sorghum or wheat plus hog fattening; with assistance of CIMMYT, the University of California crop protection project and the NCSU soil fertility project.

5. Institutional (or organizations) and macro-economic aspects connected with design and implementation of the above projects within an agrarian reform context; with support of the ISU team.

It is worth re-iterating that AID assistance should: (i) be coordinated internally and with the government as a package, (ii) have a priority commodity and regional focus using a production - marketing systems approach to development, where research, training and credit directly support such systems, and (iii) be related to, an integrated with, the agrarian reform at the farm level.

Implementation

A special section was prepared on AID staffing for planning and program leadership. It is recommended that a liason staff to work for USAID and the Ministry of Agriculture be developed one for each of six subject matter areas of concentration:

(1) Sector evaluation analysis,

(2) Macro Demand / Supply analysis,

(3-4) Production and marketing systems,

(5) Private sector development, and

(6) Farm and Institutional management.

This Program Management staff would be responsible for program formulation and project monitoring of AID assistance in Agriculture. The staff would be recruited through U.S. Universities and/or from the USDA.

The last section of Chapter 6 discusses implementation from the country side. The introductory statement points out the need for country leadership and responsibility for Program development and project implementation. USAID technical assistance should be advisory.

Technical and financial assistance needs of agrarian reform is rediscussed for emphasis. A suggested organization for implementation based upon a vertical and a horizontal approach and commodity technical commissions is developed for consideration.

CHAPTER II

SCOPE AND METHODOLOGY OF THE STUDY

I. Introduction

The purpose of this inquiry is to evaluate the Peruvian agricultural sector plan in order to identify areas where the technical or financial resources at AID's disposal could be most effectively brought to bear in support of the policies already established. In this undertaking the primary requirement is isolation of those elements which are the primary or sole responsibility of the government and at the same time essential to the success of any attempt by a foreign or international agency to contribute to the development process.

The study provides an indication of the historic performance of Peruvian agriculture, including land area and use and land potentials, and human and technical resources requirements for improved production and marketing. Specifically, the questions addressed are:

1. What could AID effectively work upon?
2. What strategies provide the best opportunity for AID assistance?
3. What kind of constraints must be removed for the assistance to be effective?

II. Terms of Reference

Overall sectoral goals consistent with development strategy and resources availability have been established by the Plan Agropecuario A Mediano Plazo 1971 - 1975. These plans set out the production and employment targets by regions and suggest the area of land and technology level required to achieve these targets. The strategy confronts a number of fundamental questions governing agricultural policy:

1. How far should agriculture be pushed towards 100% import substitution?
2. How far can agriculture go in expanding exports?
3. What is the capacity of the non-agricultural sector to generate productive employment?
4. What factor proportions are indicated for agriculture to permit higher per capita production in the sector consistent with resources endowment, market constraints and labor which cannot be productively absorbed in non-agricultural sectors?

National development strategy identifies intra-sectoral (agriculture) and inter-sectoral income distribution as a prime goal. Intra-sectoral distribution will be achieved through changes in agrarian structure particularly land tenure, marketing and provision of capital inputs and services to farmers. Since consumption per capita in non-agricultural sectors is currently several times that in agricultural the only means of improving distribution is to achieve higher rates of increase in per capita output in agriculture. Since the crucial indicator is agricultural output $\div$ agricultural population, the answer is self-evident: (i) increase agricultural output for export, import-substitution, and satisfaction of an increasing per capita food consumption in both the agricultural and non-agricultural sectors, and (ii) reduce and reverse the rate of growth of the rural population through accelerated inter-rural, rural-urban migration, and/or family planning.

III. Public Policy

A. The characteristics of agriculture which are subject to influence by public policy are as follows:

1. Production technology (capital and labor per ha.).
2. Location of production.
3. Organization of the farm enterprise and size of farm.
4. Composition, volume and value of total output.
5. Rural - urban migration rates.
6. Per capita consumption levels.

B. Influence may be exerted through a combination of the ollowing policy instruments:

1. Price control through direct regulation or taxation on products, capital inputs, wages or marketing services.
2. Taxation on income, land or inheritance.
3. Expropriation of land and capital.
4. Construction, operation and maintenance of productive infrastructure in rural areas - highways, storage, handling or processing facilities.
5. Provision of social services - education, health, recreation; differential quality of these services between urban and rural areas may accelerate rural-urban migration.
6. State enterprises in any input and processing industry aspect of agricultural or forestry, production or marketing.
7. Credit availability and credit terms.

8. Generation and dissemination of information on:
   (a) agricultural production technology
   (b) markets
   (c) family planning
   (d) urban job skills
   (e) availability of urban job opportunities
9. Control of foreign trade through exchange rates, import quotas, export taxes, excise taxes, subsidy and protective tariff on domestic manufacturing in agricultural or forestry processing and input industries.

C. The effectiveness of these policy instruments is constrained in a number of ways:

1. Technical and administrative capability of public agencies.
2. Existing resource endowment.
3. Quality of human resources.
4. Physical capability of land and forest resources, i. e., the production function.
5. Capital
6. Social factors
7. Limited acceptance of risk and uncertainty
8. Motivation based on culture and tradition rather than profit.
9. Traditional mistrust of government and many institutions associated with marketing and provision of services to agriculture.
10. Location preferences and resistance to rural-urban migration.

D. The policy question to be addressed is:

In seeking the output, employment and income distribution goals for the agricultural sector, how should expansion of output be achieved (intensification versus expansion of the land frontier) i. e. what policy instruments should be brought to bear, where, and at what level of effort, taking into account the above constraints?

IV. Development Alternatives

Taking the three principal ecological zones of the country (Costa, Sierra and Selva) as the point of departure, alternatives are as follows:

A. Expansion of output in the "Costa";

1. Intensification on existing irrigated areas;
   - increasing return to variable capital over the relevant range
   - output/labor ratio increasing
   - land/labor ratio decreasing
   - capital/output ratio decreasing

or,

2. Expansion of irrigated areas with progressively increasing costs i. e., decreasing returns to fixed capital in irrigated land.

For the most part existing infrastructure (highways, urban, etc.) has excess capacity. Thus, there is little or no social overhead involved in either form of expansion, particularly the former.

B. Expansion of output in the "Sierra", will require either;

1. Redistribution of land to permit more efficient use of land and labor resources without any significant capital requirement (i. e., higher yields in some areas and stable or lower yields in others). The overall effect would be intensification to reduce fallow ratio and/or increase yields through:
   - reorganization (primarily for more effective use of land and labor) without capital
   - reorganization plus capital

or, 2. Additional irrigated area, with decreasing returns to fixed capital

The present productive infrastructure (roads and storage) will not meet the expanded demands.

C. Expansion in the "Selva", will require either;

1. Intensification of the limited area already opened up and supplied with basic infrastructure. This would require a massive infusion of capital, intensive (and probably labor - saving) technology to increase yields.

or, 2. Expansion into new areas (with or without advanced technology). Expansion with traditional technology of agriculture production will require perhaps four times the highway investment per unit of marketable output, but with improved technology the investment per unit will be much less. Selection of technology will depend on the trade off between labor absorption, minimum income levels, and the demand for marketable products.

Expansion will require large infrastructure investment in the Jungle area; maintenance and operation will be costly; and, if markets are located on the coast there will be a need to improve transport across the "Sierra".

V. Empirical Considerations

The data used to determine the performance of Peruvian Agriculture including individual policies such as land, water, agrarian reform policy were obtained from various reference sources in the Mission and in the Ministry of Agriculture. Additional documents were obtained from U. S. D. A. and from other international sources.

In addition to reviewing the available published documentation on the historic performance of the Peruvian agriculture, field visits were made to the primary producing areas in Peru, covering a cross-section of the major food commodities. These field visits were made by the members of the evaluation team and included such areas as Arequipa, Pucallpa, Yurimaguas, Chiclayo, Huancayo, the research stations in the Lima area, and a visit to the Agrarian University at La Molina. Trip reports were prepared and materials from these trip reports were utilized in the body of the report (see Appendix A). Interviews were conducted with GOP officials in the various major departments of the Ministry of Agriculture including credit, cooperatives, agrarian reform, banking, the Ministry of Agriculture, and the Planning Section of the Ministry.

VI Analytical Procedure

The first requirement was to build an analytical frame by means of which project activities could be evaluated. Three conditions were imposed upon the analytical framework: (1) that the GOP agricultural development objectives were to be maximized simultaneously, (2) that the objective maximizing process was to be achieved in the context of agrarian reform, and (3) that the objectives were to be maximized for each of the three agricultural zones: Costa, Sierra, and Selva. A decision was made to focus the analytical frame upon increased production of priority commodities, and to maximize the objectives by means of integrated commodity production - marketing systems.

Thus, relative to GOP agricultural goals, the analytical frame consists of two main parts: (1) a project planning - implementation procedure, Charts 1, 2, and 3, and (2) a diagnostic production - marketing system for crops and livestock, Charts 4 and 5. This procedure has these evaluative features: (1) it enables the evaluation to identify gaps, weakness or strengths in the system comparative to and in terms of the objective function to be maximized, (2) it provides an objective basis of comparing the need for and contribution of agricultural development alternatives, and (3) it provides a means of continuous reassessment of activities and achievement rates for corrections to be made, or rates and emphasis of the activity, or its alternatives, to be changed relative to maximizing the values of the objectives.

In summary, the analytical frame constructed has these features:

a) It identifies and expresses GOP agricultural goals in terms of strategy relative to two main problems: low production and marketing efficiency and poor rural income distribution.

b) It states that the goals are to be maximized by determing the contribution of alternative projects, by first determing what projects are needed, and then determing which procedure with respect to each project is the most efficient.

c) It uses production - marketing systems analysis as the analytical frame to identify problems and to recommend project requirements.

Key terms of the analytical frame are: (1) project planning - implementation requirements, (2) priority commodity focus and regional concentration, and (3) farm to national level production - marketing systems.

<u>Staged Approach to Accelerating rates of Agricultural Productivity</u>

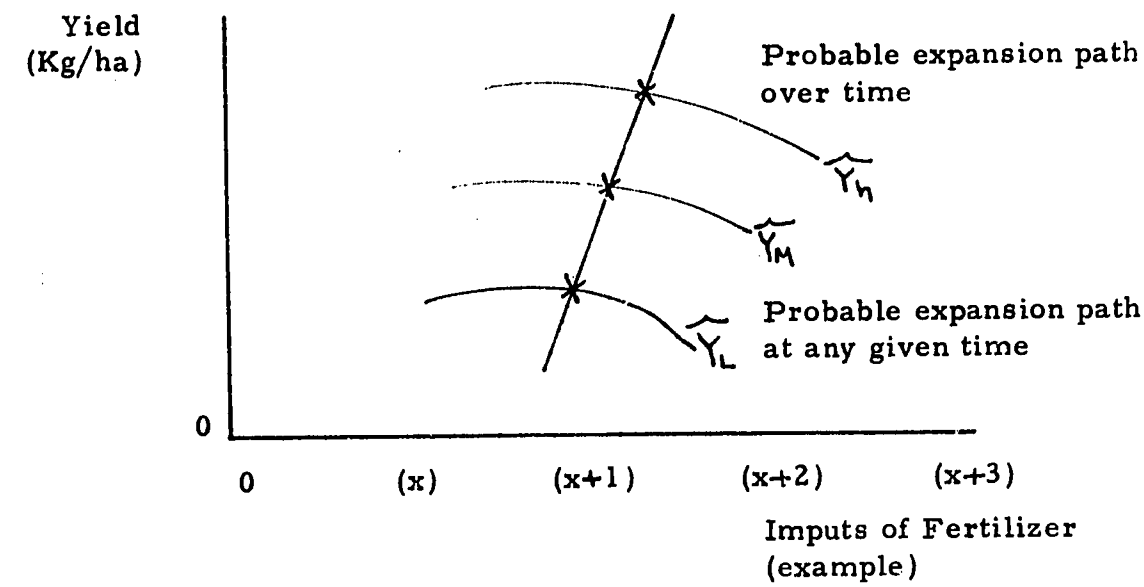
Four sequential steps to deriving improved forms of productivity are:

1. Identification of the basic problems constraining production.
2. Definition of strategy to correct the problems.
3. Specifying programs which will achieve the strategy aims.
4. Evaluation of alternative mechanisms for implementing programs.

With respect to these four evaluation steps, an evaluation matrix can be constructed as follows: (1) T_i(technology) for, (2) E_i (enterprises), with respect to (3) P_i (Prices) of E_i, and C_i (Costs) of technology T_i.

Simplified, and diagrammed, these four groups of variable can be presented as follows with respect to each other:

Figure 1 Diagramatic Expression of Possible Production Expansion Path of Commodity X, with respect to time and fertilizer.



Legend

H = farms with high technology, M = Medium, L = Low.

At any moment in time some movement will occur in production to achieve the $\hat{Y}_t$ input - output sequence, the majority of production is forecast by the composite of input - output functions $\hat{Y}_h$ $\hat{Y}_m$ $\hat{Y}_l$. These functions are generally discrete with respect to each other. This knowledge is important in projecting production response because for accelerated expanded output the extension path is $\hat{Y}_t$.

The task of implementation planning is to locate Y_t with respect to $\hat{Y}_h$, $\hat{Y}_m$, and $\hat{Y}_l$ and to determine the requirements for achieving their alinement with this expansion path, commodity by commodity. To actually shift production to input - output relation Y_t requires: (1) development of farm capital formation processes, (2) transference of agriculture science and technology to production, (3) creation of market infrastructure, and (4) providing production and marketing incentives.[1/]

1/ Explanation:

a) Given that $\sum_{i=1}^{N}$ output $= f(\widehat{Y_t})$

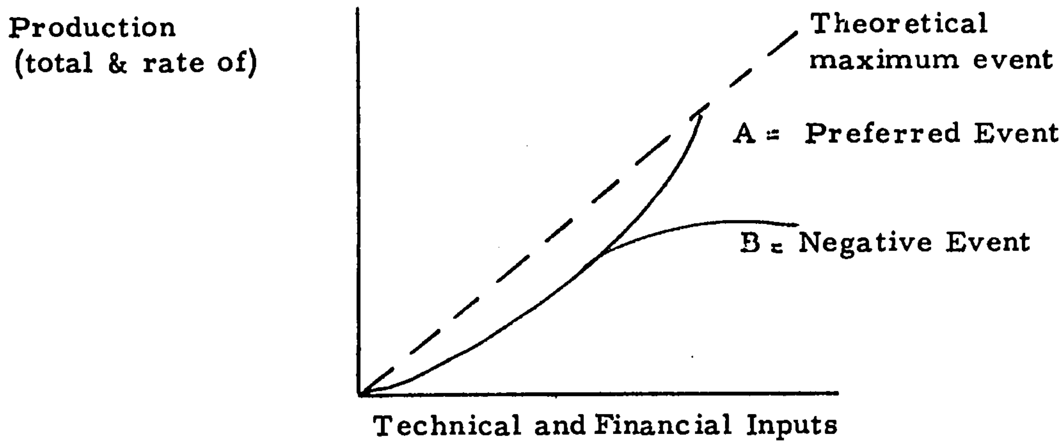
b) then $f\ (Y_t)$ with respect $\sum_{i=1}^{N}$ output (Maximum)

is:

	Legend
1. $(Y_L) = x - (x_c + x_s + x_p)$	x = output
2. $(Y_m) = x - (x_c + x_s)$	c = capital
3. $(Y_h) = x - (x_c)$	s = skill
4. $(Y_t) = x$	p = price

The value of this kind of analysis frame is to: (1) provide a determination of the correct routing of productivity, and (2) to provide a choice criteria to make the right decisions: to assure event A, Figure 2.

Figure 2 Selecting the Preferred event from Alternative Events of Equal Probability.



The sufficient condition is to determine the knowledge, reasoning, and action process which will result in a maximum likelihood probability of event A occurring. This probability can be estimated by input - output analysis, and the systems method of aggregating production and marketing and, which in turn, can be subjected to price equilibrium evaluation by means of aggregative demand and price elasticity coefficients

VII USAID Strategy

The principle relating to U. S. financial and technical assistance is in what ways is the U. S. best qualified to help define and reinforce GOP strategy, where, in impact terms, strategy is taken to be:

1. Concentration on a limited number of products in the initial stage in order to permit evaluation of performance, and identification of bottlenecks;
2. Concentration in a few geographic areas for the same reasons as above;
3. Selection of products which relate to each of the four development objectives;
4. Emphasize improvement of marketing, availability of production, credit, and technical assistance;
5. Place major emphasis on developing marketing parallel with production.

Two recent reports on Peru's economic growth have been released, one by CIAP, "Domestic Efforts and the Needs for External Financing for the Development of Peru", April, 1971, and one by IBRD, "Economic Growth of Peru : Problems and Prospects", April, 1971. These reports emphasize external financing and building agricultural exports; however, they do not focus on agricultural development policy, employment, income distribution and improved nutrition. Also, the defects in the technology and processes of agricultural production within a viable institutional context was not included in their study, and therefore not recognized as a fundamental problem.

VIII. Explanation of the Analytical Frame (Charts 1 and 2)

The purpose of this section is to provide an understanding of the analytical frame prepared to develop a comprehensive analysis of alternatives. The analysis frame is a simplified diagnostic systems methodology.

A. Description of Chart 1

The pivotal points of Chart 1 are the "planning" block, column 5, and the "agrarian reform" block, column 3. Given the strategies, programs, and program mechanisms chart 1 states that it is the responsibility of planning to determine the requirements for implementating the development process. Columns 2, 3, and 4 set up the necessary conditions for setting in motion the development process; the requirements column sets forth the sufficient conditions. The critical path relationships of Chart 1 are as follows:

1. Column 1 and 2 sum from left to right into the respective blocks in column 3, as indicated by the flow paths. Each block of Column 3 narrows the strategy statements to a more specific group of proposed activities.
2. Column 4, "Mechanisms" contains a list of titles of relevant activities with respect to program. The specific form and content of each mechanism will depend upon the nature of the activity to be undertaken. Each mechanism, column 4, is contained in each program block of column 3, as appropriate.

3. The agricultural programs specified in terms of mechanisms (activities) to be applied are then integrated into the framework context of agrarian reform for implementation.
4. It is then the responsibility of the development planning section to specify the requirements for implementation. The essential categories, and category relationships are set forth in column 5. Fundamentally, column 5, states that implementation requires:
   a) Concentration of activities by region and commodity
   b) Identification of priorities by region and commodity, and specification of the nature of the constraints upon development.
   c) Development of integrated production - marketing systems based upon adequate input - output, and demand - supply - price analysis.
   d) Identification of institutional infrastructural, policy, and financial support requirements for implementation.

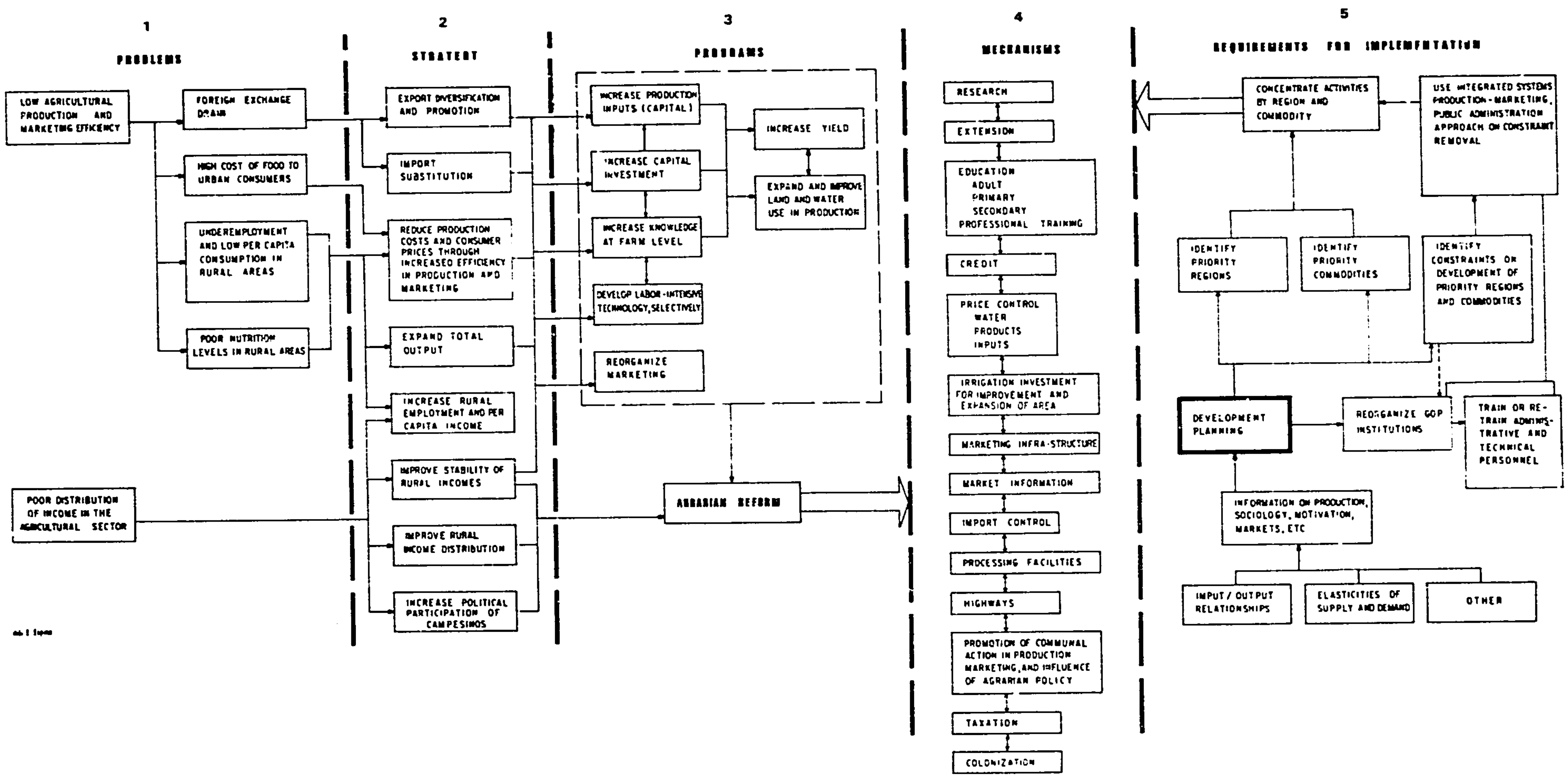
B. Description of Chart 2

Chart 2 provides a planning - implementation framework for the requirements column, chart 1. This is done by grouping the development goals under planning (column 1) to indicate that these goals are what planning is to be "focused" upon, and by grouping the column headings (chart 1) under implementation requirements, and by adding a policy block, to indicate what the implementation process must concentrate upon.

CHART No 1

USAID AGRICULTURAL PROGRAM EVALUATION

ANALYSIS SCHEME BASED UPON GOP AGRICULTURAL DEVELOPMENT PLAN



The evaluative - analytical procedure of Chart 2 is as follows:

1. Two sets of "ranking" criteria were developed (located elsewhere in this section), one to rank priority concentration commodities, and the other to rank priority inputs and infrastructure. The ranking was done in terms of the agricultural development goals.1/

2. By the procedure set forth in column a concentration group of commodities was determined nationally, and then regrouped and ranked by region as follows:

Costa	Sierra	Selva
Non-ruminant livestock	Sheep	Rice
Chickens	Cattle	Cattle
Hogs	Milk	Fruit
Milk	Wheat	Milk
Corn	Beans	
Vegetables	Potatoes	
Wheat		
Oil seeds (cotton)		
Beans		

3. The commodity concentration group was then introduced into a government planning and implementation system, column 3. Column 3, contains:

   a) Analytical context for investigation and analysis of production - marketing systems in an agrarian reform - policy context.

1/ The GOP development plan priority commodities were found to concentrate upon one goal - import substitution, and upon one region - The Costa.

b) Provision for determination of institutional, financial, resources, management, and administrative requirements, and limitations, upon program implementation. Charts 4 and 5.

4. After the governmental programs have been selected, and the implementation requirements are complete, possible external source assistance can be considered. Column 4, Chart 2, identifies two external assistance sources, the international assistance network, and USAID.

5. The assumption on which the listing of possible kinds of USAID assistance are based are that the USAID could concentrate assistance on: (1) planning and analysis, (2) development of improved production and marketing systems, and it could do this by:

   a) By present means and procedures (alternative A)

   b) By giving an implementation action focus to the USAID agriculture program (alternative B)

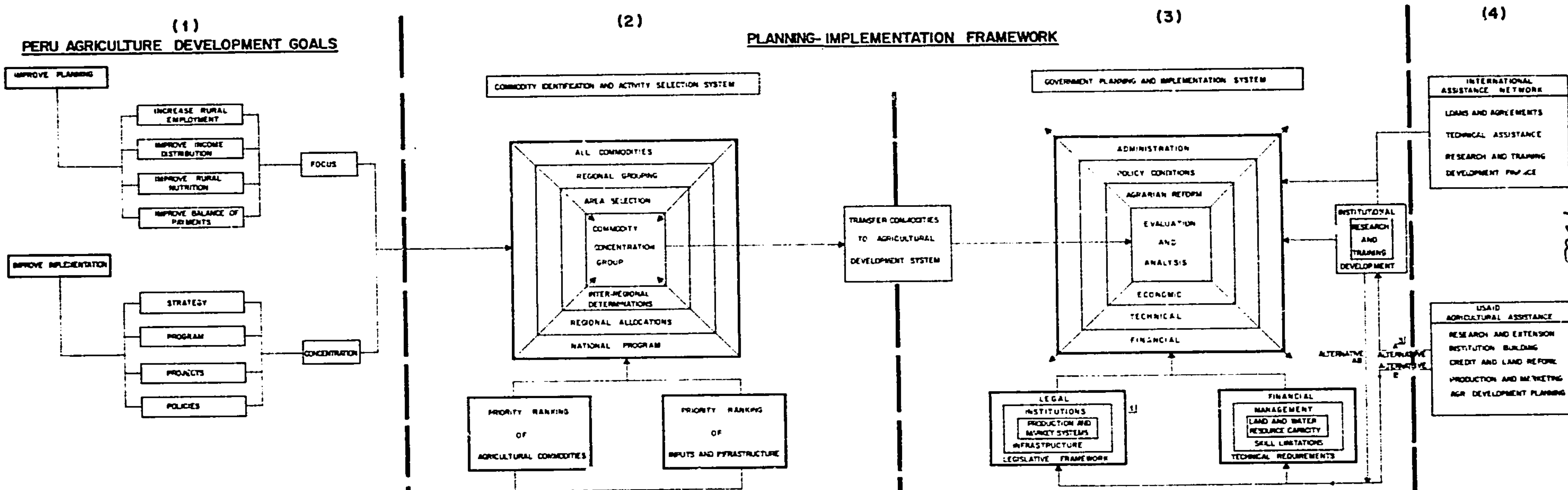
   c) By doing both A and B, giving a direct problem solving focus to alternative A (alternative AB).

C. <u>Discussion of Commodity Concentration</u>

Key terms of Chart 2 are focus and concentration - focus upon activities which would provide for immediate impact upon the four objectives functions, Chart 1, and concentration of resources to maximize the returns per unit of input. A necessary condition of the agricultural development objectives is that agricultural development distribute the employment and income benefits so as to simultaneously achieve as

CHART Nº2

RELATIONSHIP OF GOALS AND INTERNATIONAL ASSISTANCE TO AGRICULTURAL PLAN IMPLEMENTATION



1/ RESTATEMENT OF REQUIREMENTS SECTION, METHODOLOGY FROM CHART Nº 1
2/ ILLUSTRATIVE OF POSSIBLE TYPES OF ASSISTANCE
3/ PROGRAM OF ALTERNATIVES DISCUSSED IN TEXT

widely distributed social and economic welfare as possible. Therefore, the product of development inputs and accelerated agricultural productivity, must be considered in terms of the distribution impact, regionally, and inter-regionally, including inter-regional transfers of commodity emphasis, and rural migration. Thus, to achieve additive economic effect on such objectives a commodity concentration group was determined, and to achieve additive distributive social effect, regionalization of the additive effect was necessary.

The procedure used to determine the priority commodity concentration group was as follows:

1. Value weighting of all products and possible products of agriculture relative to their additive contribution to the values of the development objectives (fisheries and forestry were excluded by reason of time and structural factors).
2. Selection of the top ranked 30 commodities without reference to regionality to compare with the commodity group listed as priority in the 1970 agricultural plan.
3. Value weighting of the agricultural plan commodities relative to the agricultural development goals, and reselection of a commodity group of 30 commodities as candidates for inclusion in a priority concentration group.
4. Ranking of each commodity by the sums of weights assigned to each of 10 criteria, selected as denotative of a

meaningful social and economic definition of each of the four objectives, taken collectively.

5. Distribution of the top 12 commodities among the three regions according to: (a) economic and/or physical resource advantages, (b) employment and income distribution equalization, and (c) opportunity for immediate social and economic impact.

D. Commodity Priorities

By and large, the commodity concentration group is not different as a list of commodities from the list in the 1970 plan, but the emphasis is different. The top priority commodities of the plan primarily emphasize import substitution, with regional concentration on the Coast. The concentration group selected attempts to contribute to each objective, and to achieve a national social and economic impact by means of regionalization of the distributive effect.

The priority commodity group selected is listed by commodity in Table 1. The top row of Table 1 lists the criteria and the weights used to determine the selection of priority commodities. Ten criteria were used to determine the composition of the commodity group. The criteria, collectively, denotate national employment, income, nutrition, and import substitution. Because of special economic, policy, and possible problems of location of production, and possible future production surplus of rice the methodological issues associated with these questions are given special consideration in the report.

TABLE 1

PRIORITY RANKING CRITERIA AND RANKING OF PERU AGRICULTURAL COMMODITIES RELATIVE TO GOP AGRICULTURAL DEVELOPMENT GOALS.

COMMODITY	LAND IMPROVEMENT OR LAND EXP. POT	HIGH RATIO OF BENEFICIARIES TO CAPITAL	HIGH RATIO OF LOW INCOME BENEFICIARIES	IMPORT SUBSTI-POTENTIAL	IMPROVED NUTRITION POTENTIAL	POTENTIAL TO HAVE MULTIPLIER AFFECT	PRODUCTION CONSTRAINED BY CAPITAL	PRODUCTION CONSTRAINED BY TECHNOLOGY	PRODUCTION CONSTRAINED BY MARKETING	HIGH RATE OF RETURN ON PUBLIC INVESTMENT	RANK	
											NUMERICAL	PORCENT
WEIGHT (BASIS = 100)	(15)	(10)	(17)	(8)	(10)	(10)	(15)	(5)	(10)	(10)		(100)
RICE	15	10	8	0	2	8	5	0	10	10	9	(68)
WHEAT	10	5	17	8	10	10	10	2	8	10	4	(90)
MILK	15	8	10	8	10	10	15	2	10	10	1	(98)
SHEEP	15	10	17	0	8	5	15	3	8	10	3	(91)
CHICKENS/HOGS	15	10	17	8	10	10	15	4	8	8	2	(92)
BEEF	15	5	10	8	10	5	15	2	10	7	6	(89)
POTATOES	5	10	17	0	5	2	10	1	5	10	10	(65)
BEANS	10	10	12	0	8	2	10	1	5	4	11	(62)
COTTON	5	10	10	0	0	10	15	2	10	10	8	(72)
CORN	10	10	13	8	10	10	15	4	10	10	5	(90)
FRUIT	10	5	6	0	5	5	10	5	10	5	12	(61)
VEGETABLES	15	5	10	0	8	10	10	2	10	10	7	(80)
COLUMN RANK (NUMERICAL AND PERCENTAGE)	3 (9.8)	2 (9.8)	4 (8.6)	6 (5.0)	4 (8.6)	4 (8.7)	2 (9.6)	5 (5.6)	1 (10.4)	1 (10.4)	—	

Table 1 represents limiting factor analysis in the selection of commodities for concentration and focus of action. The table headings appear to be reasonable, but no attempt was made to be all inclusive. By this rating procedure, the priority enterprises, by order of rank, by region, are:

Costa	Sierra	Selva
Milk	Sheep	Rice
Corn	Milk	Cattle
Beans	Potatoes	Fruit
Wheat	Beans	Milk
Rice	Wheat	
Cotton		
Non-ruminant livestock		
Chickens		
Hogs		

Table 1 ranks these commodities, by priority, on a national basis, according to weights assigned each of the criteria, and according to a weight adjustment procedure based upon: high = 3, medium = 2, and low = 1, for each weights assigned each of the criteria. As previously noted, the purpose of this procedure was to narrow down the candidate list of commodities to a manageable impact group for the GOP agricultural development plan (Chart 2).

An equally meaningful way to consider the priority grouping of commodities is to group them by aggregate weights rather than by numerical rank. This results in the following sub-groups of commodities.

RANKS OF COMMODITY GROUPS BY WEIGHT

Rank 1 Commodities
(weight of 90 or more)

- Milk
- Chickens
- Hogs
- Sheep
- Wheat
- Corn

Rank 2 Commodities
(weight of 80 or more)

- Beef Cattle
- Vegetables

Rank 3 Commodities
(weight of 70 or more)

- Cotton[1/]

Rank 4 Commodities
(weight of less than 70)

- Rice
- Potatoes
- Beans
- Fruit

While the rank 1 commodity group is not greatly different than the deficit commodity group as listed in the 1970 agricultural development plan, one thing of note is that this ranking procedure does not give a high emphasis rank to commodities for which the technology is already in place. In this regard, meat has been made specific by source, rice is included as a special problem crop (but given rank 4 as a priority crop). Oil seeds (except as related to cotton) were deleted because of the absence of plant materials and technical capacity to quickly mount a program. Cotton is included because of its high value contribution to oil, livestock feed, and employment. Oil seeds

1/ Cotton was selected because it is a high employer of labor not because it is an export crop.

are treated as a special case under research. Beef cattle drops to the second group of commodities because of high capital and time requirements to get an impact program under way without purchasing breeding stock from other countries. An economic case for doing this, and accomplishing the desired result in a reasonable time period is presented in detail in Chapter 4.

The rank 4 commodities are a special group. Their needs are not so much technology as organization of efficient production and marketing systems. In the case of rice a shift in geographic location of production to the Selva, could be of economic advantage for the Costa and the Selva.

In Table 1, the row rank of commodities is consistent with the column rank. Therefore, maximization of the economic values of the commodities should, simultaneously, maximize the social values of the criteria. In substance, private investment in capital formation and public and private investment in the science and technology of agriculture, and in markets, transport and storage, can be expected to have immediate impact and a high rate of pay off.

IX. Infrastructure and Inputs

A. Discussion

Table 2 attempts to rank inputs and infrastructure to provide an indication of the relative importance of the different factors. Table 2 also addresses the question of the needs of the small farmer by specifically relating inputs and technology to the farm level. Agrarian reform is a way of bringing technology to the small farm and of involving the small farmer in social and economic development. The criteria of Table 2 are an index of a critical mass to have significant immediate impact on output.

B. Construction of Table 2

As in Table 1 each criteria of table has been given a weight. The commodities are selected to illustrate the procedure. A significant conclusion of Table 2, comparative to Table 1, is that Table 2 indicates that the high priority commodities also have high input and infrastructure requirements. Farm inputs, infrastructure, technology, and management are decidedly lacking for almost every commodity.

Hard facts were not available, and so the rankings in Table 2 are based upon yield records, observation in the field, and deductions from discussions with informed people. With regard to the present technological state of agriculture Table 2 poses the following tentative hypothesis:

1. Lack of analysis of the technological needs of agriculture and a tendency for assistance to agriculture to take a piecemeal approach.
2. Lack of capital formation, mechanization, and systematically order of input-output relations in agriculture.
3. Lack of specificity in planning and uncritical reliance upon traditional approaches.
4. Lack of continuity, and continuousness, of evaluation and reevaluation of development progresses.

The hypothesis indicate a critical need to examine: (a) the state of technical knowledge and capital formation of the priority commodity group, (b) the state of effective transference of research and technical knowledge to the producer, and (c) the state of the infrastructure capability to provide inputs and handle output, and of the institutions and policy to provide incentive and essential services.

TABLE 2 ILUSTRATION OF PRIORITY RANKING CRITERIA AND RANKING OF ADDITIONAL INPUT AND INFRASTRUCTURAL REQUERIMENTS FOR ACCELERATED CROP PRODUCTION 1/

ENTERPRISE (WEIGHT) 2/	IMPROVED GENETIC MATERIALS (10)	SOIL FERTILIZATION (10)	IMPROVED PRODUCTION PRACTICES (15)	FARM MGT (10)	DISEASE AND PEST CONTROL (5)	STORAGE AND/OR PROCESSING (10)	IMPROVED MARKETS & MARKETING (15)	MINIMUM PRICE SUPPORT (5)	FARM LEVEL TECH. AND MGT. ASST. (10)	RESEARCH AND/OR TRAINING SUPPORT (10)	ENTERPRISE RANK (100)
WHEAT	X	X	X	X	X	X	X	X	X	X	100
CORN	X	X	X	X	X	X	X	?	X	X	95 5/
RICE	?	X	X		X	X	X	X	X	X	80
POTATOES		X	X		X	X	X	X	X	X	70
SHEEP	X	X 4/	X	X	X	X	X	X	X	X	100
BEEF	X	X 4/	X	X	X	X	X	X	X	X	100
MILK	X	X	X	X	X	X	X	X	X	X	100
FRUIT / VEGETABLES	X	X	X		X	X	X	X	X	X	95
PRACTICE RANK	6	8	8	5	8	8	8	6	8	8	92.5 / 7.2

27a

1/ CRITERIA ARE BASED UPON TABLE 1 CHECK-MARKS INDICATE PRIORITY EMPHASIS

2/ WEIGHTS BASED UPON RELATIVE IMPORTANCE.

3/ IMPROVED PASTURES.

4/ ALSO SUPPORTS LIVESTOCK PRODUCTION.

CHAPTER III
PERUVIAN AGRICULTURE IN THE SIXTIES AND PROJECTIONS TO 1980

Introduction

Peru's land resources for agriculture are made up as follows:

Table 3, Land Resources of Peru

Type of Land	Hectares (millions)	Percent of Total
Arable lands	2.6	2
(Irrigated lands)	1.1	(1)
Grasslands	27.3	20
Forested lands	87.0	70
Other lands	11.5	8
Totals	128.5	100

The three distinct ecological regions of the country are Costa, Sierra and Selva, characterized as follows:

Costa - Low rainfall; zero to 10 inches/year

Sierra - Mountainous; rains Oct. - March, comparatively dry April-September. Temperatures; moderate to cool

Selva - Rain forest; hot and humid; "dry period" - April-Sept.

The components of Peruvian agriculture are shown in Table 4. Sugar, coffee and cotton are major export crops; and meats, dairy products, wheat, fruits and vegetables, and edible oils are the major import crop commodities.

Food crops of major importance are maize, rice, barley, pulses, potatoes, cassava and sweet potatoes, citrus, onions and tomatoes.

Livestock and livestock products are highly important in the agricultural economy. Although milk produced per cow is still low, the total milk and milk products produced yearly are quite substantial. Red meat from cattle, sheep and goats totaled 148,000 metric tons in 1966; but this amount was supplemented with 31 million US dollars of live animals in 1966. Imported dairy products (largely milk powder) and eggs accounted for 18 million US dollars.

These data suggest that agricultural production of foodstuffs in Peru is not meeting domestic requirements. The feasibility of achieving self sufficiency is discussed in subsequent sections of this report.

Between 1950 and 1970, the yield indices of the basic agricultural commodities show no substantial increases, giving Peru one of lowest food production per capita indices in all of Latin America. Historically, the proportion of financial resources made available to public agencies in the agricultural sector through the central government has averaged below 3 per cent of the national budget. 1/

1/ "Long Term Projections of Demand for and Supply of selected Agricultural Commodities through 1980" Universidad Agraria, La Molina, Lima, 1968.

Table 4

PERUVIAN AGRICULTURAL STATISTICS

(from 1969 FAO Yearbooks)

A. Crop Production and Trade

Crop	Total Area (000 Ha.)	Total Production (000 Ha.)	Average Yield (100 Kg/Ha.	Trade Export Millions US (Dollars)	Trade Import Millions US (Dollars)
Rice	63	208	33.1		1.8
Wheat	150	150	10.0		34.5
Barley	180	170	9.4		
Maize	360	590	16.4		
Dry Beans	60	70	11.7		
Dry Peas	20	18	9.0		
Broad Beans	25	28	11.2		
Chick Peas	6	3	5.0		
Potatoes	270	1700	63.		
Cassava	42	500	119.		
Sweet Potatoes & Yams	13	150	115.		
Onions	7	123	176.		
Tomatoes	6	65	112.		
Citrus		300			
Cottonseed	154	167	10.8		
Cotton lint	154	101	6.5	64.0	
Sugar Cane	48	7000	1,458	53.7	6.0
Coffee	101	51		29.9	22.
Cocoa beans	4	2			
Tobacco	4	4 1/2	10.1		3.1
Fruits & Vegetables				2.3	10.8
Processed edible oils				.5	5.9

B. LIVESTOCK AND LIVESTOCK PRODUCTS

(1969 FAO Yearbook)

(1966 data)

		Number	Animals Slaughtered
1.	Animals		
	Horses, Mules, Asses	1,250,000	
	Cattle	3,800,000	633,000
	Sheep	15,100,000	1,990,000
	Goats	4,000,000	708,000
	Pigs	1,940,000	1,003,000
	Poultry(all types)	20,000,000	
2.	Meats Produced		
	Beef	76,000 M.T.	
	(Goat &)Mutton	30,000 M.T.	
	Pork	42,000 M.T.	
	Poultry	42,000 M.T.	
	Lard	10,000 M.T.	
3.	Wool		
	Greas wool	16,000 M.T.	
	Clean wool	8,000 M.T.	
4.	Hides & Skins		
	Cattle	650,000	
	Sheep	2,030,000	
	Goat	1,140,000	
	Pig	515,000	

DAIRY & POULTRY PRODUCTS

Milk Production

From cows	420,000 M. T.
From Sheep	62,000 " "
Milk produced per cow	670 kg/yr.
Butter	6,000 M. T.
Cheese	24,000 " "
Condensed and Evaporated & Powder	51,000 " "

Eggs

Number	390 Million
Weight	19,500 M. T.

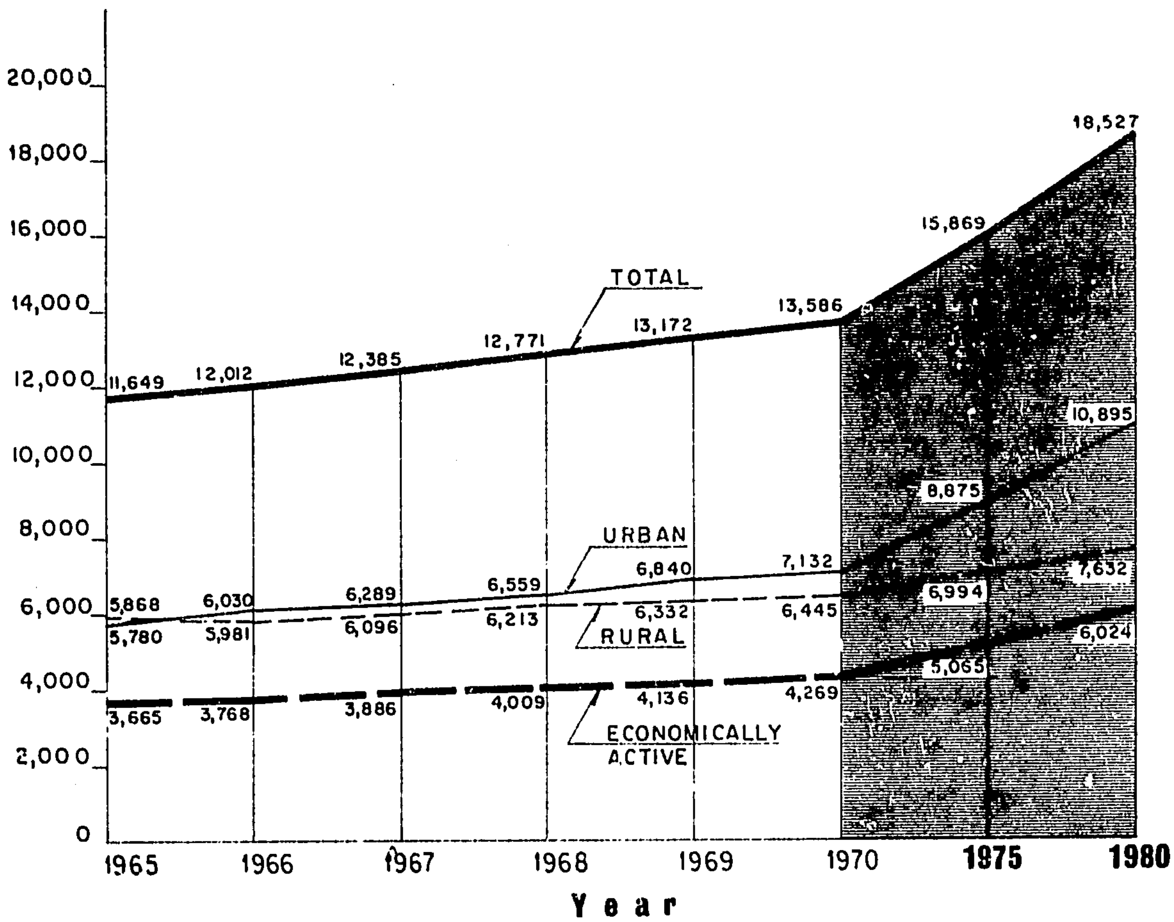
C. TRADE IN LIVESTOCK PRODUCTS, Millions of US$

	Export (Mil.)	Imports (Mil.)
Live animals	0.2	17.7
Meat & Meat Preparations	0	13.4
Dairy Products & Eggs	0	18.3
Total		$ 49.4 Mil

Figure 3

POPULATION IN PERU

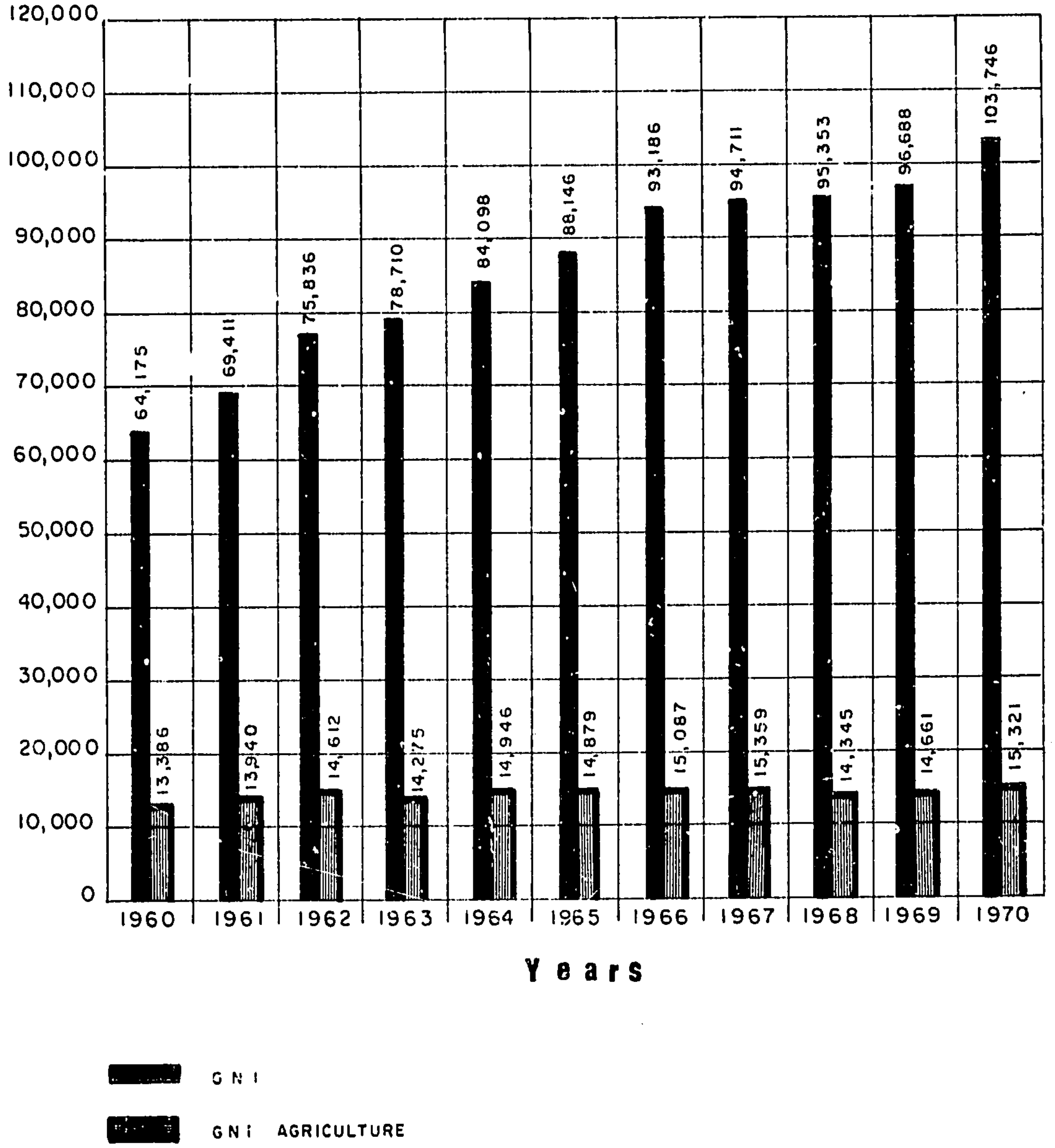
Population figures for the year 1965 through 1970 and estimate through 1975 and for 1980 (in thousands of people)



SOURCE: CENTRO DE ESTUDIOS DE POBLACION Y DESARROLLO

Figure 4

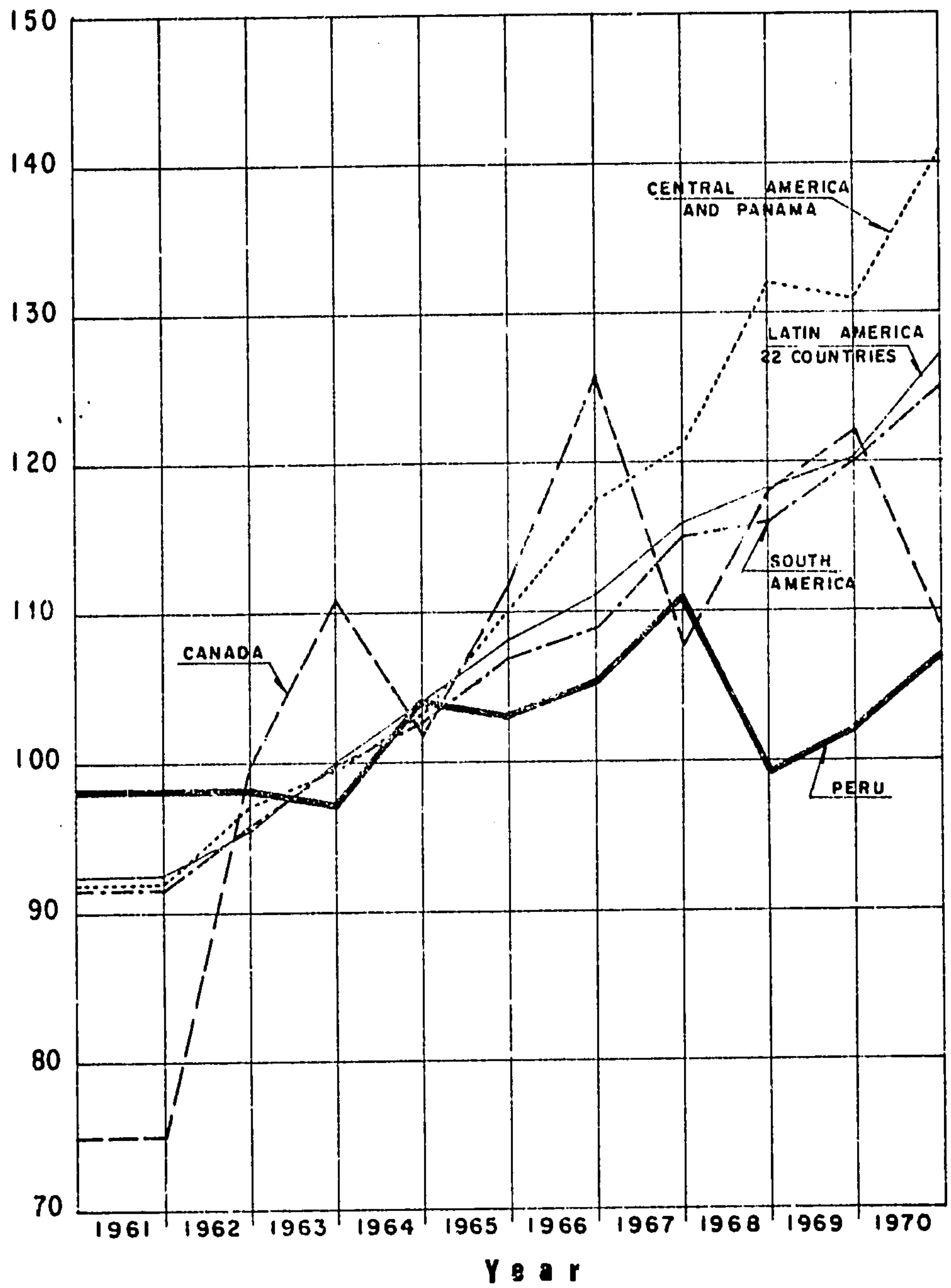
Gross National Income Compared to Gross National Income From Agriculture (1963 Constant prices)



SOURCE: BANCO CENTRAL DE RESERVA

Figure 5

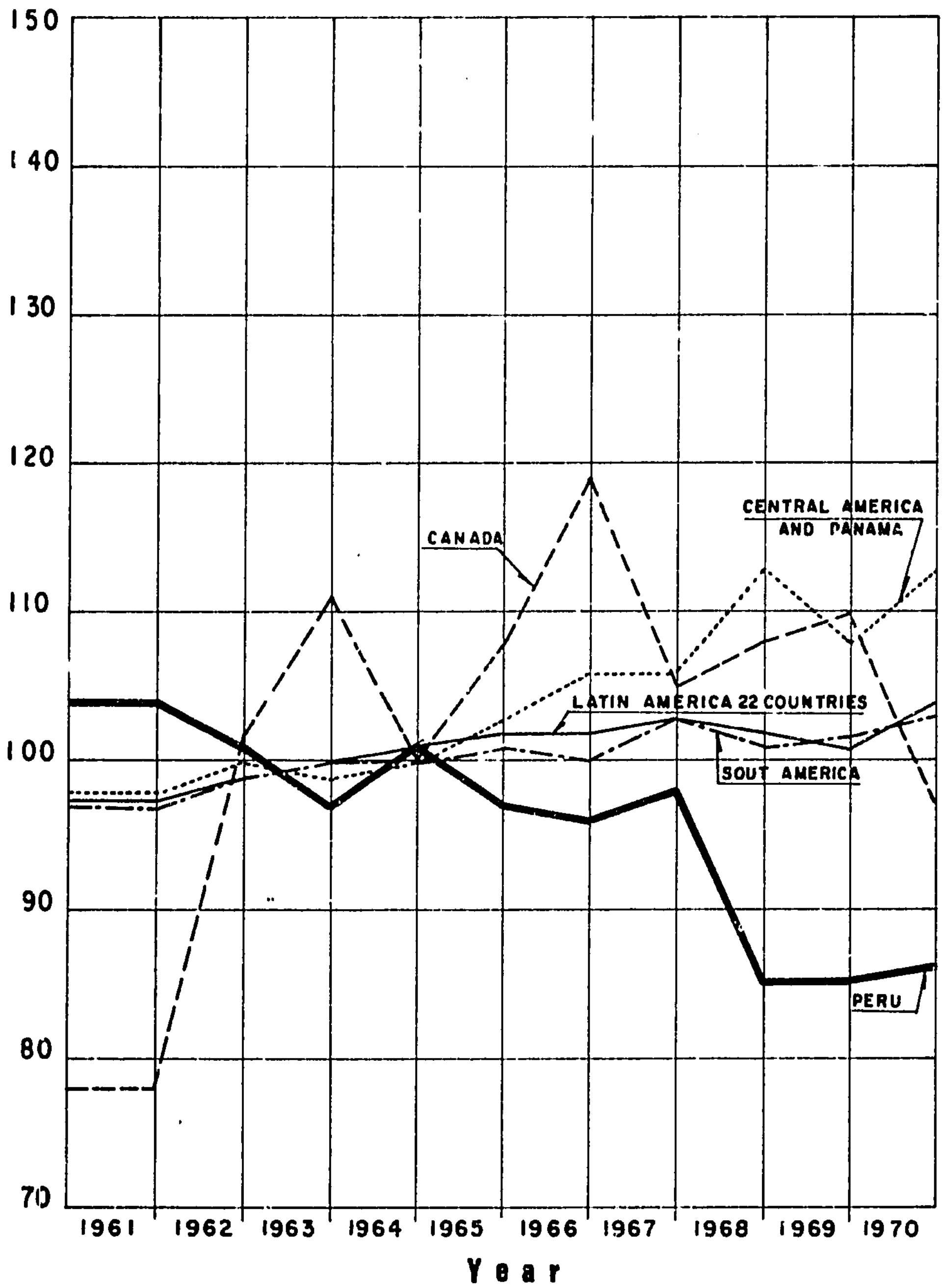
Indices of Total food production, by country, 1961-1970
1961-65 = 100



SOURCE: ERS - FOREIGM 264, APRIL 1971

Figure 6

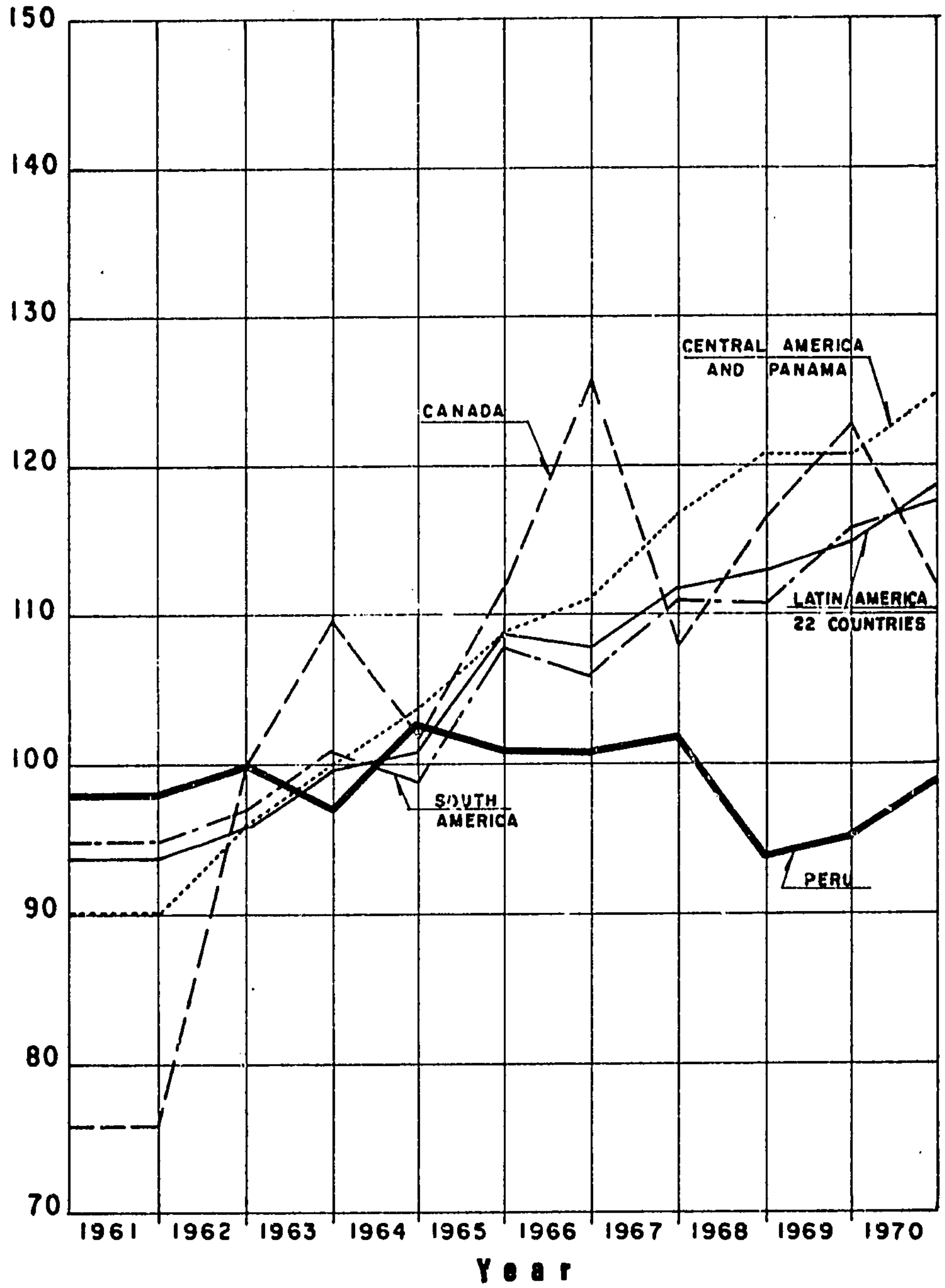
Indices of per capita food production, by country 1961-70
1961-65 = 100



SOURCE: ERS - FOREIGM 264, APRIL 1971

Figure 7

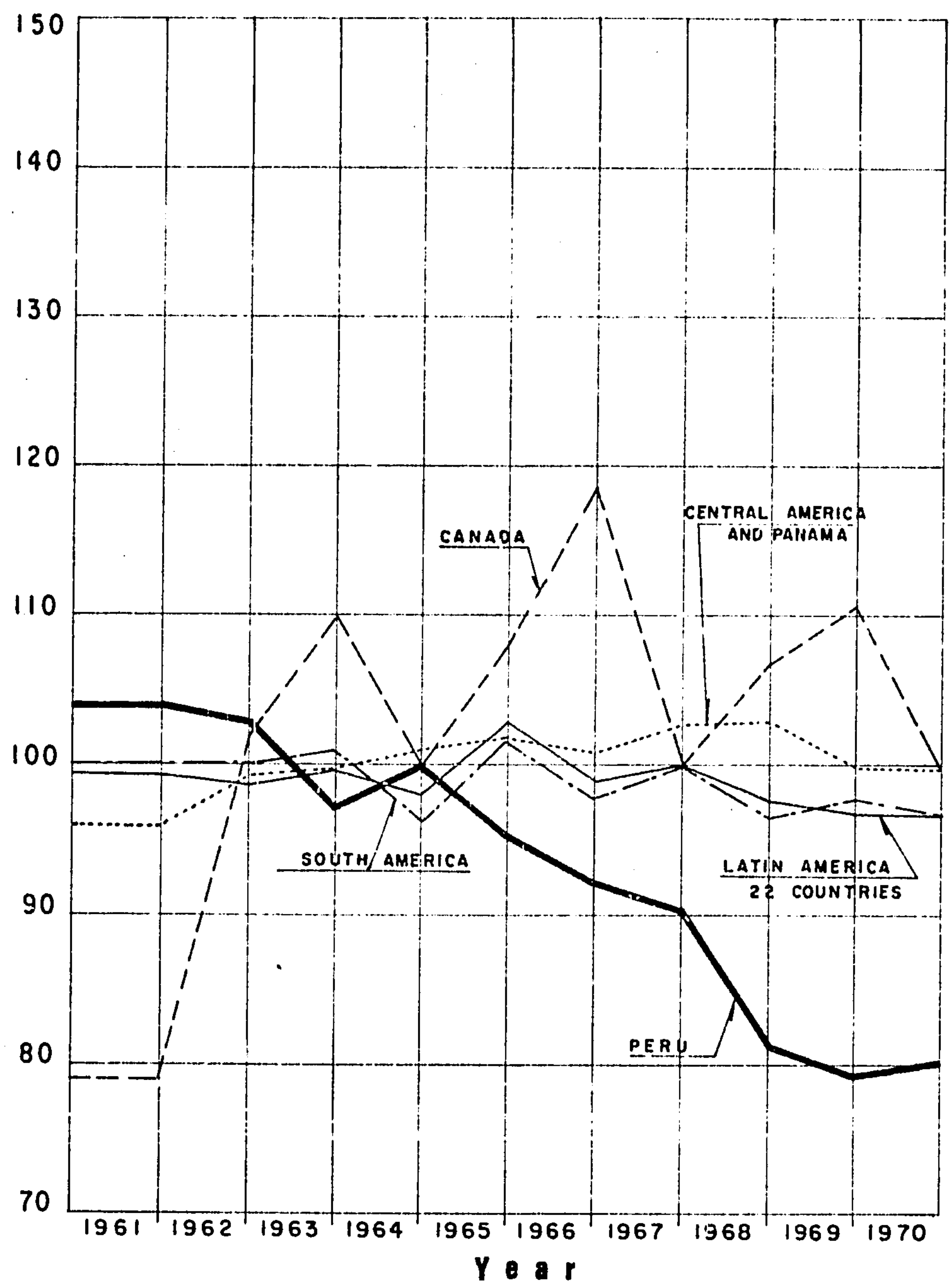
Indices of Total agricultural production, by country, 1961 - 70
1961 - 65 : 100



SOURCE: E R S - FOREIGM 264, APRIL 1971

Figure 8

Indices of per capita agricultural production, by country, 1961-70
1961-65 = 100



SOURCE: ERS - FOREIGM 264, APRIL 1971

General Economic Indicators

Gross national income in Peru grew at an average rate of 4.4% per year between 1950 and 1970, and total population increased an average on 3.1% per year. From 1971 to 1980 the gross domestic income and population are expected to increase at these same rates per year. Between 1950 and 1970, the total agricultural yield index showed no substantial increases; remaining static throughout the period. The demand for food has grown as a result of population growth; but since the supply of food has not increased, there has been an increase in imports of foodstuffs, which reached a level of U.S. 145 million in 1970.

Agricultural Production Performance

National agricultural production of commodities for domestic consumption must be evaluated in terms of population growth. Total population is believed to be increasing at a rate of 3.1% per annum, reaching a level of 13 1/2 million people in 1970. Population is projected at nearly 16 million by 1975, and 18 1/2 million by 1980. Urban population is growing more rapidly than rural population, which will place an increasing burden on agricultural producers. Figure 3 shows the projected acceleration of the spread between rural and urban sectors of the population. The problem ahead is to foster agricultural production as may be needed to meet total domestic needs.

Another facet of the agricultural problem is shown in Figure 4. The absolute value of agricultural production has remained virtually unchange since 1960, while gross national product (GNP) has grown more than 60%. This indicates that sectors of the economy other than agriculture are accelerating at a far greater rate than the agricultural economy.

Figure 5 compares the performance of Peru with that of other Latin American regions, as to total food production. Peru has made very little progress on total food production since 1964, while other regions have moved upward rather strongly.

When expressed in terms of per capita food production, Figure 6, Peru has lost ground since 1964. The drop was quite sharp from 1967 to 1968, and has been stationary since 1968.

Since urban population has been growing more rapidly than rural population, it is useful to examine the indices of total agricultural production in Peru, in comparison with other Latin American countries, Figure 7. This chart indicates that the unsatisfactory status shown in Figures 3 and 4, is not due to the more rapid growth of the urban population. Total agricultural production in Peru has shown no significant progress since 1961, while other Latin America countries were moving continuously upward.

Agricultural production is expressed in terms of per capita agricultural production, in Figure 8. During the decade of the '60s, the other countries of Latin America were just about holding even in per capita agricultural production. By contract, Peru has lost 20 percentage points since 1964. There is no evidence of any significant recovery since 1968.

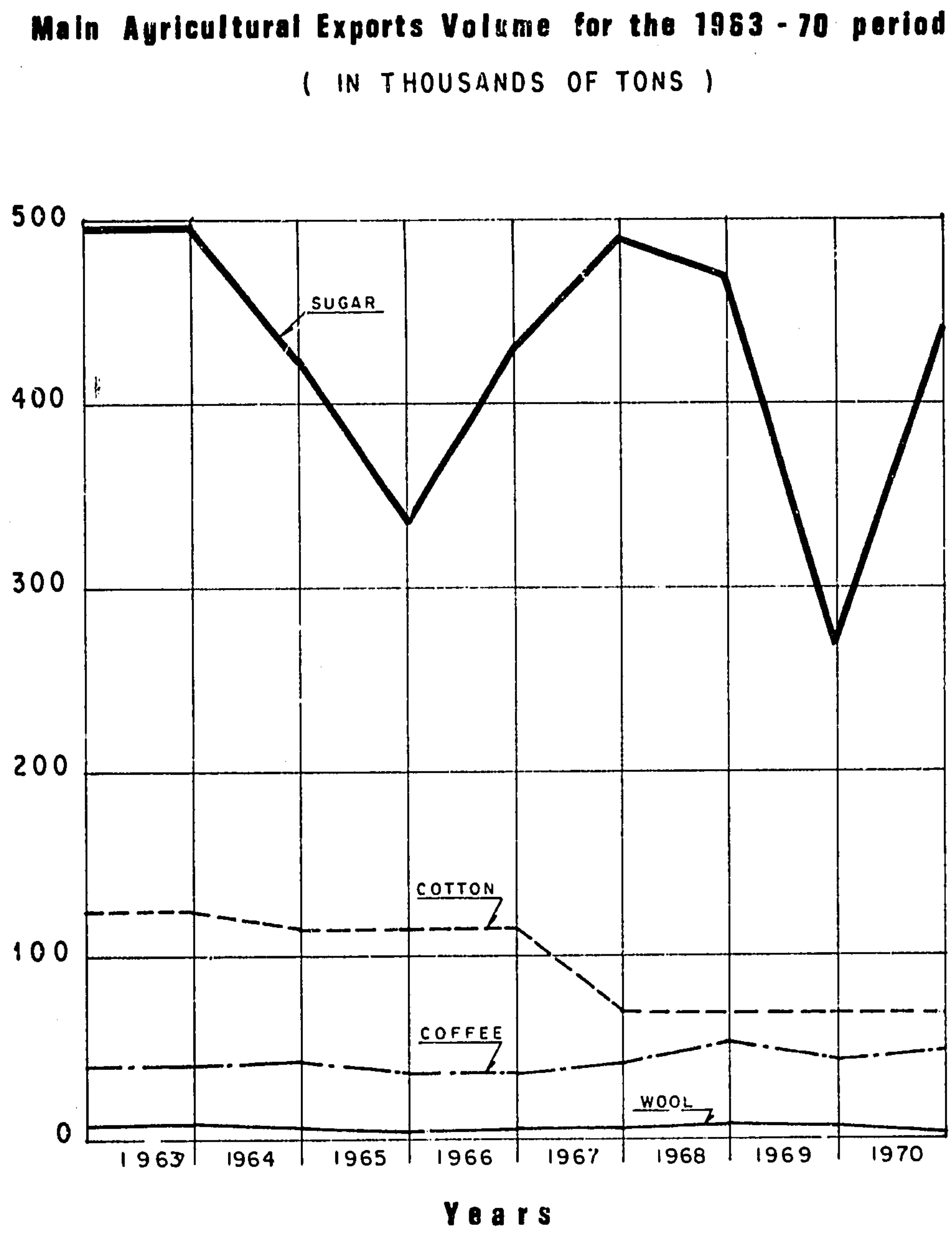
Taken together, these figures strongly indicate the need to critically examine the agricultural sector of Peru, to determine policies and programs that would rectify the present inbalances of agricultural production. These imbalances do not affect only the rural population; they are of great importance to the total economy, and to the success of agrarian reform, as well as to the welfare of the urban population.

Exports and Imports of Agricultural Commodities

The status of agriculture in Peru is directly related to the export and import trade in agricultural commodities. See Figure 9. Of the 4 principal exports, sugar has shown rather wide fluctuations since 1964 but had nearly recovered by 1970. Cotton exports were affected by the world wide reduction in demand, but have been stable since 1967. Coffee has been comparatively stable with a moderate upturn 1968-70. Wool has declined in 1969 and 70, as a reflection of of slackening world demand for this fiber.

Although exports are valuable as earners of foreign exchange, it is the imports that reflect the status of foodstuffs for domestic use. These imports primarily serve the urban sectors of the country. Figure 10 indicate a consistent increase in the volume of wheat imported. The volume of meat and meat animals has grown somewhat since 1960, with a marked increase in 1970. The erratic volume of imported meats was produced by the Government's efforts to control this commodity by various methods. The production of red meats in Peru has continued to fall short of market demand.

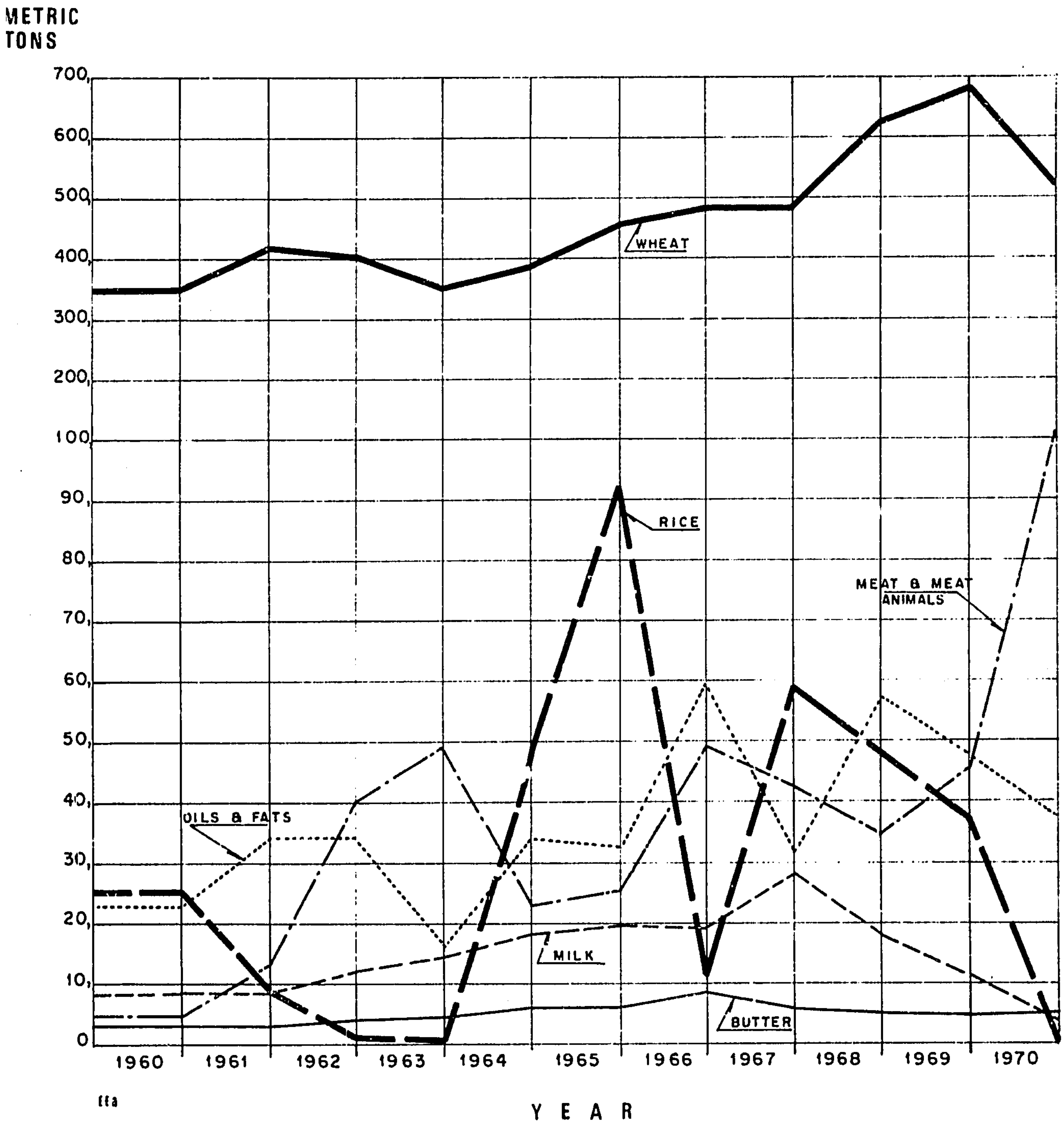
Figure 9



SOURCE: DIRECCION GENERAL DE ADUANAS

Figure 10

Imports volume of major foods in Peru during the 1960-70 period



SOURCE: SUPERINTENDENCIA NACIONAL DE ADUANAS

The volume of oils and fats (primarily edible types), has generally increasedduring the decade. These oils and fats are supplementary to domestic cottonseed oil, which has decreased in volume because of the deteriorating world market for cotton.

Rice has been imported in substantial volume at various times since 1963, but domestic production increased sharply in 1970 as a result of a favorable price paid to producers, and the introduction of improved types, and more adequate use of fertilizers. Self sufficiency in domestic rice production may continue unless the authorized price is reduced to unprofitable levels.

Milk products as imports have dropped off substantially since 1967. This appears to have been the result of significant increases in domestic production of milk in the regions of Lima, Arequipa, and Cajamarca. The favorable government price for milk has stimulated dairy farming and milk production in recent years.

Regional Distribution of Crop Production in Peru

Any evaluation of Peruvian agriculture must recognize that the 3 ecological regions are vastly different in natural resources, in the present status of development, and in the commodities produced that enter into the market economy. Virtually all of the agriculture in the Coast region is based on irrigated land. The Sierra region is rugged terrain, with relatively thin soil, cool climate, and it is adversely affected by a scanty road system. The High Selva on the eastern slopes of the Andes (elevations of 600 to 8,000 ft.) has adequate rainfall for most types of agriculture, but is largely underdeveloped, and hampered by almost complete lack of roads. The Low Selva is a vast area that appears to have great agricultural potential, but has not yet been developed as an agricultural asset to Peru. Not only are roads absent (water transport or major streams provides the only movement possible), but there is only air transport to connect with the urban markets of the coastal region.

The regional distribution of production for the major crops is shown in Table 5. Corn is grown in all 3 regions, but it most important in the Sierra. The corn grown in the Sierra is currently consumed for human food, and will not importantly enter the market economy until the volume is substantially increased. In the Coast region, corn is used mostly as a feed grain for poultry and swine, and for dairy cows. Rice is a major crop in the Coast region, but production under irrigation in the high Selva has recently made a sharp upturn. Wheat is now grown almost exclusively in the Sierra, although there appears to be great potential for growing wheat in the Coast region where conditions are not greatly different from the great wheat growing centers of Mexico. Barley is predominantly a crop of the Sierra, where it replaces wheat where frosts make that crops undependable.

Beans (Phaseolus species) are grown in all 3 ecological zones, but broad beans (Vicia fava) are grown primarily in the Sierra. Other beans (actually, the pulses; - chick peas, lentils, peas) are grown both in the Sierra and the Coastal regions. Potatoes are a major food in the Sierra, and supplies in excess of local needs are marketed in the Coastal cities. Manioc is a major foodstuff of the people in the Selva, while sweet potatoes are produced in the Coastal region. Cotton and

Table 5

REGIONAL DISTRIBUTION OF CROP PRODUCTION IN PERU
(1964 - 65 Data)

	Total for Peru			Regional Distribution of Production		
Crop	Hectares	Yield	Price	Costa	Sierra	Selva
Corn	346,140	1,450	1.74	93	220	33
Rice	82,200	4,276	2.17	62	-	20
Wheat	149,300	959	1.72	2	147	-
Barley	179,400	1,019	1.59	2	177	-
Quinua	19,390	909	2.86	-	19	-
Beans	40,580	968	3.83	21	8.5	10.6
Broad Beans	29,620	1,193	1.89	-	29.6	-
Lima Beans	3,000	897	4.40	3	-	-
Other Beans	31,910	1,076	3.25	8	23	-
Potatoes	261,500	5,855	1.54	8	254	-
Manioc	49,000	9,148	0.79	7	6	36
Sweet Potatoes	12,550	12,776	0.78	11	1	-
Cotton Lint & Seed	246,140	1,581	7.12	236	1.5	9

Source: Ministry of Agriculture data, reported in Hendrix's thesis Iowa State University, Appendix Table D.

sugarcane are grown almost exclusively in the coastal region, under irrigation. Coffee and tea are mainly grown in the high Selva, and cocoa beans and rubber are products of the low Selva.

Livestock Production by Regions

The distribution of the livestock industry in Peru is indicated by the following data - Table 6.

Table 6. - Livestock population in 1964

Number of Head in Thousands

Type	Coast			Sierra			High Selva			Low Selva	Total
	No.	Cen.	So.	No.	Cen.	So.	No.	Cen.	So.		
Beef Cattle	170	145	52	727	913	1,439	35	37	17	90	3,625
Milk Cows	68	84	19	285	361	628	17	17	8	38	1,523
Sheep & Goats	35	26	13	1,174	4,456	8,825	2	-	12	5	14,548
Hogs	155	80	31	430	591	526	15	29	20	120	1,997
Alpaca	-	-	-	635	2,634	1,314	-	-	-	-	4,583

Poultry are grown in all regions, but the principal commercial production is in the vicinity of coastal cities. Beef cattle, dairy cows, and sheep were predominantly found in the Sierra.

The consumption of beef (46% of red meats) declined 7% in 1970, and total cattle population decline 3%. This may be compared with cattle and beef imports in the same year. Live animals imported from Colombia, Ecuador and Argentina for slaughter amounted to 113,000 head in 1970, up 40% from 1969. Imports of all beef amounted to 9,778 metric tons in 1970, and imports of mutton were 6,860 M. T.

Feed Supplies for Livestock Production

Since livestock enterprises are highly dependant on feed supplies, it is useful to evaluate the status of such feeds. Table 7 presents a summary on feeds.

Poultry and hogs are supported principally by grains and other concentrates, but cattle, sheep and goats utilize forages and pastures quite effectively. Table 5 indicates that poultry (broilers and eggs) are much greater consumers of commercial supplies of grains and other concentrates, than are hogs. Dairy cattle are consuming about four times as much in concentrates per animal as beef cattle, indicating the importance of forages and pastures for support of beef enterprises. Sheep are produced almost wholly on pastures, with only limited supplemental feeds.

Sorghum grain has begun to be an important feedstuff in the Coastal Zone, where it frequently out yields corn. Sorghum grain has almost the same feed value as corn grain, and should be a valuable feed for expanding poultry and hog production. Sorghum is also useful in formulated concentrate feeds for dairy cows, and for finishing beef animals.

Table 7

ESTIMATED FEED SUPPLIES FOR

LIVESTOCK PRODUCTION

A. Commercial Feedstuffs

Total for poultry, hogs, beef & dairy. (1,000 Metric Tons)

Feed use, Pct. by type.

Feedstuffs	1960-64	1970	Poultry %	Dairy %	Beef %	Hogs %
Corn Grain	163.5	400.7	89	4	2	5
Milled cobs	116.7	190.7	0	70	30	0
Wheat by-prod.	88.1	143.3	62	26	6	4
Cotton cake	111.3	117.2	10	60	30	0
Cotton hulls	63.1	66.5	0	70	30	0
Rice by-prod.	36.1	48.0	40	60	0	0
Fish meal	0.7	0.9	36	31	18	15
Mollasses	44.7	53.4	10	40	30	20

B. Total Harvested Forage - 1,000 Metric Tons

Forage type	1960	1970	
Corn silage	458	532	(Mostly in Lima area)
Sweet Potato leaf	687	1,003	(Largely in Selva)
Alfalfa green	4,673	4,889	(Sierra cultivated pastures)
Others	1,499	2,138	

C. Pastures

a. Sierra Natural Pasture - 24 Million Hectares - Carrying Capacity 0.13 Animal Units* per Hectare of unimproved pasture; and 1.5 to 2.0 A.U. per Hectare, with fertilizer and controlled grazing.

b. Cultivated Pastures for all of Peru - 10% of arable land - 210,000 Ha. Carrying Capacity up to 3 A.U. per Hectare

* One animal unit equals 1 cow, or 5 sheep

Source: Agrarian University, La Molina

Changes in Agricultural Commodity Production 1964 - 70

Changes in production of selected commodities are shown in Table 8.

Rice production has increased about 75% from 1968 to 1970, mostly because of increases in hectares planted. This increase coincided with more favorable prices set for growers. The introduction of improved varieties, fertilizer usage, and better cultural practices which began in 1969, may further increase total production.

Wheat production, limited principally to the Sierra, has remained stationary despite reports of research results that seem to indicate improved productivity.

Corn has improved in productivity since 1968, by reason of improved hybrids and greater use of fertilizer in the Coastal region.

Potatoes grown principally in the Sierra, increased in both acreage and yields after 1968, apparently as the result of improved technology (improved varieties, disease-free seed, fertilizers).

Bean production has fluctuated without any firm trends being confirmed to date.

Harvested forages (green chop corn and sorghums, Napier grass, alfalfa, etc) had not improved materially by 1968, although incomplete reports for 1970 indicate that new varieties and cultural practices are producing substantially increased yields.

Table 8

CHANGES IN PRODUCTION AND VALUE OF SELECTED COMMODITIES - PERU

Item	1964				1966			
	Area Ha	Yield Kg/Ha	Prod. M. T. (thousands)	Value Million S/.	Area Ha	Yield Kg/Ha	Prod. M. T. (thousands)	Value Million S/.
Rice	82,200	4,275	351		95,875	3,900	374	1,060
Wheat	149,300	960	143		156,700	925	145	412
Corn	349,640	1,450	503		354,920	1,630	581	1,367
Potatoes	261,500	5,855	1,531		254,630	5,885	1,499	3,084
Beans	40,580	950	39		64,575	880	57	270
Cotton seed	-	-	-		-	-	197	-
Forages	-	-	-		29,585	17,991	532	121
Improved Pastures	-	-	-		267,650	36,592	9,794	2,387
Total								
Meat (cattle & sheep)	-	-	81		-	-	-	909
Milk	-	-	499		-	-	-	1,559

Source: Oficina de Estadisticas del Ministerio de Agricultura

- 50a -

Table 8 (continued)

Item	1968				1970			
	Area Ha	Yield Kg/Ha	Prod. M. T. (thousands)	Value Million S/.	Area Ha	Yield Kg/Ha	Prod. M. T. (thousands)	Value Million S/.
Rice	75,975	3,765	286	1,398	136,849	4,447	613	NA
Wheat	143,240	835	119	475	155,000	930	144	NA
Corn	316,140	1,685	533	1,790	370,000	1,620	600	NA
Potatoes	261,850	6,080	1,592	1,928	312,000	7,250	2,262	NA
Beans	54,655	725	40	275	75,000	920	69	NA
Cotton seed	-	-	166	-	-	-	-	NA
Forages	35,645	16,941	604	190	-	-	-	NA
Improved Pastures	291,920	36,391	10,602	3,435	-	-	-	NA
Total								
Meat (cattle & sheep)	-	-	77	1,394	-	-	78	NA
Milk	-	-	730	2,505	-	-	752	NA

Improved pastures are said to be in the same status as harvested forages. Improved technology is available, particularly for the Sierra, and benefits may occur if the technology is applied on a wide scale.

Red meat production shows no significant change from 1964 to 1970, but milk production has registered strong increases in 1968 and 1970. This coincides with a favorable government price to producers of milk.

Direct Cost of Inputs for Crop Production

The direct costs (exclusive of labor) are shown in Table 9, for 1966, for 7 crops in the 3 major regions of Peru. These may be interpreted in connection with the region where each crop is most important.

For rice, with major importance in the Costa and secondary significance in the Selva, the total direct costs (exclusive of irrigation water) were 4 times as high in the Costa. The biggest item responsible for this difference was the large cost of fertilizer in the Costa. Cotton in the Costa was twice as high in direct costs as rice, with major components being fertilizer and pesticides.

Cultivated pastures (primarily alfalfa) costs were 610 soles in the Sierra, and 1410 soles in the Costa. All components were higher in the Costa, but pesticides cost 5 times as much in the Costa as in the Sierra.

Beans were an important crop in all 3 regions, but costs in the Costa were 860 soles, in the Sierra 500 soles, and in the Selva 400 soles. Fertilizer was a prime contributor to costs in the Costa.

Potatoes are far more important in the Sierra than in the Costa; and input costs were only 2,130 soles per hectare in the Sierra as contrasted to 6,500 soles in the Costa.

It is significant to note (section D of Table 9) that cotton, potatoes, and rice are the crops requiring the greatest cash outlays for direct costs. Beans and cultivated pasture are intermediate in costs; and wheat and corn had the lowest costs in 1966.

Those crops requiring the heaviest cash outlays are the ones most likely to be affected in situations where market prices are uncertain, or are believed by the grower to be too low to permit a net return for growing the crop. In recent years, rice has been protected by a favorable government price to producers. Cotton has not been so protected because of world market conditions, and acreage has declined.

Use of Fertilizers in Peru

There has been a sharp drop in use of fertilizers beginning in 1964. This drop involved phosphates and potash, but not nitrogen, which has shown no marked trends. Since there are more reliable data on fertilizer usage year by year, during the 1960's, than another input it is interesting to compare Figure 11 with Figure 6 on per capita agricultural production. Fertilizer usage may be reliable indicator of the general application of known technology to crop production. The similarity in the decline in fertilizer use and in the index of agricultural productivity, is fairly close. Although one may question the specific causes of the decline in total agricultural productivity, it is possible to explain the reduced use of fertilizer. Fertilizer is a major

Table 9

INPUT DIRECT COSTS FOR SELECTED CROPS, BY REGIONS, 1966

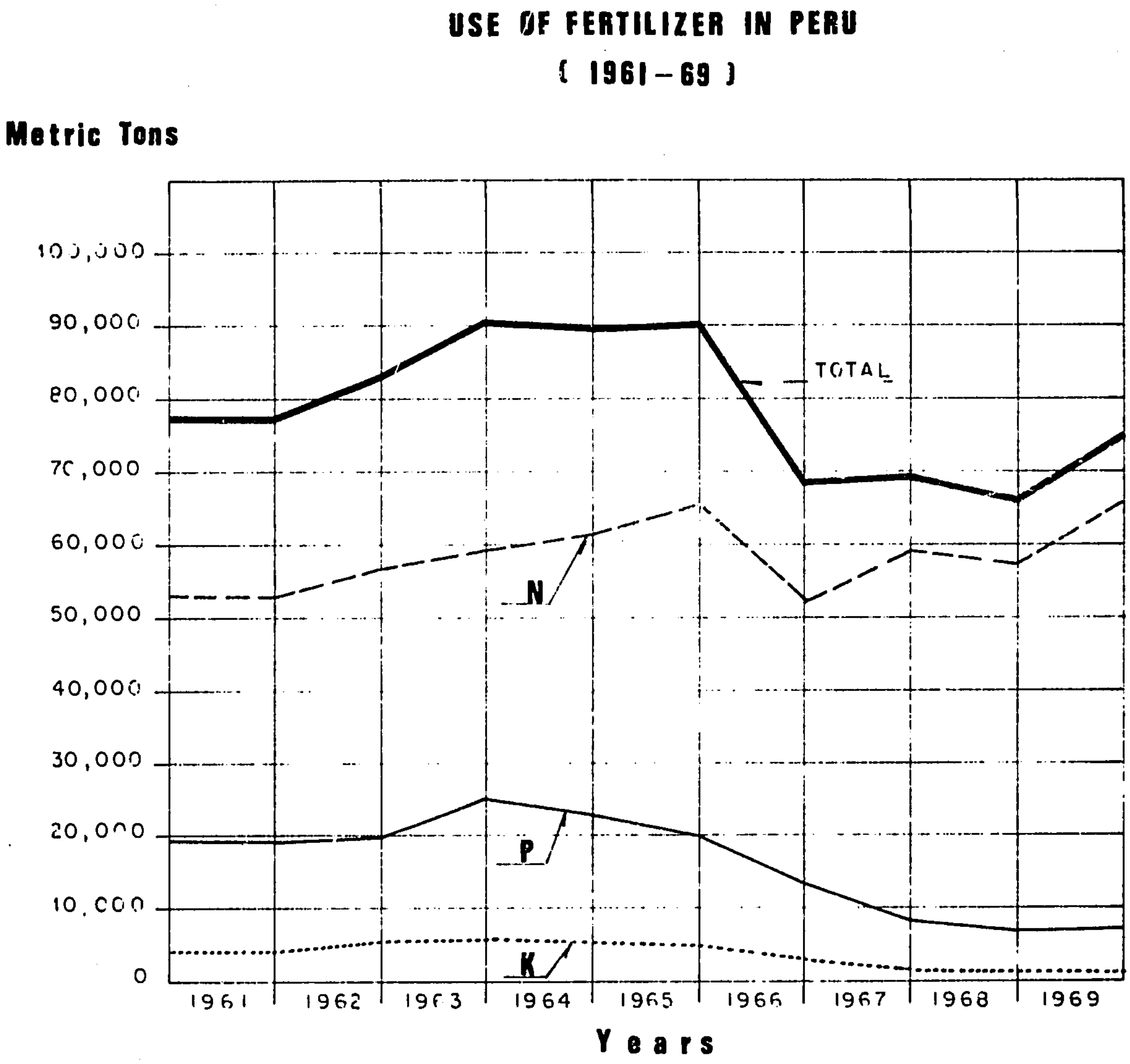
	Seed	Fertilizer	Pesticides	Fungicides	Tools	Gas and Oil	Other	Total Direct Cost Per Ha.
A. For the Coast Region								
Paddy Rice	270	640	-	200	150	-	-	1,260
Wheat	160	-	-	50	120	-	-	330
Corn	100	640	100	60	150	-	-	1,050
Beans	200	360	200	50	50	-	-	860
Potatoes	3,150	1,100	1,000	150	200	300	600	6,500
Cultivated Pasture (alfalfa)	150	160	500	100	300	100	100	1,410
Cotton	130	960	800	200	200	100	-	2,390
B. For the Sierra Region								
Paddy Rice	270	400	-	150	100	50	50	1,020
Wheat	240	40	-	50	50	-	-	380
Corn	100	16	50	50	50	-	-	266
Beans	200	-	200	50	50	-	-	500
Potatoes	1,500	80	100	200	150	50	50	2,130
Cultivated Pasture (alfalfa)	150	60	100	50	150	50	50	610

Table 9. (continued)

	Seed	Fertilizer	Pesticides	Fungicides	Tools	Gas and Oil	Other	Total Direct Cost Per Ha.
C. For the Selva Region								
Paddy Rice	150	-	-	50	50	-	50	300
Corn	150	-	100	100	50	-	-	400
Beans	200	-	100	50	50	-	-	400
Cotton	130	-	200	100	100	-	50	580
D. Average Costs for Peru								
Paddy Rice	239	474	-	161	125	-	13	1,012
Wheat	239	39	-	50	51	-	-	379
Corn	105	183	68	57	77	-	-	490
Beans	200	191	174	50	50	-	-	665
Potatoes	1,550	111	127	198	152	57	67	2,262
Cultivated Pasture (alfalfa)	150	80	180	60	180	60	60	770
Cotton	130	936	785	198	198	97	1	2,345

-54-

Figure 11



SOURCE: SENAFER

component of direct input costs, and farmers become unwilling to invest in fertilizer whenever they lose confidence in the possibility of recovering the investment when the crop is harvested. The decline in fertilizer use is, therefore, a direct measure of the farmers confidence in the profitability of farming. Although farmers may continue to grow the crop, costs are reduced by curtailing use of cash inputs as much as possible.

By this reasoning, one may conclude that lack of confidence in the profitability of farming has been a prime factor in the decline of agricultural productivity since 1964. The principal exceptions have been rice and milk, for which the government price to producers of both commodities has been high enough to insure the sustained interest of producers. Without these commodities, the drop in national agricultural productivity would have been even more drastic than has occurred.

Technical Training in Agriculture

The foregoing review of agricultural performance in Peru, must be supplemented by an evaluation of technical training in agricultural fields. Table 10 shows the total number of students registered in academic programs pertaining to agriculture. This number has grown from 1631 in 1960 to 5,350 in 1969; the total, in all Peruvian Universities.

In 1969, precise information reveals that a total of 441 professional degrees were awarded to students in academic programs pertaining to agriculture in the same universities. This amounts to 8.2% of those registered. Applying this optimistic percentage to

Table 10

TOTAL NUMBER OF STUDENTS REGISTERED IN ALL PERUVIAN UNIVERSITIES

FOR THE PROGRAM LISTED

Academic Programs	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Agronomy	1,196	1,328	1,605	2,268	2,171	2,305	2,812	3,180	3,090	3,354
Agricultural Engineering	-	51	86	114	213	281	479	517	518	435
Forestry Sciences	42	17	18	24	45	48	72	117	153	135
Animal Sciences	62	170	250	342	397	411	501	552	600	625
Veterinary Medicine	331	436	450	370	386	429	488	598	641	671
TOTAL	1,631	2,002	2,409	3,118	3,212	3,474	4,352	4,964	5,002	5,350
Estimated number of degrees awarded	134	164	196	256	263	285	357	407	410	439

-57-

each of the years 1960 - 1969, the total number of graduates in such academic programs was 2,911. It may be assumed that most of these graduates are now employed in agricultural fields within Peru.

It is clear that progress has been made in training the technical manpower required to implement a strong national agricultural development program. The number of trained professional personnel will continue to grow yearly as the universities continue to grow and produce graduates in agriculturally related academic programs.

Graduate Training

Prior to 1971, all training to the M.S. and Ph.D. levels was accomplished by sending selected individuals to universities in other countries, as follows:

	Training in the U.S.	
	At the M.S. level	- 222
	At the Ph.D. level	- 18
1960 - 1970	Total	- 240

The ratio of 2,911 trained to the B.S. level, to 240 trained M.S. and Ph.D. graduates, is considered in balance. However, the total number of such professional and scientific personnel falls considerably below levels generally believed to be adequate to meet minimum national needs.

Graduate Training in Peru

Training in the National Agrarian University, La Molina, is now moving into the graduate level. This training is being undertaken by the 6 educational programs that provide a major share of Ingenieros Agrónomos, Agrícolas, Forestales, Zootecnistas, and Economistas. The successful launching of training at the M. S. levels marks a new era, since all graduate training has previously been accomplished through U. S. Universities. This evidence of increasing maturity of UNA suggests that a majority of the graduate training in agricultural subject matter fields may soon be accomplished within Peru. With suitable support from the Ministry of Agriculture and the Ministry of Education, graduate training may be expanded rapidly to the level needed to meet national needs for such specialists.

Extension Training

The agricultural program at all levels, is dependant on the supply of trained manpower. These trained people are required for responsible positions in the Ministry of Agriculture, in the Agrarian Zones, in Agrarian Universities, in the Extension Service, and in agricultural businesses and industries.

At present, the Extension Service is manned as follows:

Ingenieros Agrónomos	160
Médicos Veterinarios	50
Sectoristas(Técnicos Agrónomos)	560
Mejoradoras del Hogar (Home Economics)	65
Total	865

This indicates that less than 1/4 of the extension specialists have been trained to the professional level; the remainder are sub-professionals, with special training up to 2 years beyond the high school level. As improved technology is used to increase agricultural productivity of the nation, the need for professionally trained people for the extension service may be expected to grow very substantially. Extension specialists should be well qualified in subject matter fields of production and marketing, and also have competence in dealing with rural people, individually and in groups. Training of fully qualified Extension personnel must keep pace with improved technology coming from research, and with production programs operated by the Ministry and Agrarian Zones.

D. Evaluation of Past Institutional and Policy Performance

It is evident that of the range of policy instruments at the disposal of the government, none have been used in a systematic way to influence performance in the agricultural sector; e. g. intensity, type, volume and location of production, nature of beneficiaries.

For example, the few price policies which have been applied were not articulated with the import, marketing, credit, or extension policies and programs.

1. Research

This activity has covered the full range of problems without real focus or specificity with respect to priority production needs of the country. While it would be impossible to establish a direct relationship between research carried out between 1960/70 and agricultural output over this period (or even a lagged relationship such as research in 1950/60 with 1960/70 production performance), it would appear that its impact has been minor, with one or two exceptions where it was combined with other elements; pricing, credit, and extension, to achieve a significant response, e.g. rice.

Thus, in explaining the relatively poor performance of agriculture in the decade of the sixties, research either before or during the period has played a neutral role. This is not to imply that the knowledge accumulated during the period may not have an important impact on production in the seventies if it is combined with elements needed to make the farmer both aware of the possibilities and motivated to adapt new technology.

Between 1960 and 1970 the goals for agriculture were vague to say the least, nor was there any effective mechanism whereby farmers needs could be transmitted to the research administrators via extension or credit channels. The foregoing should not be interpreted as an indictment of research. Nevertheless, a refocusing and concentration of research, along the lines outlined in this report, is considered essential.

In this regard economics research which bears upon agricultural performance is located in a number of diverse institutions - OSPA, UNA, INP, Banco Central, BFA, Dirección de la Reforma Agraria, and in the future the recently created Instituto de Investigaciones Economicas may play a prominent role. Consolidations and focusing of economic research on the priority problems is axiomatic to achieve progress.

One of the consequences of a research focus is the apparent fact that policies applied in agriculture over the period 1960/70, e.g. price control, irrigation and highway investment, agrarian reform, foreign trade, and credit, apparently were developed unrelated to economic research or evaluation. Thus, as in the case of biological research, it may be concluded that little, if any, of Peru's agricultural performance over the decade can be attributed to research in economics. A vague and indirect impact may derive from the research experience gained by people who subsequently become policy makers.

2. Extension

The extension service was reorganized four times between 1960 and 1970, and had a number of different ministers of agriculture and extension directors.1/ This instability in itself could have influenced effectiveness, moreover, it is hardly conducive to creating expectation of staff development and career advancement. Performance statistics available for the period 1963 - 67 show no consistent pattern, e.g. the number of farm families connected with extension ranged from 114,000 in 1963 to a peak of 177,000 in 1965, thereafter declining to 153,000 in 1967, (18% of total farms); treatment of cattle and sheep declined about 50% during the period while treatment

1/ To a lesser degree this same instability affected agriculture research, since this activity was incorporated with extension in two of the reorganizations.

of poultry tripled; fertilizer distribution increased, reaching about 20% of national consumption in the peak year 1965. 1/

In a correlation of extension expenditures and agricultural output by region no relationship was apparent. i. e. the implication is that if there is an impact from extension it is random in its effect, and suggests that any attempt to measure effectiveness would be confounded by other factors. Even multiple regression analysis including credit, and government investments yielded no significant correlation. 2/

While it might be assumed that 1960/70 agricultural performance would have been worse without the extension service; indications are that not meaningful evaluation can be made of extension effectiveness. In one study it has been assumed that there is a direct correlation between public expenditures and yield increases. i. e. about 0. 3 - 0. 5% annual increase in yields 1962 - 68 is attributed to expenditure in research and extension. By tripling this amount it is asserted that yield increase may be accelerated to 1 - 2% annually. 3/

1/ "Diagnostico del Sector Agropecuario", OSPA. Julio de 1969, cuadros 7-9.

2/ Unpublished study by Dr. H. Van de Wetering, IOWA Mission, OSPA, Lima, 1970.

3/ "Long Term Projections of Demand and Supply". op. cit. p. 10 and 124-127.

3. Credit

In the solution to agricultural production and productivity credit is a limiting resource. See Chapter 6 for a statement on the supervised credit program.

4. Marketing

The deficiencies in the marketing system as impediments to agricultural developments, are widely recognized in virtually every study of the sector; for example, inadequate storage and organization to deal with seasonal excess and shortages with resultant waste and price fluctuations of up to 200% during the year; inability to handle the year to year supply and demand situation further aggravating the precosiously unstable price conditions faced by farmers; inefficient elements in the system leading to wide margins. In spite of this long standing recognition of the problem, only in a few isolated cases was any progress made during the period 1960 - 70.

With the exception of rice and milk it may be reiterated that the chaotic state of marketing certainly acted as constraint on the 67% of total output which entered into commerce over the period.

Since the establishment of the Ministry of Agriculture in 1943, the marketing has been under the following offices: Superintendencia de Abastecimientos, Dirección de Economía Agraria, Corporación Nacional de Abastecimientos (CONAP), Corporación Nacional de Comercialización Agraria (CONACA), Dirección General de Comercialización y la Empresa Pública de Servicios Agrícolas (EPSA); the last two were created by Supreme Decree N° 17533 of March 25, 1969.

5. Irrigation Policy

Under the 1902 water law, copied from Spanish Law, the maximum rate of irrigation was set at 1 litre/second/Ha; no attempt was made to set total volume quotas. Further, certain historical water rights were recognized including preference to those with up-river property. There were many deficiencies in such an imprecise system which among other aspects resulted in larger land owners over-declaring their area and obtaining an excessive share of the scarce resource.

Estimated price was around S/.0.002 (1970) per M^3 of water which gave an obvious subsidy to the large users,[1/] and gave no real economic basis for allocating what is, in effect, the scarcest productive resource in the Costa. Thus, the structure (crop composition and intensity) of the most important segment of Peruvian agriculture (Costa) has stemmed from the faulty distribution of water rights and lax pricing policy, but the performance of agriculture over the decade is not attributable to water policy.

6. Rural Banking System

The Banco de Fomento Agropecuario was created by Supreme Decree 7273 of August 16, 1931. The functioning of the Bank is regulated by its Organic Law. A Directory appointed by Supreme Resolution executes the government of the Bank. The general policy of the Bank has been to help the low income farmers which are less able to get credit in commercial banks.. For the loans to these farmers, the Bank charges a rate of interest between 7-10%, and asks for less legal

1/ Under the 1969 water law the price will be raised to S/.0.01-0.02/M^3

requirements (they do not need to register their contracts at the Public Register Office and Mortgage Security). There are no limitations on loans which have met the basic legal and technical-economic requirements.

The Bank has been able to fulfill short run credit needs, but the coverage of long term credit demand has been limited due to the lack of funds. One of the main factors affecting long-term credit loans, appears to be uncertainty of repayment because of low returns in agriculture. A second consideration in coverage of support of agriculture is lack of spatial distribution of loans by regions and products. Recently, as a first approach to evaluate credit needs more broadly in 1971 and 1972 for each agency, projections have been made and the results are now in the process of being checked.

E. Projections of Agricultural Performance to 1975 and 1980

Two things stand out about the historic rates of productivity of Peru's agriculture: (1) food production per capita has been steadily declining (and may start declining at an increasing rate), and (2) Peru's index of agriculture production has been steadily declining with respect to most other major Latin American countries. In general terms, the reasons appear to be:

1. Failure to effectively transfer agricultural science and technology to the farm level;

2. Lack of a systems approach to organizing and implementing production and marketing in the rural sector;

Table 11 Actual and projected demand and supply of principal commodities by regions and the Republic, 1970, 1975 and 1980.

Commodity by Ecological Region	Production	Projected Domestic Apparent Demand		Projected Domestic Supply	
	1970	1975	1980	1975	1980
	1000 M. T.	1000 M. T.	1000 M. T.	1000 M. T.	1000 M. T.
COAST					
Beans (canary)	42.5	42.4	56.1	62.7	91.4
Corn (grain)	395.3	768.8	1140.4	572.2	824.3
Cotton (raw) 1/	9403.9	10208.7	12379.2	10208.7	12379.2
Rice (with hull)	403.6	533.8	713.5	509.4	640.2
Wheat	2.9	538.3	735.7	2.2	1.2
Tomatoes & onions	228.6	242.9	325.7	302.8	405.1
Poultry (meat)	24.3	45.0	65.0	35.1	51.3
Hogs (pork)	9.0	30.6	53.7	12.6	16.8
Cows (milk)	203.1	752.7	1097.9	241.5	286.9
HIGHLANDS					
Beans (broad	10.7	21.2	24.6	14.1	17.9
Potatoes	1548.7	1370.1	1544.2	1675.9	1780.7
Wheat	151.1	389.6	436.1	151.0	165.5
Sheep (mutton)	26.0	25.6	29.2	31.0	36.7
Cows (milk)	383.6	338.5	391.2	456.3	591.9
JUNGLE					
Bananas	590.1	381.3	486.4	754.1	974.9
Rice (with hull)	80.8	61.8	82.3	102.6	127.8
Cattle (beef)	5.9	19.3	28.2	6.9	8.1
Cows (milk)	13.4	30.7	47.0	16.0	19.0
REPUBLIC					
Bananas	590.1	266.6	992.8	754.1	974.9
Beans (canary & broad)	68.5	112.3	133.2	110.9	163.8
Cotton (raw) 1/	9511.5	10208.7	12379.2	10208.7	12379.2
Corn (grain)	725.0	1012.3	1501.5	987.7	1493.0

Continued (Table 11)

<u>REPUBLIC</u>					
Rice (with hull)	487.0	701.4	893.9	699.0	921.0
Potatoes	1656.6	1957.3	2206.3	2026.5	2260.0
Tomatoes & onions	228.6	303.7	406.2	302.8	405.1
Wheat	154.0	955.9	1214.1	174.2	199.1
Cattle (beef)	89.2	139.9	196.8	104.7	122.5
Cows (milk)	600.1	1121.1	1536.1	713.8	847.8
Hogs (pork)	71.4	105.6	146.8	100.3	133.4
Poultry (meat)	32.7	47.9	69.7	47.2	69.0
Sheep (mutton)	26.5	32.0	37.7	31.0	36.7

1/ In 1000 of quintales; 1 quintal is 46 kilos.

Source. - Dr. H. Van de Wetering, IOWA Universities Mission to Peru.

Table 12 Projected apparent demand in 1975 by urban, rural, subsistence and other components by commodities and regions.

Commodity by Ecological Region	Projected Apparent Demand 1975					
		Rural		Seed	Industrial and Animal	Losses
		Commer.	Subsist.			
	1000 MT.	1000 MT.	1000 MT.	1000 MT.	1000 MT.	1000 M. T.
COAST						
Beans(canery)	34. 2	11. 9	0. 5	3. 4	-	4. 8
Corn (grain)	30. 9	8. 0	-	11. 0	687. 9	31. 0
Cotton (raw)[1/]	-	-	-	-	10208. 7	-
Rice (with hull)	412. 9	76. 2	7. 8	10. 3	-	25. 6
Wheat	427. 9	85. 3	-	-	-	27. 1
Tomatoes & onions	174. 9	31. 7	-	-	-	36. 3
Poultry (meat)	42. 7	-	0. 9	-	-	1. 4
Hogs (pork)	26. 2	2. 2	2. 2	-	-	
Cows (milk)	680. 8	59. 6	-	-	-	12. 3
HIGHLANDS						
Beans (broad)	6. 6	4. 5	5. 5	1. 9	-	2. 7
Potatoes	278. 3	485. 6	257. 7	206. 8	-	141. 5
Wheat	191. 4	101. 6	62. 1	13. 3	-	21. 2
Sheep(mutton)	10. 4	6. 7	7. 0	-	-	0. 4
Cows(milk)	111. 8	81. 8	88. 3	-	12. 1	44. 2
JUNGLE						
Bananas	71. 0	141. 7	116. 0	-	-	52. 6
Rice (with hull)	28. 6	18. 4	7. 7	2. 0	-	5. 1
Cattle (beef)	6. 0	8. 1	4. 3	-	-	0. 9
Cows (milk)	19. 9	2. 0	7. 1	-	-	1. 7
REPUBLIC						
Bananas	296. 6	297. 8	-	-	66. 5	105. 7
Beans(canery & (broad)	49. 5	33. 6	-	5. 3	-	7. 5
Cotton (raw)	-	-	-	-	10208. 7	-
Corn (grain)	43. 8	244. 8	-	18. 1	659. 6	51. 0
Rice (with hull)	521. 3	131. 7	-	13. 8	-	34. 6
Potatoes	579. 8	895. 0	-	285. 8	1. 2	195. 5
Tomatoes & onions	217. 9	40. 4	-	-	-	45. 4
Wheat	620. 6	274. 0	-	13. 2	-	48. 1

Continued (Table 12)

REPUBLIC						
Cattle (beef)	109.9	23.1	-	-	-	6.9
Cows (milk)	812.5	238.8	-	-	82.1	58.2
Hogs (pork)	40.2	60.3	-	-	-	5.1
Poultry (meat)	45.4	0.9	-	-	-	1.4
Sheep (mutton)	2.6	27.8	-	-	-	1.6

Table: 13 Projected deficits and their on farm value of principal commodities by regions and the republic, 1975 and 1980.

Commodities by Ecological Region	Projected Deficit		On Farm Value of Deficit 2/	
	1975	1980	1975	1980
	1000 M.T.	1000 M.T.	Million $	Million $
COAST				
Beans (canary)	20.3	35.3	2.5	4.3
Corn (grain) 1/	-196.6	316.1	12.2	19.6
Cotton (grain)	-	-	-	-
Rice (with hull)	-24.4	-97.7	-1.8	-7.3
Wheat	536.1	-734.5	-40.1	-54.9
Tomatoes & onions	59.9	80.1	2.1	2.8
Poultry (meat)	-9.9	13.7	4.8	6.6
Hogs (pork)	18.0	36.9	-6.5	13.3
Cows (milk)	-511.2	-811.0	-36.6	-58.1
			-97.4	-152.7
HIGHLANDS				
Beans	-7.1	-6.7	-0.9	-0.8
Potatoes	305.8	236.5	16.6	12.8
Wheat	-238.6	-270.6	-17.9	-20.3
Sheep (mutton)	5.4	7.5	2.0	2.8
Cows (milk)	117.8	150.7	8.4	10.7
			8.2	5.2
JUNGLE				
Bananas	372.8	488.5	9.3	12.2
Rice (with hull)	40.8	86.3	3.0	6.3
Cattle (beef)	-12.4	-20.1	-5.5	-8.9
Cows (milk)	-14.7	-28.0	-1.1	-2.1
			5.7	7.5
REPUBLIC				
Bananas	-12.5	-17.9	-0.3	-0.4
Beans (canary & broad)	-1.4	30.6	-0.2	3.8
Cotton	-	-	-	-
Corn (grain)	-24.6	-8.5	-1.5	-0.5
Rice (with hull)	-2.4	-27.1	-0.2	2.0
Potatoes	69.2	53.7	3.7	2.9
Tomatoes & onions	-0.9	-1.1	-	-
Wheat	-781.7	-1015.0	-58.5	-76.0

Continued

REPUBLIC				
Cattle (beef)	-35.2	-74.3	-15.6	-32.9
Cows (milk)	-408.1	-688.3	-29.2	-49.2
Hogs (pork)	-5.3	-13.4	-1.9	-4.9
Poultry (meat)	-0.7	-0.7	-0.3	-0.3
Sheep (mutton)	-1.0	-1.0	-0.4	-0.4
			-104.4	-155.9

1/ In thousands of quintales; 1 quintal = 46 kilos

2/ Using 1966 farm gate prices and a conversion of 38 soles to 1 U.S. dollar

Source: Dr. H. Van de Wetering, IOWA University Mission to Peru.

3. Failure to develop and effectively utilize the obvious inherent potential of the human and physical resources of the Sierra and the Selva.

Peru's rural sector has the capacity to adequately feed the country, and more. It has the capacity to add strikingly, and substantially to rates of growth of Gross National Income, to help affect imports of food items, to become an important contributor to export trade, and to utilize its comparation advantage in several commodities in inter-regional trade in Latin America. Nevertheless at this point in time the rural sector is dormant, if not stagnant, not exhibiting much more capability than feeding itself, and except for a need for cash earnings, would very likely be making less. That this is probably true is supported by the demand and supply projects of selected commodities, by region and in total to 1975, and to 1980 (Table 11). While the projected total supply of each commodity is shown as increasing in Table 11 the actual supply per capita of population will decline unless agricultural production makes growth faster than the population increases.

Social and Economic Consequences of a Continuation of Past Trends

The national distribution effect of the projected supply deficits is readily seen in Table 13, projected apparent demand, urban, rural agricultural uses, and losses, to 1975. Table 12 indicates that only about 27 percent of the agricultural food commodities are available for urban consumption (73 percent of what is produced remains in the rural sector). This is a rather significant relationship when it comes

Table 14 Projected labor requirements and the average annual rate of increase in farm employment for selected commodities in regions

Commodity by Ecological Region	Labor Requirements for Cultural Practices 1975	Labor Requirements for Cultural Practices 1980	Average Annual increase in Labor requirements
	million mandays	million mandays	million manyears
COAST			
Beans (canery)	2.0	2.6	441
Corn (grain)	8.7	10.9	1618
Cotton (raw)	22.2	22.8	441
Rice (with hull)	14.4	17.4	2206
Wheat	-	-	-
Tomatoes & onions	2.1	2.7	441
Poultry (meat)	.3	.4	73
Hogs (pork)	.1	.1	-
Cows (milk)	.8	1.0	147
HIGHLANDS			
Beans (broad)	3.6	4.0	294
Potatoes	35.1	36.0	662
Wheat	6.5	6.8	221
Sheep (mutton)	2.5	3.0	368
Cows (milk)	4.4	5.2	588
JUNGLE			
Bananas	4.3	5.6	956
Rice (with hull)	3.7	4.2	368
Cattle (beef)	.2	.2	-
Cows (milk)	.1	.1	-
REPUBLIC			
Bananas	4.3	5.6	956
Beans (canery & broad)	6.8	8.3	1103
Cotton (raw)	22.2	22.8	441
Corn (grain)	35.9	40.6	3456
Rice (with hull)	16.6	19.8	2353

Continued

REPUBLIC			
Potatoes	35.8	36.6	588
Tomatoes & onions	2.1	2.7	441
Wheat	6.8	7.1	221
Cattle (beef)	4.3	5.6	
Cows (milk)	5.3	6.3	735
Hogs (pork)	.5	.7	147
Poultry (meat)	.3	.4	74
Sheep (mutton)	2.5	3.0	368
	139.3	154.1	10883

Note: 1 man year is 272 work days; the commodities listed represent 33 percent of total labor requirements; each year as additional 44 thousand persons must find employment in agricultural activation in rural areas; the commodities listed provide jobs for 25 percent of the annual increase in the farm labor force.

to projecting food supply availability for urban consumption both on a per capita, and on a price cost basis.

Higher food costs can reasonably be projected for the future, much less food will be available for the urban consumer on a per capita basis, with the heaviest effect following upon the lower income segment, the largest portion of the urban population. With regard to supplies available for rural (commercial) and urban consumption it is well to point out that 18-20 percent of total food production is absorbed by on farm subsistence requirements and losses. An additional 14-15 percent of production (cotton excluded) goes to industrial and animal uses. Thus 30-35 percent of food production (except a percentage thru animals) never reaches a commercial market channel.

The economic meaning of the above to the urban consumer is particularly significant in terms of perspective costs. A corresponding cost also arises at the farm level. The sales opportunity lost is a farm value deficit. This farm value deficit for the 12 commodities considered (Table 14) amounts to 104 million (U. S.) in 1975, and 156 million (U. S.) in 1980. Considering that there are about 60 agricultural commodities, these figures provide an indication of the size of the farm value deficit being experienced.

Employment and Income Distribution

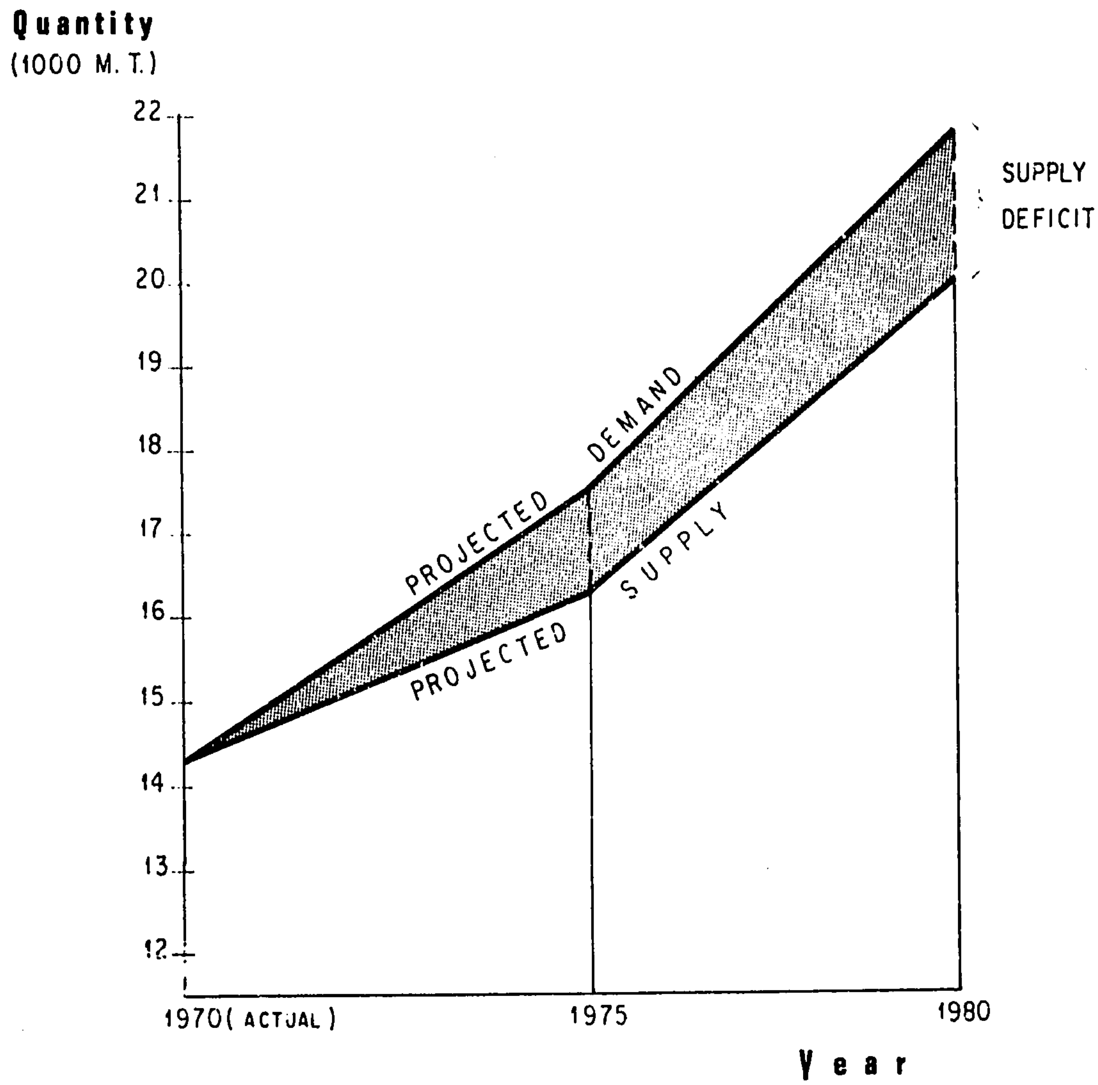
This deficit reflects negatively also, upon rural employment and rural income distribution. To provide an indication of the losses in employment and wages the labor requirement to make up the projected supply deficits were calculated. On the basis of the employment losses due to the supply deficit, a loss in wages of 52 million (U. S.) was estimated for 1975, and a wage loss of 62 million (U. S.) was estimated for 1980.[1/] In these and the above terms, the supply deficit sums up to have a significant economic impact which translates itself to the consumer as: less food and higher food price; to the producer as a farm value deficit; and to farm labor as a loss of employment and wages. The country losses in terms of Gross National Product, and; thereby, health, education, and social welfare also are losers.

In making the projections in Tables 11, 12, 13 and 14, demand, domestic food supply plus imports, and price were accepted as being in equilibrium. The demand deficit projections were made holding imports constant at 1970 levels. The perspective on the projected supply deficit is provided by Figure 12. Additional prospective is provided by taking one of the commodities and expressing the farm value of the deficit in supply of that commodity as a percentage of import costs. Taking the 1969 import costs of milk and dairy products ($11. 9 Million), the farm value of the projected deficit of milk and dairy products is 2. 4 times this base point in 1975, and 4. 1 times 1969 import values in 1980. At the same time imports must be paid for, therefore, the real cost to Peru of supply deficits is the amount of farm value deficit plus the cost of imports of each deficit commodity.

1/ Based upon an estimate that labor costs are 40 percent of total variable costs

Figure 12

Relation of projected domestic demand and supply 1970 - 1980, with farm value 1975 and 1980 of the supply deficit of 12 selected commodities



It is not possible, at least theoretically, to avoid this cost by not importing food. Without imports, prices will increase so the consumer has the choice of taxes to pay for imports on the one hand, or higher food prices on the other. Export-Import trade offs may be possible but these do not appear immediately in Peru's present agricultural picture.

CHAPTER IV
PRESENT STATUS AND RESPONSIVENESS OF PERUVIAN AGRICULTURE

A. Projected Responsiveness of Peru's Agriculture

The basic question is whether Peru's agriculture has the capacity to achieve a 6.9 percent increase in productivity by 1975, and a 7.86 percent increase by 1980 (a 5.6 percent annual aggregation rate, approximately). Without major organic changes in agriculture coupled with providing incentives, Peru's agriculture cannot possibly achieve these rates. The following argument is offered in support of this conclusion. The essence of the argument is based upon the state of agricultural science and technology now in place.

The following table estimate the stage of development of farms, and follows these estimates with what this means in terms of production responsiveness.

Estimated Percentage Farms in Each Production Stage

Stage	Type	Percent of Farms
I	Modern Commercial	Less than 1
II	Transitional	Less than 25
III	Largely subsistence	75, or more

Stage III, and to a large extent stage II farms depend more upon labor and traditional practices, and less upon purchased inputs and capital investments in farm structures, machinery, and equipment. The rate of responsiveness of such farm types tends to be slow, especially in the begining, even with price and yield incentives, as new managerial and technical skills are learned. This lag in responsiveness continues well along in the production development cycle to the point where scale capacity, either extensive or intensive exists. Fundamental concepts of modern, responsive agriculture depend upon adequate farm capital formation, sufficiency of mechanization, and, above all, adequate managerial capacity. In these terms it does not appear that Peru's agriculture possesses a high coefficient of immediate response capability. Therefore a 5.6 percent annual aggregation increase in agriculture productivity would not be predicted even if all other factors were favorable.

For the longer run the ability of the rural sector to generate needed food and fiber will depend considerably upon:

1. Improvement of procedures to impart science and technology to agriculture, and the ability to develop modernized production - marketing systems.
2. Acceptance of the principle of maximizing costs and maximizing production advantages for individual commodities of each region, and integrating the regions into a national production system.
3. Willingness to allocate public expenditures in sufficient amounts to create the necessary institutional and infrastructural framework, to provide the mechanisms without which effective production and marketing systems cannot be developed.

With regard to point 3, above, the projected rates of public expenditures do not appear to be sufficient in amount to achieve a 5.6 percent annual increase in agriculture, particularly in view of the projected response lag. Given the time lag projected, it is important to isolate the causes, and to determine which can be affected most immediately. While capital investments and credit are needed, returns to the following human factors appear to have high response potential: (1) producer skills and production psychology, and (2) incentives and motivation. These areas appear profitable for public expenditure support. In a direct sense Agrarian Reform can be an effective way of dealing with social psychology as well as economic incentive. However, the institutionalizing of agrarian reform is but the first step in a continuous process. Agrarian reform needs financial and technical assistance, and markets, to succeed. And the ultimate success of agrarian reform depends upon adequate capital formation, and economic efficiency. However, the preceptive approach also remembers that the human variable is not a technological input of the production process, such as seeds or fertilizers might be considered.

Various reports indicate that public expenditures in agriculture are to be increased from present low levels to about 7.5 percent of the annual budget of the government. The overall production impact effect of even increased expenditures will depend, as indicated, upon how the funds are spent, e.g., upon large dam complexes, instead of transport, markets, and storage; or, price support of traditional practices instead of financial support of innovations such as agrarian reform.[1/]

B. Present Status of Agricultural Technology to Support Efficient Production

1. The present agricultural setting

The progressive agricultural development desired in Peru, may be evaluated with respect to the major ecological zones, the dominant commodities involved, and the nature of the farming systems. The 3 major ecological zones are the Costa, Sierra, and the Selva. The dominant commodities are red meat (cattle, sheep, and goats), pork and poultry, milk, rice, wheat, beans, potatoes, corn. Maize, grain sorghum and forages must be considered as components of the livestock commodities. Secondary products are vegetables, fruits, manioc and sweet potatoes. (The industrial crops of coffee, tea, sugar, rubber, palm oil and cocoa are a separate category of products that are presently grown in plantation systems, apart from farming systems that are based on tilled crops and forages.)

Focusing on the dominant commodities, it is important to examine the status of the technology of production for each of these,

1/ The estimated public expenditure requirement to reverse the decline in agricultural productivity and achieve rates of production commemorate with demand is 15-20 percent at present food import levels.

to estimate the current availability for enterprises, of improved practices and procedures that could be combined into a "package" to achieve greatly enhanced productivity for each commodity. This type of evaluation is a prelude to organizing campaigns of production similar to those conducted successfully for the "Miracle" rice, wheat and maize crops in various other countries of the world. A successful campaign with individual commodities has proved to be a sound basis for extending improved technology to other commodities, thereby strengthening the economic status of farmers in those regions. Campaigns for more efficient production of any commodity do not appear likely to succeed unless the "package" of improved production practices will give substantially greater returns than the current methods of culture.

In estimating whether an assembled "package" of practices is likely to attract farmers, an arbitrary figure of 40 to 50% improvement in yield of crop (or livestock product) above present yields has been suggested. It is recognized that a proposed "package" of improved production practices must be field tested under actual farming conditions, for observation on performance and for dependability, after the package has been assembled from various lines of research. The production package must be accompanied by an effective program of marketing and price support, before it is worthwhile to attempt to exploit production technology. Also it is recognized that an

Extension type program of farmer education and guidance is needed to exploit a genuinely superior package of production practices. However, the first step in the exploitation of science and technology may well be that of judging the effects of currently available technology as seen in research results when integrated into a production system. If currently research results are not sufficiently complete to deal with all of the major limiting factors of production, then the identified constraints should be the subject of further research.

With crop commodities, a major breakthrough has often occurred elsewhere in the world, when a breeding program for the crop species has produced types (varieties, hybrids, composites,) that are high yielding because of better adaptation to soils and climate of a region, that have substantial resistance or tolerance of pests (diseases, insects, nematodes), and have great capacity to respond to improved fertility and use of fertilizers. With such types, the cultural practices may be adjusted to exploit the superior crop plant types. These practices include crop protection, suitable planting dates and density of plant population to achieve high yields, and harvesting practices to save all of the crop produced.

With livestock projects, the dominant factor is often the availability of nutritious feeds that meet nutritional needs of the animals. However, other factors are the control of serious animal diseases, the husbandry or management of animals to insure success with reproduction, growth, and production (for milk, eggs, meat), and the improvement of the genetic base for the livestock species. Greatly improved productivity per animal, and for herds and flocks, are possible when all major types of limiting factors are dealt with simultaneously in a "package" of improved practices, so that no factor is allowed to block the benefits of effective practices.

A "package" of improved livestock production practices, must be tested under farm conditions and proven to be substantially superior to current practices. If superiority is not great enough to be attractive to producers, further research is needed to deal with apparent limiting factors, whatever they may be, before a better "package" can be assembled and field tested. An evaluation of the present technology for livestock production should be useful in orienting research programs, as well as testing production potentials potentials.

The marketing component of every livestock enterprise must accompany the production components. Animal products are highly perishable, and the marketing system must provide ready access to the consumer, at prices that constitute an incentive to the producer, to support a production campaign.

The objectives in seeking to increase productivity per hectare or per animal unit, is to achieve lower production costs per unit of the commodity, so that the farmer has a better opportunity to achieve substantial returns for his efforts and expenditures. Such rewards to the producer will in turn, improve the economic strength of the community; and serve the urban and industrial sectors by providing the desired foodstuffs in the volumes required to meet market demands. Thus, the field testing of a "package" of improved practices should include evaluations of the effects of higher production on the apparent cost of producing each unit. Unless unit costs of production are reduced from those prevailing in the region, there is doubt that the "package" is worthy of a campaign to introduce it into an agricultural region.

Few of these features appear to exist with respect to the present status of Peru's agriculture. Certainly, an integrated system which effectively relates and applies these factor considerations in an effective production - marketing sequence for crops and for livestock does not exist on a regional, or local, basis in the rural sector.

C. Production - Marketing Systems, Project Selection, and Project Implementation

Regional Production Opportunities

1. Costa

(a) Production of poultry and pork, on feed from grain sorghum and maize produced locally. The technology for these enterprises appears adequate for success. There has been a strong movement by farmers on these crops and enterprises since 1969; and no government action appears necessary to sustain continued expansion. Marketing of pork and poultry is unhampered by government regulations; and the demand in cities seems capable of absorbing these products for some time to come.

The possible yields of sorghum and maize are relatively high since the introduction of improved hybrids, and the adoption of adequate fertilizer and good cultural practices. The breeds of poultry and swine are productive, and disease are rather easily controlled. Both pork and poultry enterprises are suited to small holder operations as well as to large scale operations.

Grain yields of maize may be raised from the present average of 2700 kg/ha to about 6000 kg/ha by the application of the package of improved production practices. Yields of grain sorghum up to 8000 kg/ha have been produced by better farmers on the coastal region. These grains are being purchased by feed companies, and processed into suitable rations for both poultry and swine enterprises.

(b) Finishing beef animals on by-products and coarse forage: the feedstuffs available for finishing beef includes corn green chop or silage, corn and sorghum stover fed green or ensiles after grain harvest, green Napier grass, corn cobs and urea, molasses, cane tops (on sugar plantations), wheat bran, rice bran, cotton seed cake, and alfalfa. It is possible to formulate adequate rations from such feedstuffs, to support the economic growing and finishing of cattle. These cattle are largely male calves and young bulls from the dairy herds, or young stock and cows from the Sierra.

This type of enterprise is best suited to feed lot operations, rather than small-farmer production. It is not labor intensive. Animal disease control is an important problem, particularly control of foot and mouth disease. The outbreaks of disease appear to have constituted a major constraint, in that the occasional losses are severe economic shocks, and the necessary animal health services are economic only when there is a comparatively large scale operation. The formulation of adequate feeding rations from the locally available feedstuffs, requires the services of technicians that are competent practical animal nutritionists; and such assistance is not yet readily available to small operators.

There is now a growing feed grain industry, that purchases grains and formulates concentrate feeds to supplement forages for finishing beef cattle. Also, farmers in many areas of irrigation projects are producing green forages for sale to finishers of cattle. Maize green chop, sorgo-sudan hybrid forage, and green Napier grass may be purchased directly from farmers, as well as alfalfa. The availability of such feeds gives flexibility to the operators of beef enterprises, in providing feeds to supplement the available coarse forages and by-products in feeding operations.

(c) Milk Production - Lima area; this enterprise is successful, and will doubtless continue and expand as long as the present price for milk is maintained. Both large and small herds may operate successfully in the fluid milk market, wherever appropriate feed is available. Concentrate feeds that use wheat bran, rice bran, molasses, urea, grains, (maize and sorghum), cotton seed cake, and other locally available feeds are now formulated and marketed by private feed companies.

The Holstein - Friesian dairy breed is most commonly used, and semen from bulls are available for artificial insemination. The herds are generally held in pens, and feed is carried to the animals. Green chop maize and sorghum, Napier grass, and alfalfa may be produced efficiently in this area on a year-round basis to supply much of the ration required for milk herds.

The close control of milking herds makes it possible to deal promptly and continuously with disease and health problems (tuberculosis, brucellosis, mastitis, etc.). The sanitary measures necessary for production of clean milk, are not difficult to achieve in this climate. Heifers for replacements may be produced in conjunction with milking herds, and the males and excess females may be marketed for beef production.

The average milk yields per cow, and the efficiency in producing and using feeds, are capable of very substantial improvement through the wider application of well established technology. There appears to be abundant opportunity to increase total milk production at reasonable costs without any increase in number of cows, and with only moderate increases in feed production. With the present favorable price for milk, it seems likely that expansion of the dairy industry to other new producers will continue without any other government support than maintaining the price for milk. The milk supply is not critical for the urban population, since reconstituted milk from imported milk powder is being produced and sold at prices considerably below the price for fresh fluid milk, and this provides milk at lower prices for the poorer sector of the population.

Milk production has expanded in recent years. This has occurred despite the limited adoption of improved technology by the industry as a whole. The assumption might be made that growth in total milk production has occurred because (a) there has been a sustained favorable price relative to production costs, and relative to other farm enterprises, and (b) there has been enough stability in the market to generate confidence on the part of producers so that they will actually reap the rewards of greater efforts and personal investments in the production activities. It does not seem possible to either prove or disaprove this assumption, but there is a definite association between the economic stability of milk markets and enlargement of total milk production.

Any adverse disturbance of the milk market could quickly negate past growth of milk production. Regulation of the milk industry to provide equitable returns to the producers and to the processors and distributors is necessary if the consumer is to be well served in terms of the volume of milk needed to meet the demand. In the longer run, reductions in price per liter of milk must be made possible by increased efficiency of processing and distribution as well as in economical production. Any arbitrary reduction in milk price by official edict, with the intent of improving the lot of poorer people, might actually weaken the production and marketing structure for milk, and thus defeat the objectives of providing a nutritious food at lower prices.

Stability of prices and markets currently appears more important than available technology or its application, in fostering growth in milk production.

It is believed that the conditions of milk production described for the Lima area, are generally applicable to milk producing areas in the vidinity of other major cities.

(d) Rice (in Costa) the production of rice in the Coastal region has increased from 61,500 hectares in 1960-1964 to 83,000 ha. in 1970. In recent years there has been a rapid development of rice production in the Bagua - Jaen area of the high Selva, amounting to 20,000 hectares by 1970; this development may ultimately affect rice production in the Coastal region. Rice production has been encourages by the GOP through a regulared price of 5.07 soles per Kg paid to producers in the Coastal region.

The rice research station at Vista Florida, Ferreñafe has shown that improved strains derived from IR 8 will yield 11 M.T. per hectare on experimental fields, and 7 to 8 M.T./ ha. on farmer fields, in contrast to an average of 5.0 M.T./ ha. from the local varieties still grown on 80% of the total rice area of the Lambayeque Department. The improved yields are produced with 320 kg/N fertilizer per hectare, which is about double the N fertilizer customarily used by farmers on local varieties. It appears that average farm rice yields may be improved by about 50%

by a combination of land leveling to improve irrigation water distribution, use of an improved variety, adequate N fertilizer, and timely planting to make most effective use of the warm season. Net returns by practical farmers are greatly increased by this regime of culture.

In 1970, rice production in the entire country appears to have met all domestic requirements for rice. The opportunity to substantially increase rice production in the Lambayeque Department with the increased supply of irrigation water from the Tinajones dam, plus the rapidly growing production in the Bagua - Jaen area of the High Selva, and the potential for increased rice production by application of improved technology in other areas, seems to insure adequate national production of rice. This estimate assumes a rapid spread of new technology (improved varieties, adequate use of N fertilizer, and suitable cultural practices) and an assured market outlet at prices that provide an incentive for rice producers. With regard to the price paid to producers, the 1970 GOP decision (since rescinded) to reduce the official price from 5.07 soles to 4.10 soles per Kg. in the Selva rice growing areas, is an unfavorable element. Rice growers in the Selva have to contend with increased transportation costs to reach market as compared with producers in the Coast regions. Such pricing decisions create lack of confidence by growers in the maintenance of economic stability needed to achieve a net return above production cost. Without such confidence, producers are unlikely to expand rice production, and may actually produce a lesser amounts through failure to fertilize or to provide other purchased inputs.

(e) Beans (in Costa), there appears to be adequate technology now available to implement a substantial increase in bean production in the coastal region. Improved varieties are available; fertilizer needs are known; plant protection is feasible; and cultural practices required for relatively high yields have been worked out. Beans are best suited for use as a winter crop, in rotation with summer crops. With improved varieties, a crop can be produced in 3 months; permitting 2 bean crops in about 6 months of late fall, winter and early spring. The total value of improved bean crops will compare favorable with the alternative crops of maize for grain, grain sorghum, maize green chop, sorghum-sudan hybrids for green feed, and Napier grass or alfalfa as green feed. This favorable position for beans apparently will prevail even when improved practices are followed to produce higher yields of the feed grains and forages. The bean crop should continue to be a desireable alternative winter crop in the Coastal region, that has different market outlets than feedstuffs, and would therefore, provide diversity in the farm business.

2. The Sierra

Agriculture in the Sierra region is strongly conditioned by the generally high altitudes that make the climate relatively cool to cold; the reduced rainfall on mountain and valley slopes facing the west, and the sustained dry season for about half of each year. The comparatively rugged land reduce arable land to less sloping river valleys and high plateus; other lands are suitable for natural pastures only. Transportation and comunications for marketing of commodities and for social services are very difficult. There are very few roads that accomodate wheeled vehicles, and most movement of people and things must be accomplished by human transport or small loads on llamas and donkeys.

The major commodities (other than subsistence) that enter the local market economy, or are moved to urban centers, are sheep, beef cattle, milk at certain centers, potatoes, wheat, beans and broad beans.

Livestock

Sheep and beef cattle are produced principally on native pastures. These pastures are quite low in their ability to support livestock; averaging only about 0.13 animal units per hectare. (one animal unit = 1 mature cow or bull, or 5 sheep). Research has now been conducted,for Sierra pasture improvement by controlled grazing and fertilization, that promises increased carrying capacity by ten-fold. Controlled grazing requires a consistent program of herding or fencing to insure adjustment of livestock numbers to carrying capacity of the pasture forage, and the application of nitrogen fertilizers at least once per year. Fertilizer use involves purchase, transport and hand spreading, and this becomes practicable only when livestock owners or herdsmen take group action. Technology and management appear to be the key factors in feed production on natural pastures of the Sierra.

The profitability of sheep enterprises has been at low ebb in recent years because of the low world price for wool. The re-orientation of sheep enterprises to the production of meat, with wool as a secondary by-product, should greatly improve the economic status of sheep producers. The objective should be production of lambs for market, using improved natural pastures as primary sources of feed. Most of the 14 million sheep are now low in productivity, with a yearly lambing rate of about 85%, in contrast to 135% in more developed areas elsewhere in the world. Poor feed supply has been a prime limiting factor in sheep production, and improved pastures should permit a sharp increase in lambing rate, as well as maturing lambs for market in about 1 year when supplementary feed is available in the dry season, or 1 1/2 years without supplementary feed. Culling and sale of non-producing ewes, and sale of all non-essential rams will permit utilization of available pasturage for useful meat production.

Although sheep are well adapted to high altitudes and steep pastures, disease control will remain an important factor. Animal health measures to control parasites, infectious diseases, and nutritional problems are more easily handled when sheep are produced in large units, such as cooperatives would provide, under centrally controlled management. In general, the technology of disease control is known; and application depends on availability of trained technicians.

Reorientation of marketing procedures and practices to facilitate sale of lambs for meat, is a highly necessary component of profitable sheep enterprises. There is a market demand for mutton in urban centers, and this market may grow as channels of regular supply are developed, and the better quality of meat for young sheep is more common. Unless this market is developed so that the producer receives a fair return for his product, there will be no justification for fostering sheep production in the Sierra.

Beef cattle may be produced in conjunctions with sheep on native pastures, except at higher altitudes where alpaca are better adapted than cattle. Cattle and sheep may be grazed in sequence on the same pasture since their preferences for forage species are complementary rather than competitive. The use of both animal species makes more efficient use of total forage, and this grazing system becomes feasible under centrally controlled management such as that provided by producers cooperatives. With improved pastures it should be feasible to grow beef animals for market in 2 or 3 years, with higher market weights than are now achieved in 5 years or longer. To concentrate on production of beef by the most efficient use of pastures and forage, herds should be culled to remove all excess bulls, and barren or weak cows. The herd should consist principally of breeding cows, and of young animals being grown for market.

Beef production in the Sierra will be greatly improved by the use of cultivated pastures or supplemental feed crops (green chop corn or sorghum, or sudan-sorgo hybrids) to carry stock through the dry season without weight losses. This type of husbandry is more easily handled by central management of enterprises than by individual small producers.

Finishing of beef animals for the urban coastal markets may be accomplished in the coastal areas for animals that may be transported from the Sierra by practicable means. This type of arrangement would permit sale of animals from the Sierra at the end of the period of rains and adequate feed supplies, before weight losses occur. Coastal enterprises for beef finishing and slaughter are in need of greater supplies of feeder cattle.

Any sustained improvement of beef production in the Sierra must depend on marketing procedures and practices that insure a fair price to Sierra producers of live animals, or of slaughtered beef. These market requirements are now adequate. It should become possible for producers to exert more influence on markets as they become organized into groups under professional management.

Milk production There are now 2 major centers of commercial milk production in the Sierra, at Arequipa and Cajamarca. In both areas milk is purchased at a favorable price, by a corporation that produces milk concentrated for sale in cities and towns throughout the country. These corporations not only provide a market outlet for large numbers of small dairy farmers, but also handle the difficult problems of sanitation and distribution that are inherent in supplying fluid milk to consumers. Production of milk in the vicinity of these established processing centers is made possible by feed production on cultivated pastures under irrigation, by a feed industry that produces concentrates to supplement the forages, by a system of collecting milk from individual farms, and by a price to producers that provides a fair return on the investments, labor, and inputs involved in milk production.

There appears to be an opportunity for expanding commercial milk production in the Sierra, only as processing milk plants are established in valleys that are well situated for producing forages on a continuous year-round basis.

Crops

The evaluation of specific crops for promotion in the Sierra involves several separate considerations.

a. Support of people in the Sierra:

(1) The relative yields of each crop based upon application of available technology.

(2) The relative net returns to the producer from each of the alternative crops that may be grown on arable lands.

(3) The special role that each crop may have in a farming system.

(4) Specific ecological adaptations.

b. Contributions to the agricultural economy of Peru

(1) Specifically, is the Sierra the most suitable zone for production of a crop that is in short supply in the nation?

By these criteria, potatoes are the most useful crop in the Sierra, when prices are stable. Corn is the second most useful crop in net returns above cash outlay for inputs. It is a staple food crop, and also provides supplemental feed for sheep and cattle in the dry season to sustain growth and avoid weight losses. Beans and broad beans are the 3rd most useful crop, in terms of net returns, use as food, and for cash income. Wheat ranks 4th in usefulness. Even when improved varieties are grown with adequate fertilization so that yields are double the general average, the net returns are no higher than beans. Wheat production is desirable to the extent of meeting local food needs; but potential wheat yields in the Costa and high Selva are far more attractive for meeting national needs than wheat in the Sierra. Barley ranks just below wheat as a useful crop in the Sierra. It should replace wheat in those localities where frosts constitute a hazard to wheat during blooming and seed set. Barley is more resistant to such frosts than wheat.

Potatoes are the major crop in the Sierra. They are adapted to the climate of the region, and the technology developed in recent years permits relatively high yields per hectare. This technology includes development of improved varieties, production of disease - free planting stock, control of insect pests and disease, and better cultural practices as to amount seed to plant, time of planting, tillage and weed control.

The principal barriers to exploitation of potato enterprises are the weaknesses of the marketing practices and procedures. Within each producing locality, there is a season when the crop harvests exceed current market acceptance. Potatoes are a bulky product (75 to 85% water), and they have a limited storage life. The local market gluts result in ruinously low prices paid to producers, and this is reflected in growers planting decisions in subsequent seasons.

Two types of action have been proposed to stabilize potato marketing, so that potato growing enterprises may become dependable. One type of action would be the establishment of local and regional storage warehouses under government regulation, to receive potatoes from producers, for storage until the movement to market can be made without depressing the price structure. The second action is complementary to the first; namely, the establishment and operation of potato starch and potato flour processing plants to utilize those portions of the crop not readily absorbed by the market for fresh potatoes.

Potato production in the Sierra could become a more remunerative enterprise, by widespread adoption of improved technology developed through research in recent years. However, improved production must be accompanied by restructuring of storage and marketing procedures and practices, before any substantial gains may be expected. The application of improved technology should be useful to production of potatoes for home consumption, irrespective of the status of markets at a distance from the producer.

Corn has a wider usefulness as a crop in the Sierra than any crop other than potatoes. It is a staple food crop, widely grown during the warm season, except at higher altitudes. Improved varieties and hybrids are now available and the crop responds strongly to fertilizer. Hybrids that are much higher in protein quality than those previously available, will be released in the near future. Corn should also be a major feedstuff for supplemental feeding of sheep and cattle in the dry season. Since these livestock enterprises have a high priority for cash income in the Sierra, corn as a feed-stuff ranks high as an alternative crop. In addition to its use in feeding sheep and cattle, corn is a preferred feed grain for poultry and pigs; and increased local poultry and pig production will improve the protein supply for human diets in the Sierra.

Since corn ranks high in terms of direct support for the people of the Sierra, and has the important potential of providing necessary feed for sheep and beef enterprises that will augment supplies of these commodities for urban centers, corn culture is entitled to a major role in the Sierra.

Beans and broad beans are the 3rd most useful crops in the Sierra. Beans rank next to corn in net returns above cash costs for inputs; they are important protein foods for local consumption; and they usually find a stable market in urban centers. Since beans are a concentrated high value foodstuff, the cost of transport to market is less difficult than with other crops.

Improved varieties of common beans have been developed, and the substantial response to phosphate fertilizers is established. Little or no nitrogen fertilizer is needed, since beans are legumes that fix nitrogen from the soil air through root nodules. Thus fertilizer costs are considerable less than for potatoes, corn or wheat.

Less research has been done on broad beans than on common beans, but the adaptation of broad beans to the climates of the Sierra is so favorable that present production compares favorably with common beans. Broad beans have a rather narrow range of adaptation on a world basis, and this crop may have an expanding future in the Sierra.

Wheat, most of the wheat grown in Peru is produced in the Sierra, although small amounts are produced in the Coastal region. Improved varieties have been developed for the Sierra, and yields have been achieved on the order of 2,000 kg. per hectare with fertilization in contrast to average yields of 900 kg/ha.

Despite the development of improved technology for wheat in the Sierra, this crop appears destined for a minor role in the agriculture of the nation. Since it is a major crop of the Sierra region and constitutes an important component of local farming systems, suitable efforts should be made to introduce improved varieties and cultural practices that have the potential for doubling yields on present wheat growing fields. Any excess in production beyond local or regional food needs in the Sierra should readily be marketed in urban coastal areas. This volume will be a desirable addition to national wheat supplies, but cannot be expected to greatly alleviate the massive national shortages. National requirements for wheat are more likely to be met by exploiting the wheat growing potentials of the coastal region and the high Selva. These other regions should be capable of growing wheat at yield levels 4 to 5 times as large as those of the Sierra, to not only produce wheat at relatively low unit costs, but at yield levels that will make wheat competitive with alternative crops in the Costa and high Selva.

3. Opportunities in the Selva

The Selva must be evaluated as 2 distinct sectors, the high Selva and the low Selva. The high Selva occupies about 16 million hectares (as determined from aerial mapping) on the eastern slopes of the Andes, ranging from about 6,000 ft. altitude down to 800 ft. altitude. The region has sufficient rainfall to support diversified agriculture without irrigation. Rainfall is most abundant from October to March, with substantially less from April to October. The topography is gently rolling to fairly steep, but much of the area is suited to tillage or permanent grasslands. These lands are now mostly wooded, and would require clearing for agricultural development. At present, agriculture is limited to rather localized areas such as occur in the vicinity of Bagua, Tarapoto, and small settlements southeastward. The limited research and development carried out to date, indicates that soils and climate will support a varied type of agricultural enterprises. Rice, wheat, maize, pastures and forages appear well adapted. The soils are more fertile and less acid than those of the low Selva.

The low Selva includes the 60 million hectares of eastern Peru, now occupied by jungle tree growth, penetrated only by streams that are tributary to the Amazon river. This vast area is half as large as all of western Europe, and is almost wholly undeveloped. The climate is humid and warm the year round, with lower rainfall from April through October. The soils are largely alluvial in origin; they vary widely in texture, and are generally rather acid. Drainage is deficient to some extent, along stream channels. There are agricultural research stations at Iquitos on the Amazon river in eastern Peru, at Pucallpa on the Rio Ucayali, and Yurimaguas on the Rio Huallaga. The latter 2 stations are near the junctions of the low and high Selva regions.

The entire Selva is almost without roads. A road connects Pucallpa with Tingo María, and hence to Cerro de Pasco and Lima, Yurimaguas and Tarapoto are connected by a low grade road to Bagua, but the road is impassible much of the time. Bagua has a road to

Chiclayo on the Coast, which is passible in most seasons. Access to these towns is via air, but slow river craft provide the only transport through the low Selva. The lack of ground transport is the principal barrier to the development of both the high and low Selva. Although Peru has invested very large sums on irrigation projects for the Costa, there has been little interest and very meager allocation of national resources to development of the Selva. The only exception has been the construction of the road to Pucallpa, and this has not been followed by a consistent program of land development and colonization.

a. The High Selva

The agricultural potential of the high Selva appears excellent; and the construction of roads through the area should present no abnormal problems. A single trans-Andean road from Chiclayo to Bagua and Tarapoto could open up a large Northern sector of the high Selva. It is estimated that this sector has more potentially arable land than is present in the total irrigated projects of the Costa; and that up to twice as much associated lands of steeper slopes are suitable for improved pastures. The central and southern sectors of the high Selva appear to have similar suitability and land areas for development as agricultural lands. The greatest immediate agricultural opportunities are for rice, corn, manioc and wheat (at elevations about 3,000 feet) on arable lands, and for beef cattle on improved pastures. It is probable that grain sorghum, beans, and oil seeds would be productive crops that could be grown in rotation with other crops. The research conducted on rice indicates that the technology for improved yields of the crop in the North Costa, is applicable to Bagua where 20,000 hectares of rice are already in production. Further research on the other crops should be pursued diligently, not only to calibrate available technology on production, but to chart geographic and ecological zones and soil types where each crop is best adapted. Existing improved pastures on a limited scale, indicate on impressive potential for forage production on a year-round basis, suitable for beef enterprises. As a feed grain potential is developed through culture of corn and grain sorghum, it will become economically feasible to support poultry and hog enterprises.

The first requirement for development of the high Selva is to provide trans-Andean roads for the North sector and the south sector, to supplement the road from Pucallpa to Lima. The second requirement is to construct regional roads within the high Selva to connect developing agricultural areas with these trans-Andean roads.

Since the technological base for agricultural development is now quite limited, additional research on land use, crops and livestock should be given high priority, to provide more precise guidelines for production of the commodities indicated in the foregoing paragraphs.

b. The Low Selva

The following evaluation is made without counting on timber resources that may be exploited during land clearing. An impressive example of clearing the jungle and establishing agricultural enterprises has been carried out in the vicinity of Pucallpa. The beef cattle enterprises on improved pastures show great economic potential, and a chart for exploiting this opportunity is presented in Chapter V of this report. Other researches have explored the potential for such valuable tree crops as rubber, cacao beans, oil palm, and coconuts. A colonization settlement is demonstrating the economic production of tropical fruits and vegetables.

A smaller but significant example is provided at Yurimaguas on land clearing, rice production, improved pastures and beef production. The penetration of the low Selva, with land clearing and agricultural development will not be simple, since this great area is known to be variable in soils and drainage, and in types of native vegetation.

However, enough is already known through Peruvian exploration and testing to confirm the presence of a land resource of great potential. This is confirmed by programs of development of similar jungle areas in Bolivia and Brazil. Neither technology nor thenatural resources of soil climate and vegetation, constitute serious constraints for development of the low Selva. The principal limiting factors are the lack of dependable trans-andean roads, and the will of the nation to occupy and develop this great region.

CHAPTER V
AGRICULTURAL SECTOR STRATEGY

A. Agricultural Plan

A basis of argument on the need for an organic reconstruction of Peru's agricultural production and marketing systems, and for the development of agricultural policy for economic and social growth of the rural sector has been established. The evaluation herein dealt with are: (1) regional concentration and commodity focus, (2) evaluation of the effectiveness of current agricultural development, and (3) the planning and implementation requirements of an effective strategy. In this chapter, production and marketing problems of the priority commodity group are identified, and the priority needs of agriculture with regard to production credit, capital investment, technical assistance, extension and research, infrastructure, and institutions are assessed.

Key to the assessment of Peru's agricultural priority needs are two diagnostic charts: (1) a crop production marketing system centering upon rice, Chart N° 4, and (2) a livestock production - marketing system centering upon beef cattle, Chart N° 5. This chapter provides a cross-sectional representation of production - marketing problems, and an evaluation of alternative strategies. This chapter is not intended to be a prescription for all of Peru's agriculture.

B. Strategy Evaluation

The general framework for evaluation is set by Chapters III, and IV. The basic premise laid out in Chapter II is that effective development programs must: (a) have a commodity and regional focus and (b) encompass a systems evaluation procedure which incorporates the principal production and marketing aspects within a viable institutional framework. The unsatisfactory performance of agriculture over the decade 1960 - 70, highlighted in Chapters III and IV, stresses the need for major structural, institutional, policy and administrative changes if significant social and economic progress effecting 50 percent of the Peruvian population is to be made within a relevant planning period of 10 - 20 years.

The basic strategy aims to increase the rate of expansion of agricultural output from 1.9 percent to an average of 5.6 percent annually over the period 1970 - 75 and achieve major redistribution of income, were discussed in Chapters II and III (See Table 15). At this stage it becomes necessary to examine in more detail how the multiple goals for agriculture may be reconciled and achieved. It is axiomatic that no single program can be identified as the "optimum" solution. The path will be via sequential decisions and successive approximation which should lead to situation which are better than the status quo. Thus, in the following evaluation, no pretense is made that the "highest" priorities and "best" mechanisms, best policies or organizations are identified. The intent is to isolate a few manageable "high" priorities and "good" mechanisms, etc. which, hopefully over time will lead to improved public decision making or administration and a closer equation of goals and means. The approach adopted is to examine: firstly, the technical alternatives available for achieving the stated goals within constraints imposed by capital, mobility of labor, value added and employment; and secondly the institutional aspects which govern the execution of any set of production, marketing or income distribution policies.

Table 15

PRODUCTION GOALS FOR PRINCIPAL AGRICULTURAL COMMODITIES, 1971/75

Commodity	Annual Rate of Growth (%) Area	Yield	Total Production
Wheat	3.3	10.5	13.8
Peanuts	30.5	8.4	38.9
Soya	53.0	4.4	57.4
Olive oil	11.2	3.3	14.5
Olive palm	21.8	-	21.8
Beef	-	-	10.5
Mutton	- a/	-	9.3
Pork	-	-	25.0
Llama meat	-	-	1.2
Milk	3.6 a/	7.2 b/	10.8
Rice	6.4	2.9	9.5
Corn	1.3	5.8	7.1
Potatoes	0.7	5.1	5.8
Broad beans	5.5	9.5	15.0
Horse beans	3.0	4.0	7.0
Peas	2.8	13.6	16.4
Poultry meat	-	-	15.0
Eggs	-	-	14.9
Cotton	-2.7	7.3	4.6
Sugar	1.5	0.75	2.25
Coffee	- 0.1	8.1	8.0
Wool (sheep)	a/	b/	14.4
Alpaca wool	a/	b/	3.3
Non-traditional crops	-	-	58.0

a/ Increase in number of animals

b/ Increase in yield per animal

Source: "Resumen del Plan Agropecuario a mediano plazo, 1971-1975, OSPA, Ministerio de Agricultura, Lima, Octubre, 1970.

1. Technical Alternatives

Since the focus is on commodities, it is first necessary to screen the 62 agricultural products to a manageable number which are priority, and at the same time are representative of the application of policies in achievement of strategy goals. Twelve products were selected on the basis of the criteria in Table 1, Chapter II, resummarized and extended to 14 commodities as follows:

1. High number of low-income families associated with production (potatoes, broad beans, sheep, corn, and wheat).
2. Importance in export or import substitution (cotton, wheat, beef, milk).1/
3. Importance in present nutrition and future diet improvements (beef, pork, milk, poultry, mutton, canary beans and broad beans).
4. Representative of diversification possibilities in fruit and vegetables (bananas, tomatoes, onions).
5. Importance in total value of Peruvian agricultural output. In 1968 the 14 commodities accounted for 52 percent of total value of agricultural production.

1/ Sugar is specifically excluded due to special conditions of production and international marketing.

6. Potential for development of new lands (beef, rice, bananas). Thus the commodity focus becomes: bananas, beans (broad), beans (canary), corn, onions, potatoes, rice, tomatoes, beef, wheat, milk, mutton, pork, poultry.

In using these commodities as an abstraction of the Peruvian agricultural economy, joint products e.g. wool and mutton, and complementary activities such as associated rotation crops, or forages, will automatically be drawn into the analysis.

The evaluation of technical alternatives centers on five characteristics of Peruvian agriculture: the projected supply and demand for the 14 commodities; the potential productive capacity of the land resources; cost functions related to introduction of new lands; production functions related to intensification of land use; and the inter and intra regional distribution of population and income, plus associated aspects of location preference and labor mobility. Simultaneous consideration of the foregoing factors will place the primary policy issues in sharp focus.

a) Supply and Demand of 12 Commodities

The reference point is taken as the projection of supply and demand through 1980, made on the basis of qualified assumptions on continuance of past policies and behaviours of the agricultural sector.[1/] This provides a benchmark against which the impact of normative

---

1/ Peru, "Long Term Projections of Demand for and Supply of Selected Agricultural Commodities through 1980", Universidad Agraria, La Molina, Lima, June, 1969.

changes of policy, public administration, or producer behaviour, may be appraised. Tables 11, 12, 13, and 14, Chapter III shows projected levels of supply, demand and deficit of the 14 commodities for 1970, 1975 and 1980 without major changes in policy.

Among the principal conclusions which may be drawn from the above tables is the relatively gradual increase in the three national deficit commodities, $ 104 million by 1975 and $ 156 million by 1980. Deficit or excesses in other commodities are inconsequential. One of the principal contributing factors is the low projected rate of per capita demand expansion in the Sierra. Projected expansion in consumption by region is shown in Table 16.

Comparing the Sierra with Selva and Costa in Table 16 it may be seen that over the decade 1970/80 a retrogressive trend is projected in income distribution. The ratio of per capita incomes in the Sierra to other areas changes from 1:3.5 in 1970 to 1:5.1 in 1980. Distribution is even more distorted if comparison is made with the Sierra rural population (24 percent of the population); their per capita incomes relative to the rest of the country change from 1:7 in 1970 to 1:13 in 1980; i.e. over the period their relative poverty level is almost doubled. Under these conditions the food demand by an important segment of the population is severely constrained.

Tables 15, 16, and 17, do, however, indicate the general dimensions of the inter-regional trade pattern which may emerge.

Also it is evident that certain commodities are of much more importance in the rural diet than the urban. For example the projected rural per capita consumption in 1975 is 2.5 times the urban

Table 16

PROJECTED GROWTH IN INCOME, FOOD DEMAND

AND POPULATION BY REGION
1970 - 1980

Income and Population	Region			
	Costa	Sierra	Selva	Peru
Distribution of population 1980 (%)				
Urban	41	14	4	59
Rural	9	24	8	41
Total	50	38	12	100
Population expansion 1970/80 (%)				
Urban	4.8	2.3	5.6	4.2
Rural	2.7	0.8	3.9	1.8
Total	4.4	1.4	4.5	3.1
Increase in per capita gross domestic income 1970/80 (%)				
Urban	4.1	1.9	2.8	3.3
Rural	2.1	0.5	2.1	1.0
Total	3.6	0.9	2.3	2.2
Index of per capita gross domestic income, 1970				
Urban	365	105	110	170
Rural	98	22	25	40
Total	189	52	57	100

Table 16 (coninued)

Income and Population	Region			
	Costa	Sierra	Selva	Peru
Index of per capita gross domestic income, 1980				
Urban	440	102	116	190
Rural	130	19	25	35
Total	234	46	58	100
Ratio of 1980 to 1970 indices of per capita gross domestic income				
Urban	1.25	0.97	1.05	1.15
Rural	1.05	0.86	1.00	0.88
Total	1.24	0.88	1.02	1.00

level for potatoes, 15 times for mutton, seven times for corn. On the other hand in the luxury and most high protein foods per capita urban consumption is projected to be significantly higher than rural level in 1975; e. g. six times higher for poultry, four times for beef, and three times for milk.

b) Land Resource Potential for Agriculture

Productive potential by region is shown in Table 17. There is clearly no land resource constraint on production; the area in crops could be tripled, improved, and native pastures doubled. Development of new lands has been projected over the period 1965 - 80 at an average annual rate of:

18, 000 Ha. new irrigation in the Costa

16, 000 Ha. colonization in the Selva

which over the 15 year period represents a mere 25 percent of the potential in the Costa and 8 percent in the Selva.[1/]

c) Cost Functions Associated with Land Expansion

In the Costa land expansion is available only through additions to irrigated area. For any given level of capacity to meet a minimum flow requirement, the primary investment is in storage

---

1/ "Peru, Long Term Projections", op. cit and the main canal to the project area. The secondary and tertiary canal systems and on-farm development can be expected to be similar on a per ha. basis for all projects. However, in the case of storage, primary canals or ground water development sharply rising marginal costs are to be expected. Construction costs prior to 1965 averaged about S/. 22, 000 (1963) per ha. On recent projects this figure has been in the order of S/. 40-50, 000 (1963). While no data exists on costs of new projects, and the per ha. estimates are confounded in most cases by the combination of improved irrigation on existing areas with new additions to area, Figure IV-1 represents a rough extrapolation from existing information. The shape of these curves and the unit investment will be governed by the type of reservoir (small or large), sequence of construction and the degree of capacity required for minimum flow plus the m^3/ha/year requirement as set by the cropping pattern planned. Nevertheless, the general order of magnitude indicated serves as a guide in some of the economic aspects of agricultural development strategy.

Expansion of land in production in the Sierra, is in effect a form of intensification, i. e. additional areas will require increasing marginal costs in annual production inputs.

In the Selva two types of expansion are available - one similar to the Sierra above, through reduction in fallow with progressively increasing expenditures per ha. in chemicals, fertilizer, labor or machinery - the other requires expansion into new areas. In areas which already have access and some basic infrastructure, e. g. the

Table 17

ESTIMATED AGRICULTURAL POTENTIAL OF PERUVIAN
LAND RESOURCES

	CROPS a/				PASTURES				
	Potential (000/Ha.)				In Use 1967 (000 Ha)		Available for Improved or Native (000/Ha)	Unused Potential (%)	Forestry and other uses (000/Ha)
	Used in 1967	Fallow 1967	Virgin 1967	Unused Potential (%)	Improved	Native			
COSTA									
North	345.3	24.8	246.4	44	28.0		1.060.7		132.5
Central	234.0	31.5	170.9	46	12.4		273.3		
South	26.9	6.8	191.0	88	17.9		321.1		
TOTAL	606.2	63.1	608.3	53	58.3		1.655.1		132.5
SIERRA									
North	264.2	41.7	35.8	23	53.8		1.905.1		-
Central	405.9	207.9	-58.3	27	38.2		5.183.8		-
South	339.7	267.3	-110.2	32	51.7		7.173.3		-
TOTAL	1.009.8	516.9	-132.7	28	143.7		14.262.2		-

a/ Permanent and annual crops

Source: "Estadística Agraria, Peru, 1967", Tomo I, Oficina de Estadística, Ministerio de Agricultura, Lima, 1970

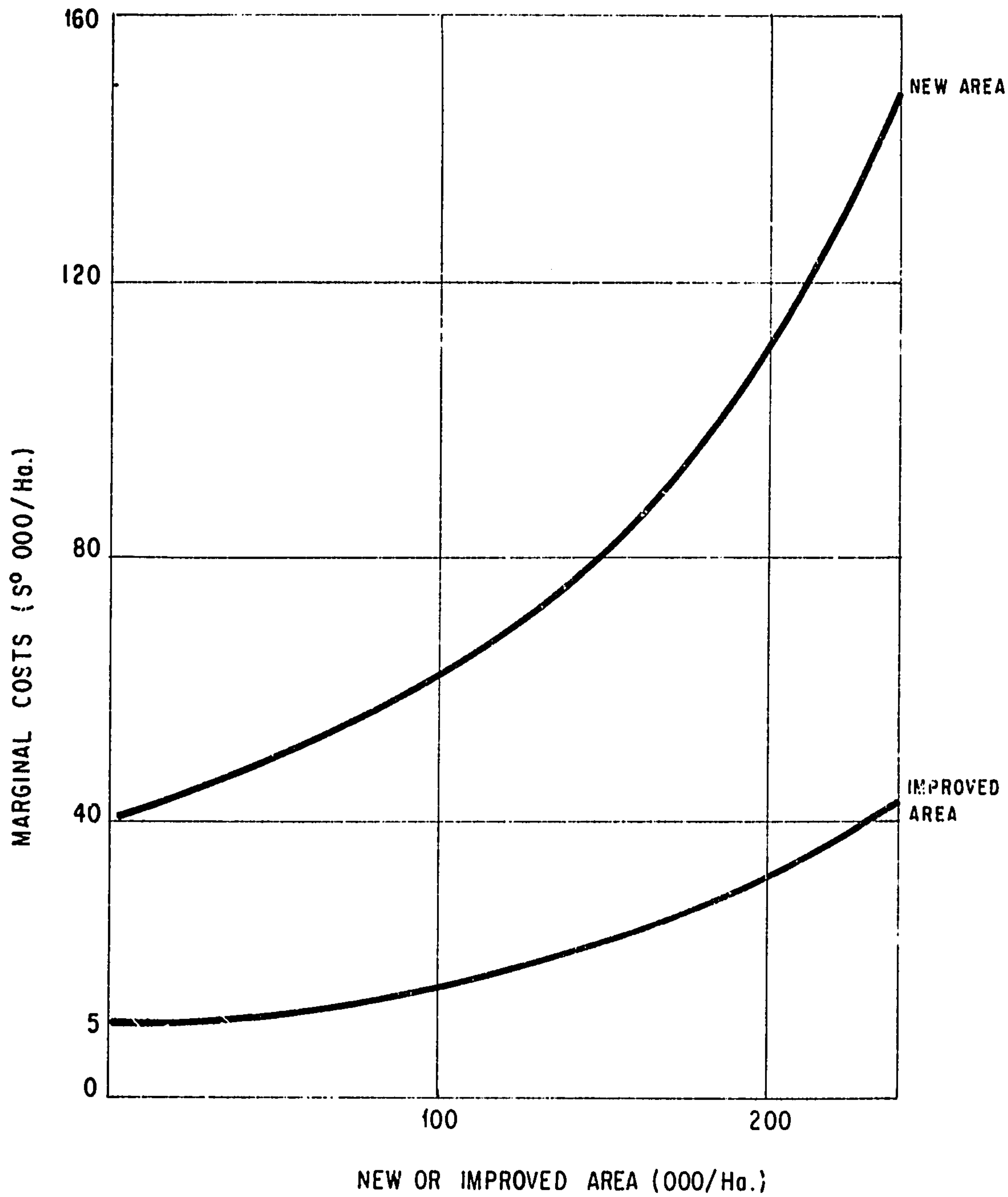
"Ocupación de espacio económico", ONERN, INP, Lima, octubre, 1970

Table 17 (continued)

SELVA ALTA							
North	45.1	3.0	526.4	92	5.7	1.692.5	5.089.4
Central	90.5	3.3	830.1	90	22.6	3.377.6	6.070.4
South	53.5	2.2	481.8	90	1.6	1.405.3	3.690.9
TOTAL	189.1	8.5	1.838.3	91	29.9	6.475.4	14.850.7
SELVA ORIENTE							
TOTAL	120.0	10.0	910.3	88	46.5	4.207.9	9.121.0
TOTAL PERU	1.925.1	598.0	3.224.2	67	278.4	26.600.6	24.104.2

FIGURE IV - 1

MARGINAL COSTS OF IRRIGATION EXPANSION IN THE COSTA REGION



Huallaga valley or Pucallpa, this expansion may be achieved at constant marginal costs of S/. 12, 000/ha. As wholly new frontier areas are opened up, area development marginal costs may rise because the need for new units of basic land clearing and structures, land preparation, and roads and other infrastructure. Also, unless a local center of consumption or input supply develop, marginal costs of production and marketing will increase.

In summary, the expansion of land in Costa will entail sharply rising marginal costs. In the Sierra instead of new lands expansion will have to come through increased production inputs. A similar situation applies to reduction of the percentage of fallow lands in the Selva. Most likely expansion into new Selva lands will be at constant costs.

d) Production Functions and Intensification of Land Use

In terms of intensification of production a wide range of possibilities exist. Projected improved irrigation from 1965/80 is 6, 000 ha. annually in the Costa and 15, 000 ha. annually in the Sierra. In addition, 40 percent[1/] of the cultivated lands in the Sierra are in fallow (517, 000 ha.) advanced technology could undoubtedly bring a higher proportion under permanent cultivation.

1/ José Salaverry LL.

On the other hand this may be offset by the large areas of cultivated land in the Sierra which should be placed under permanent pasture for conservation purposes. Estimates of fallow in the Selva range up to 50 percent of total land cleared from forest.

Aside from improved water supply and use of a technology to keep a higher proportion of the land in traditional production there is technology to increase annual output from a unit of land through double or triple cropping, or use of improved production and management inputs. Production functions from cross - sectional data are shown in Figures IV-2 to IV-6 for rice, wheat, corn, beans and potatoes. The yields have been plotted against gross expenditures in seeds and chemicals. Thus, since a number of other variables such as soil, management and labor quality may influence yields the function AB in each case is not complete. The curves ab, cd and ef respectively represent approximations of the different actual production functions along which one might move to intensify production with a given input or fixed combination of inputs.

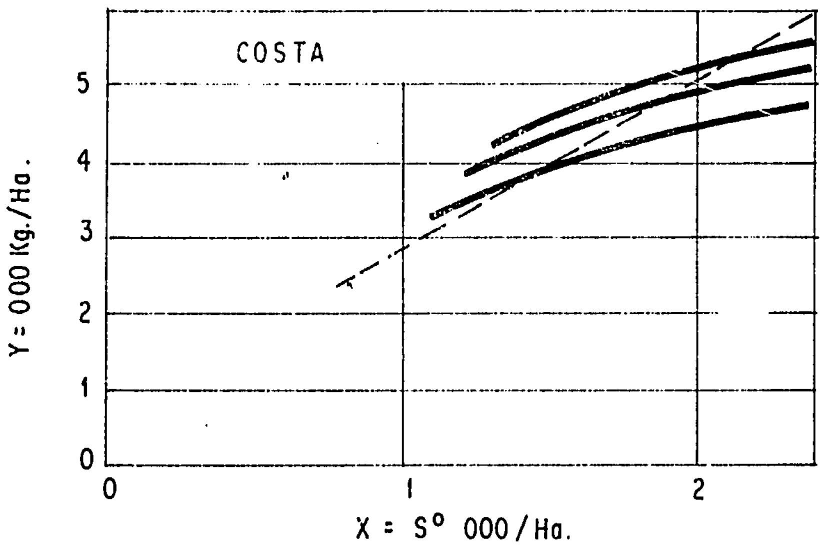
This latter point leads to the set of technical production functions establishing the upper limits on intensification. Figure IV-7 shows such a set of functions.

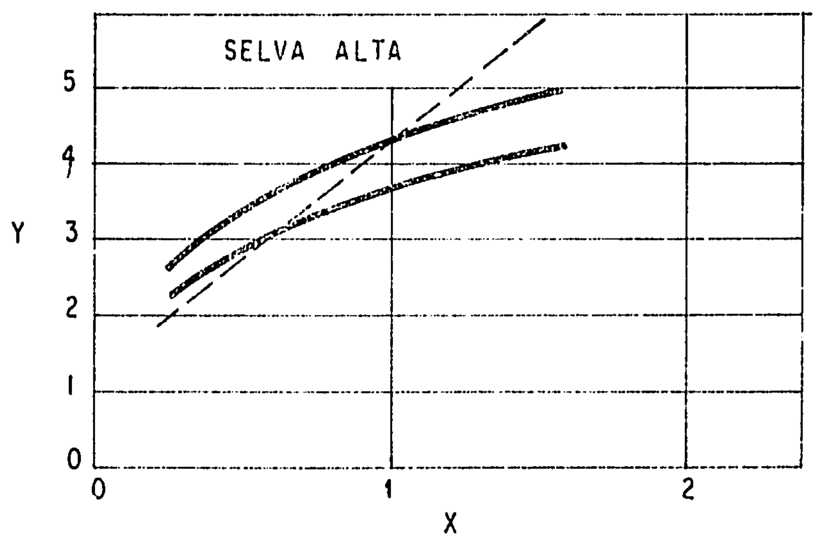
e) Alternate Strategies

Returning to the supply and demand projections for the 14 commodities taken as indicators of the agricultural sector (Tables 11, 12, and, 13, Chapter III), and superimposing the cost functions, production functions and income distribution we have the

FIGURE IV-2

RICE-PRODUCTION FUNCTIONS BY REGION





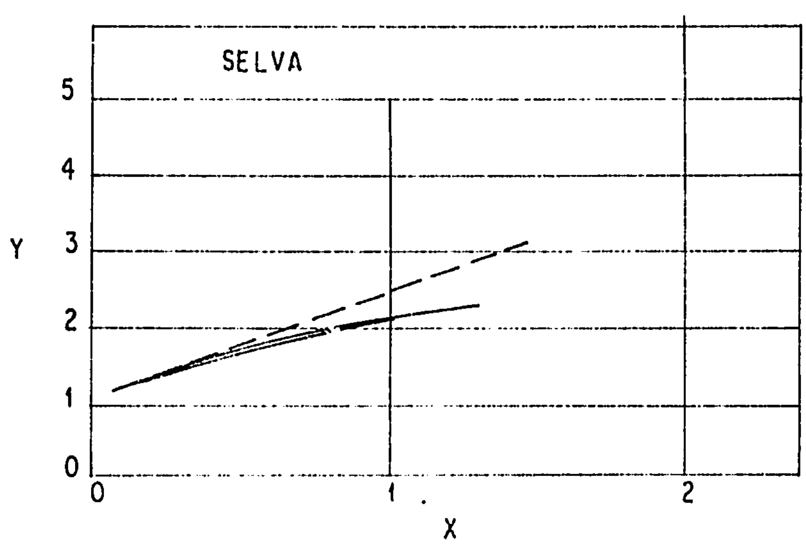


FIGURE IV - 2a

WHEAT- PRODUCTION FUNCTIONS BY REGION

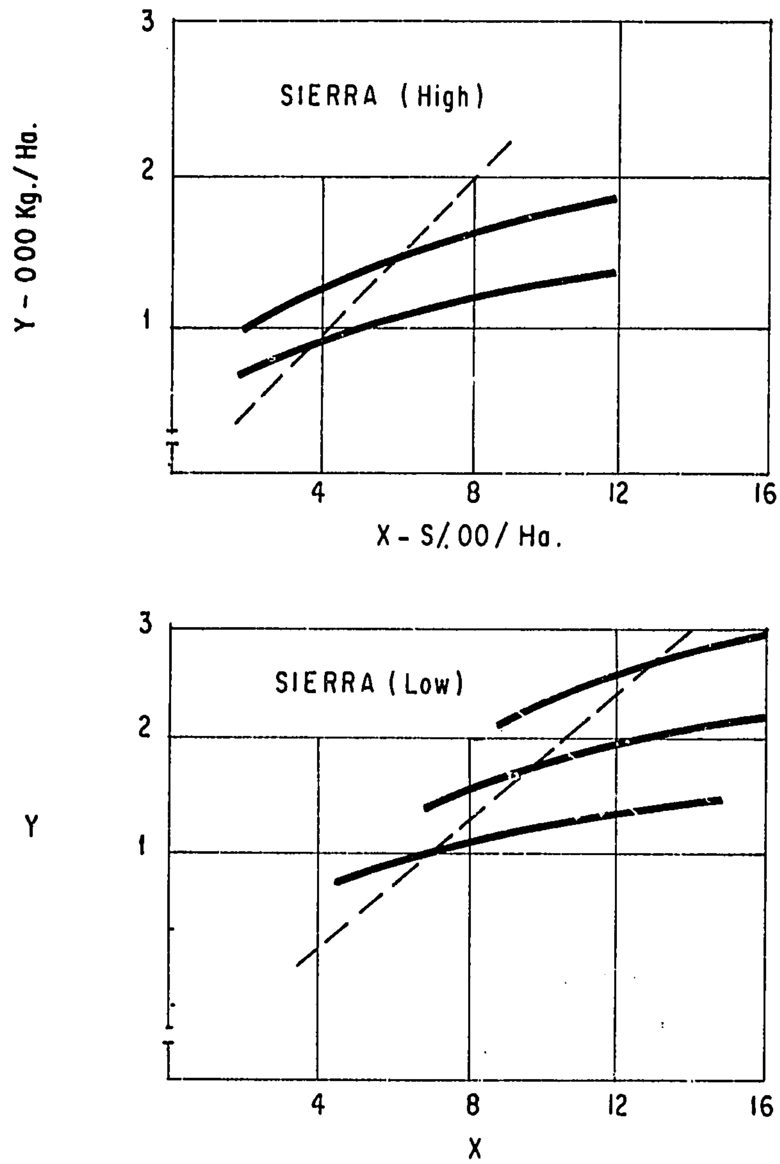


FIGURE IV - 3

CORN - PRODUCTION FUNCTIONS BY REGION

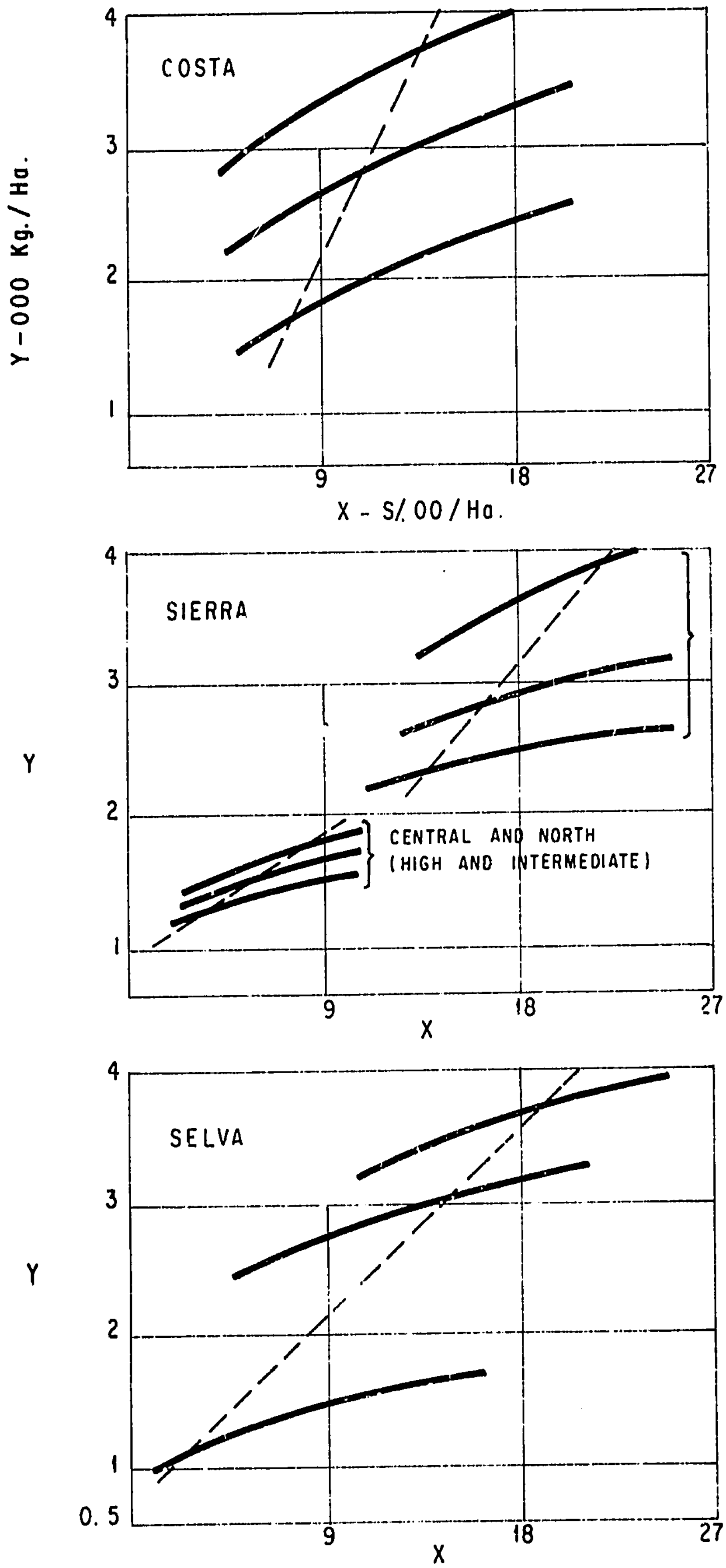


FIGURE IV - 4

BEANS - PRODUCTION FUNCTIONS BY REGION

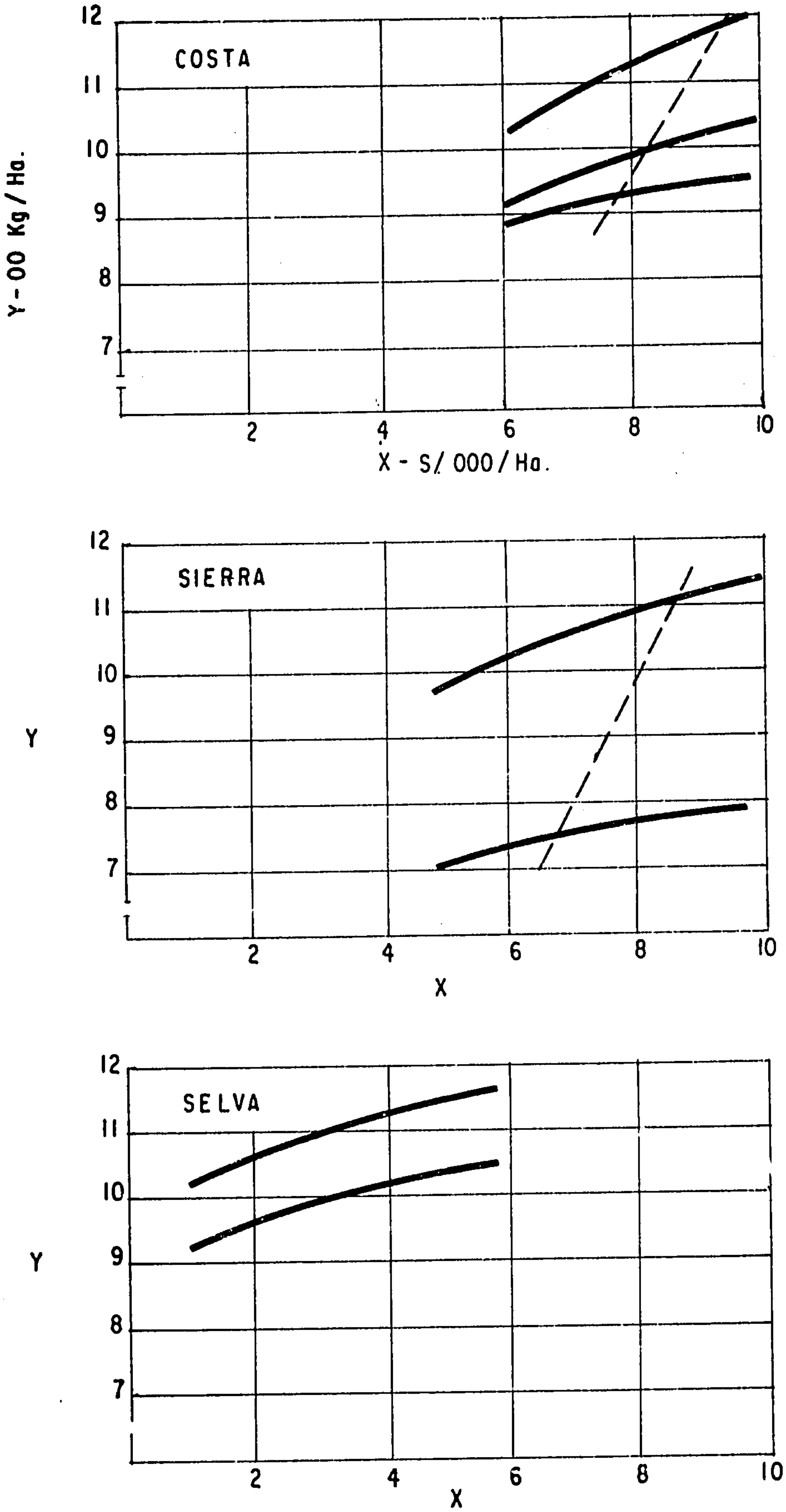


FIGURE IV - 5

BROAD BEANS - PRODUCTION FUNCTIONS BY REGION

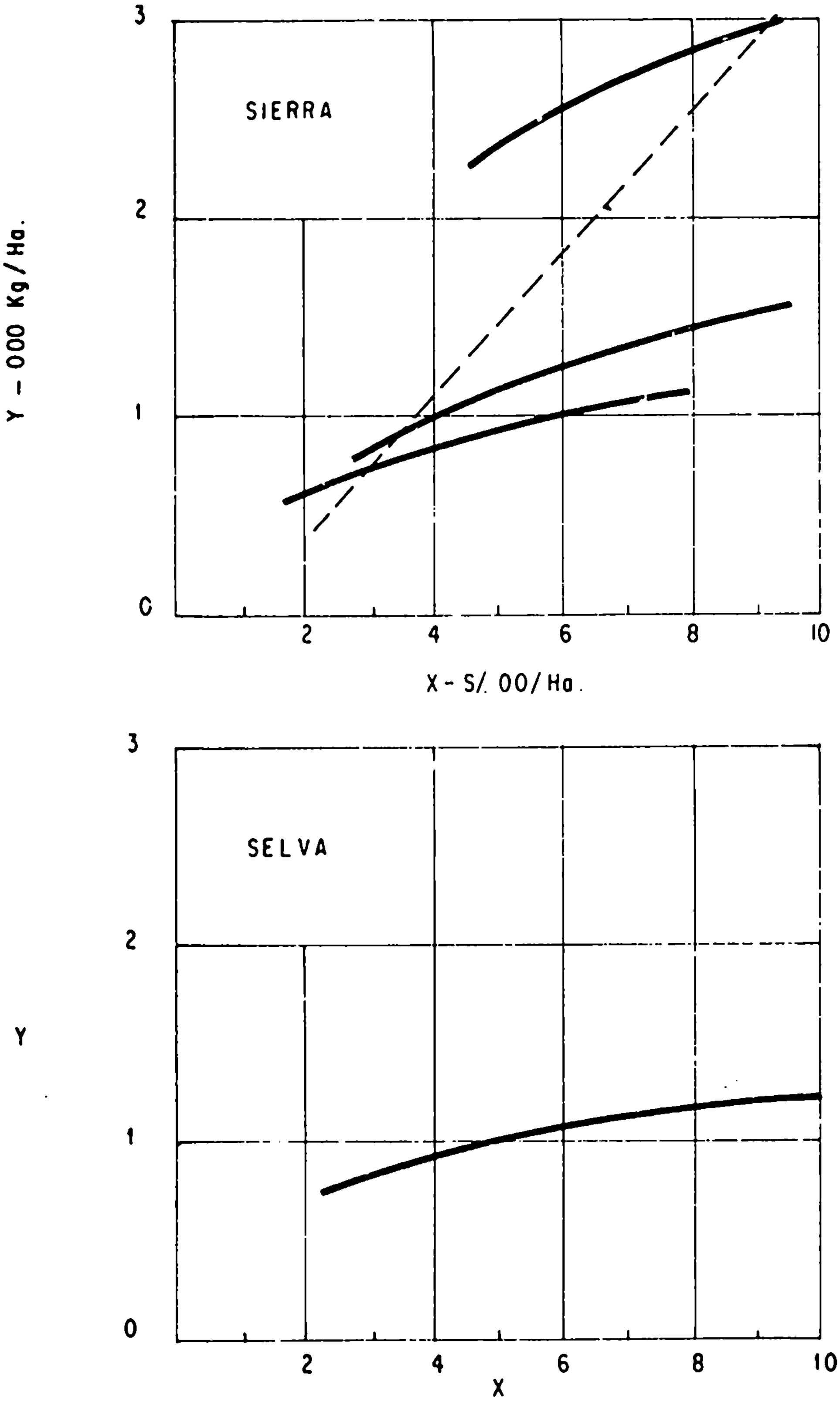


FIGURE IV - 6

POTATOES - PRODUCTION FUNCTIONS BY REGION

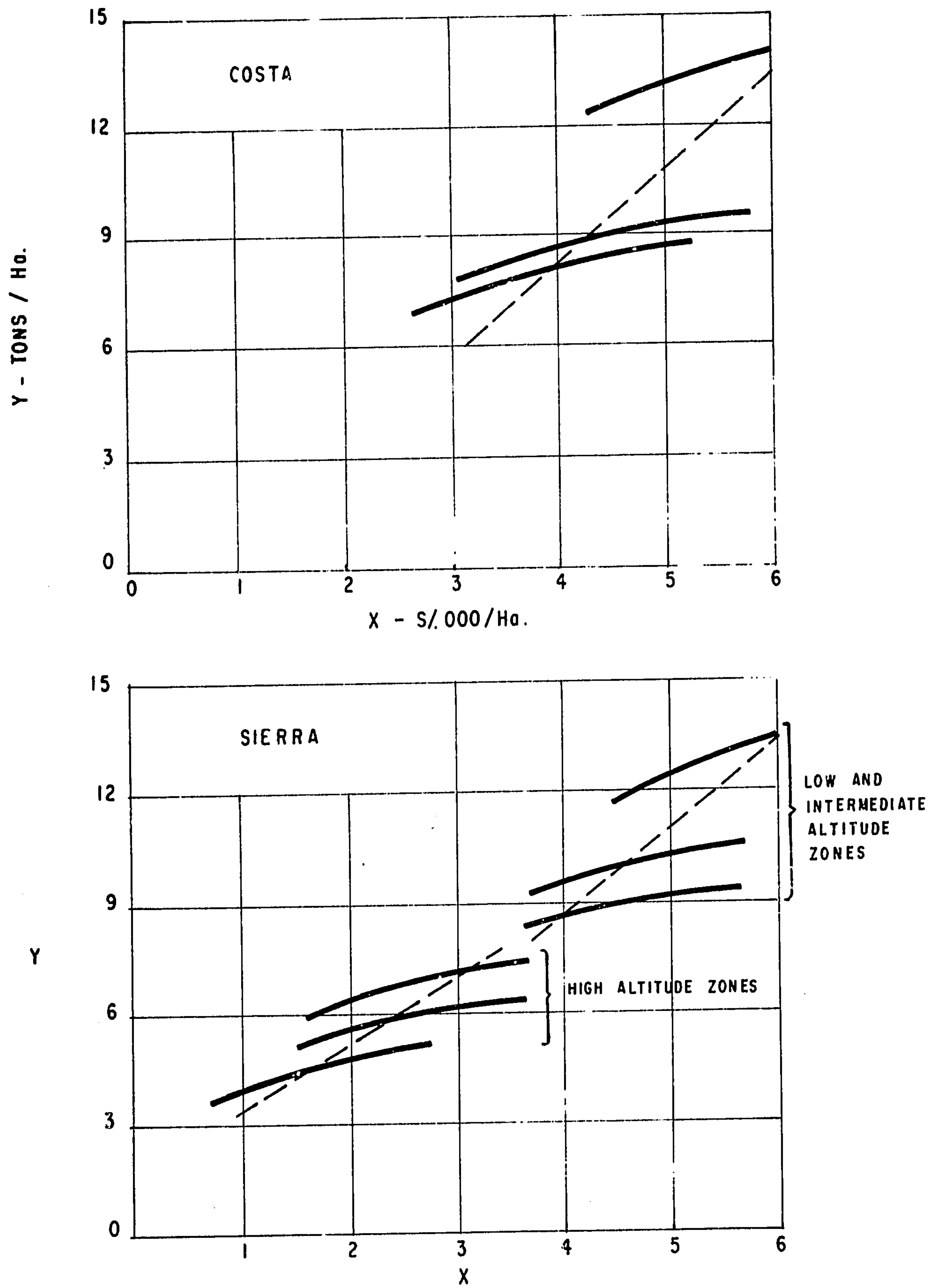
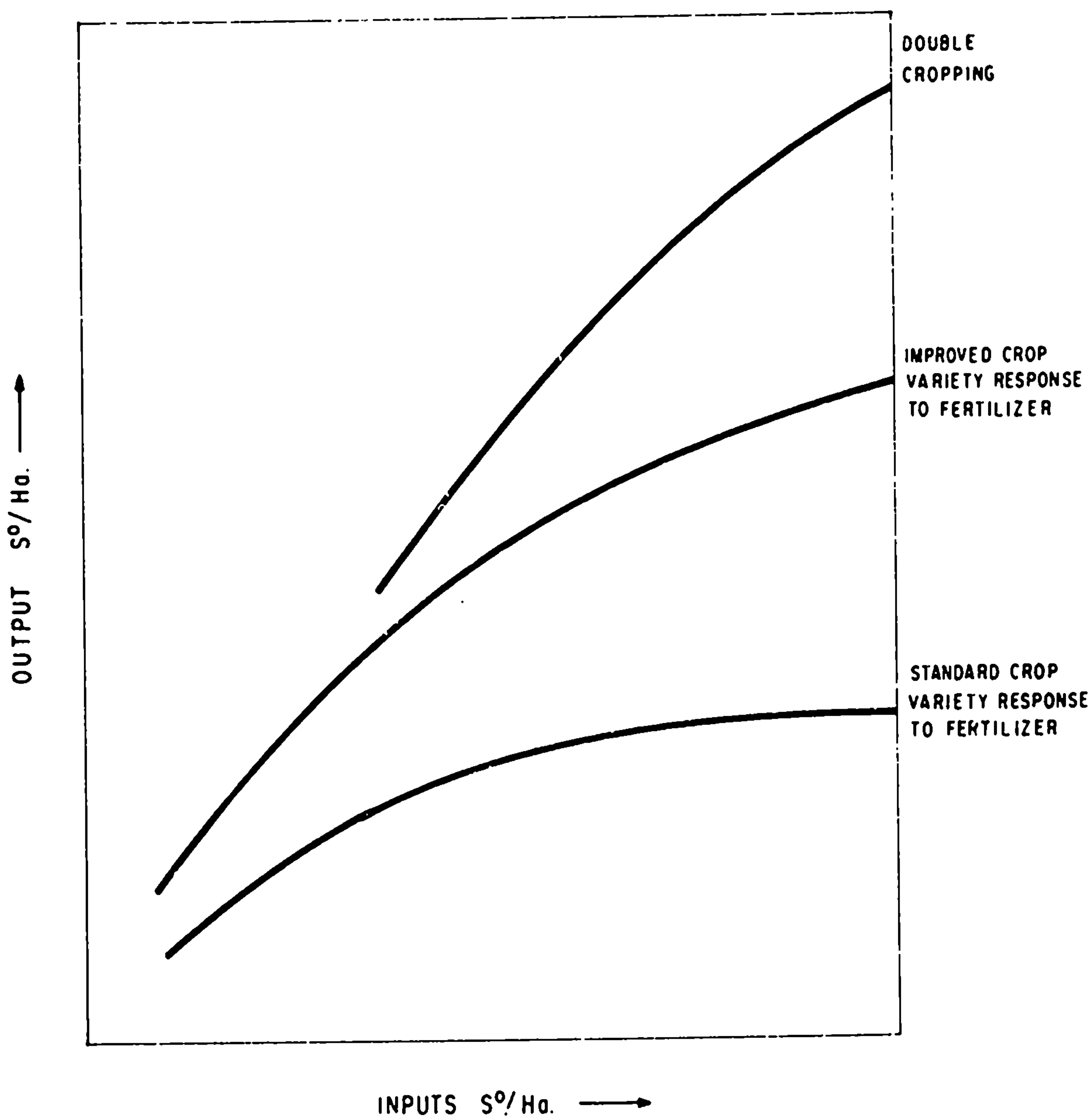


FIGURE IV-6

PER HECTARE PRODUCTION UNDER INTENSIFICATION OF INPUT USE AND DOUBLE CROPPING



basis for a first approximation of some alternative ways of approaching the sector goals, expressed in terms of; the commodity, location of production, and costs.

The most obvious discrepancy between goals and the above projections is the regressive income distribution with respect to the two fifths of the population expected to be living in the Sierra in 1980. If one takes seriously the income distribution objective, listed number one in government planning documents,[1/] it must be assumed that deliberate policies will be executed to minimize or reverse the projected trend. The questions of nutrition and employment are directly related to income distribution. The need to improve the foreign exchange position of Peru through import substitution, or export promotion does not appear to be critical.[2/] However, since one of the major constraints on rural incomes is the limited domestic demand for agricultural products a strong case can be made for import substitution.

1/ "Peru, Estrategia del desarrollo nacional a largo plazo", Instituto Nacional de planificación, Lima, Noviembre de 1968, p. 3. Resumen del "Plan Agropecuario a mediano plazo, 1971-1975", Tomo I, OSPA, Ministerio de Agricultura, Lima, Octubre 1970, p. 8.

2/ See notation on two recent studies, last paragraph, Chapter III.

The basic question is how to focus public capital investment, research, extension, credit, price incentives (efficient marketing of inputs and products) and foreign trade controls, in such a way as to draw forth expanded production from the precise groups which should be benefited. The crucial element, and the one about which least is known, is the migration elasticity of the rural population in the Sierra, either to urban activities or other rural areas. For purposes of this discussion it is assumed the rural - urban migration rate will continue to accelerate, but not sufficiently to result in an absolute decline in the rural population in less than 20 years. Thus, among the options open for agricultural development, highest priority must be assigned to increasing per capita consumption in the Sierra. Avenues which suggest themselves are as follows:

i) Seek a high level of technology in wheat production in the Sierra, rather than promoting irrigated wheat in the Costa as currently programmed. Simultaneously seek a high level of technology in all Sierra crops which compete with wheat for available lands, thus freeing land for expanded wheat.

ii) Follow the same procedure as (i) above for milk in the Sierra.

iii) Promote sheep production in the Sierra with emphasis on meat. Integrate sheep production in the high Sierra, with forage and improved pasture for fattening in the low Sierra. Control prices and imports to foster substitution of mutton for beef.

iv) Seek a high level of technology in corn production in the Sierra as a feed grain for hogs in the Sierra and poultry in the Costa. Control prices and imports to foster substitution of pork and poultry for beef.

Programs such as those suggested above clearly involve inter-regional substitution of production, which in all probability will have a cost in terms of lowered economic efficiency. For example, wheat, corn and hogs may be more efficiently produced in the Costa. On the other hand irrigated land may be freed for cotton or specialty fruits and vegetables for export. In accordance with such an objective rice production may be transfered completely to the Selva. (See Chart N° 4).

Should the possibility exist for labor-intensive irrigated export crops which may offer attractive opportunities to the excess labor in the Sierra, this may be preferable to substituting beef imports, if capital is limiting and employment generation is of major concern. The only possibility of covering the projected $ 33 million beef deficit in 1980 is through massive land clearing in the Selva and large - scale purchase of breeding animals from Brazil - a process which will absorb much capital and little labor, assuming mechanized jungle clearing. (See Chart N° 5).

Aside from beef and rice, the high Selva offers unlimited technical opportunities for oil seed, wheat, corn and milk production. However, infrastructure, input and transport costs are high, and incentives required to attract the necessary labor migration remain to be tested.

The foregoing discussion centers on intra and inter-regional substitution of products with intensification and expanded area in an effort to achieve multiple goals with respect to production volume, production efficiency, income distribution and employment generation. It must be accepted that no program will be taken to the total exclusion of another. The aim is to specify more precisely the relative emphasis, through examination of a range of feasible alternatives.

In order to identify the priority commodities and regions which could spearhead the public programs for development of the agricultural sector, it is necessary to test the economic feasibility of a number of the possibilities outlined above. This requires firstly, analysis of the marginal rates of commodity substitution within regions, with constraints imposed by employment, value added, and capital (variable production inputs, fixed investment in irrigation, land clearing and infrastructure); secondly inter-regional comparisons of substitution rates.

f) <u>New Investment in Irrigation Projects</u>

Among the specific projects under current discussion are the Olmos and Majes irrigation projects, and the second phase of the Chira Piura irrigation project.

The Majes irrigation project in Arequipa has once been turned down by external financing on economic grounds. The Olmos project will reportedly bring in 110, 000 ha. into production at a cost of 200 million dollars (US) approximately; the Majes project, 90, 000 ha. at

150 million dollars (US), and the Chira-Piura project, 90,000 ha. at 200 million dollars (US). These projects will take 9-12 years to maturity from start of construction. It will take another 10-15 years to maturity in agricultural production, a total of 20-25 years.

Projections of net farm income, at 1970 prices and costs, do not support the economic logic of these projects strictly as viable agriculture projects. Social and other public benefits of considerable magnitude would need also be generated to justify the investments. This is because the net return in terms on the projected capital investment, and charging interest on the investment, (without counting the costs of on-farm structures) the rate of contribution to the net earnings of agriculture are below reasonable economic and social return on the projected public investment, comparative to alternatives, particularly Agrarian Reform.

Given the above, it is fair to ask what measures of social benefits might be generated. Employment would be one of these but to a fairly restricted group of the population, and it would not be lasting. Nutrition would not be furthered, except in the above restrictive sense. And because high value export crops would be the main beneficiaries of the program, import substitution of food crops would not be materially affected.

However, an important question is the possible regression effect of the three proposed irrigation projects upon Peruvian agricultural development. Assuming the $ 550 million investment to be distributed over a 10 year period this represents an annual expenditure in 3 projects which is 1.7 times the total annual GOP outlay in agriculture from 1965/70.

During this period per capita agricultural production has been declining steadily, and food prices have been rising. The prospect is for further per capita food production declines, and for further price inflation, accompanied by increased dependance upon imports.

As indicated in Chapter III, the probable preferred rate of public expenditure needed in agriculture is 16-18 percent of GNP, and preferably 20-28 percent over the next 20-25 years to reverse the downward production trend, and to provide minimum amounts of food for a growing population at reasonable prices.

The irrigation proposals appear to have the possibility of penalizing the Sierra, and Selva, almost completely, and the agricultural areas of the Costa except for the three areas directly involved, and; as a consequence, delaying general agricultural development for sometime. In this context, the Olmos, Majes, and Chira-Piura projects are not considered consistant with the four broad social and economic GOP agricultural development goals of the 1970's, and, in terms of relatively low cost-high return food production and overall social welfare alternatives immediately available, comparative to a program such as Agrarian Reform.

The basic principle involved is the economic returns axiom that scarce financial resources be used on end products, starting with the product with the highest economic and/or inputed social values.

The Implementation Gap

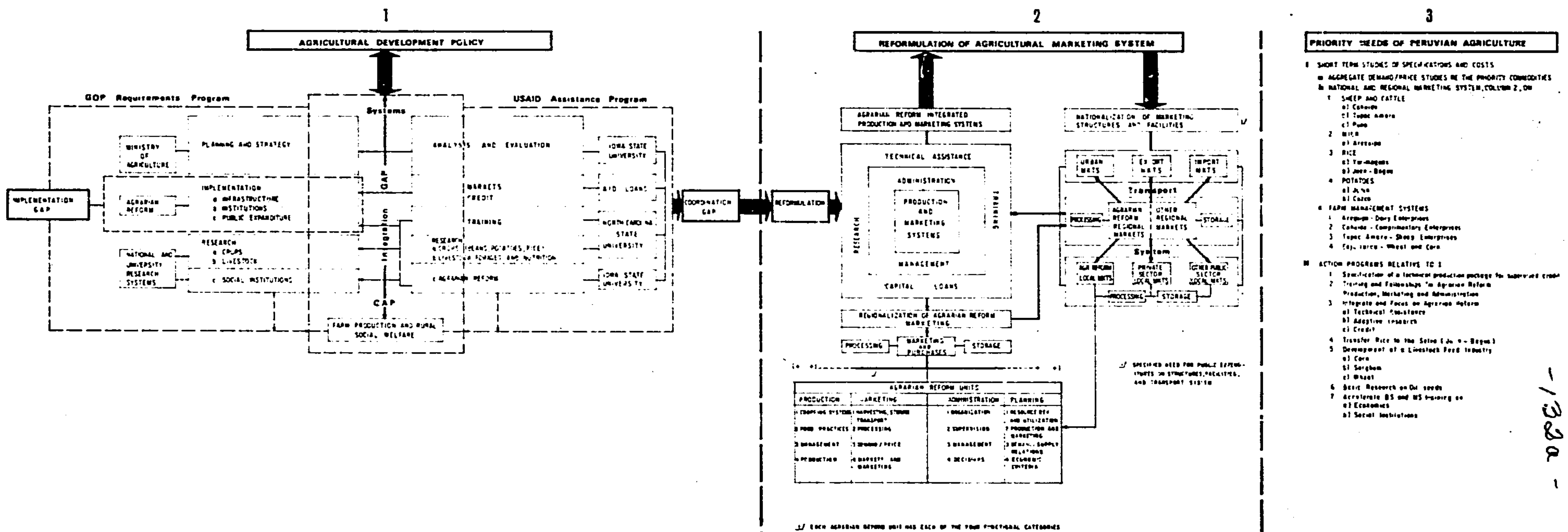
1. Discussion of the Concept

The purpose of Chart N° 3 is to layout, in perspective, the relationship of the AID program in agriculture to policy and the functional components of Peru's agricultural development process, as it is presently structured. The reason for doing this (column 1) was to be able to illustrate as the study shows, the precise points at which the development gap exists. The gap has three major components, one structural, one analytical, and one functional; and all of which relate to implementation. The structural gap is in infrastructure, institutions, and public expenditure. A production-marketing systems gap exists for nearly all, if not all, commodities which relates planning and implementation procedures to both farmers and consumers. Correspondingly, the entire linkage does not effectively relate policy, research, agrarian reform, training, and extension to each other as a unit.

Unless effective means are devised the farmer may continue to be rather neglected. This is because neither planning nor extension appear to consider the farmer and the rural economy as an integral ingredient of plans. Rather, the farmer appears to be considered as an entity to act upon, rather than to interact with. Consequently, agricultural planning, to the extent it divorces itself from the farm level, loses essentials of planning, basic knowledge and interpretive judgment. This failure can be a main reason for program implementation error. The rather complete structure

CHART Nº3

Evaluation of Peru's Agricultural Development Program Relation to Production Marketing Systems and Agrarian Reform



-132a-and communications made between top administration and the farm, with programs, thereby, targeted in on the farm over a distance and knowledge gap, with no action return channels of communication from the farm to top administration can be disastrous.

Imaginative new approaches to agricultural development are needed, and a great need exists for a quantum jump in agriculture production. It will be difficult to achieve an immediate quantum jump without structural and implementation viability in the system. A second problem is the number of people capable of providing essential detailed planning competence, and funds and qualified people to carry out programs. These circumstances makes even more critical the capability and role of agrarian reform to take the lead in developing effective production-marketing systems. The agrarian reform units should be selected out, because they represent the organized segment of agriculture, as the points of concentration and the points of departure for agricultural development. The agrarian refrom units, to plan an effective role, must be consolidated internally, and extended externally if agriculture in Peru is to grow. In this regard the growth process must be built step by step from the bottom up, with simultaneous development of the infrastructure (Column 2, Chart 3).

<u>Significance of Chart N° 3</u>

With Chart N° 3, the evaluation system becomes a closed system and Charts 4 and 5 become part of Chart N° 3. Column 2, is the institutionalization of a production-marketing system. Column 2 is enclosed in the planning-implementation system of Column 3, Chart N° 2. Therefore, Charts 4, 5, and 3 are contained in Chart N° 2. Since Chart N° 2 is contained in Chart N° 1, Charts 2, 3, 4, and 5 are contained in the planning-implementation section of Chart N° 1, and the evaluation system is a closed system.

Key Role of Agrarian Reform

The pivot of the Peruvian Government's agricultural policy is a decisive and far-reaching Agrarian Reform. Since it is proposed in this evaluation that all AID activities in the agricultural sector be coordinated in such a manner as to directly support this reform program, it is necessary to have a clear understanding of what agrarian reform entails and the alternative lines along which it may evolve. Changes in the agrarian structure are seen as the means of improving social equity in the short-run, and creating the preconditions for an efficient agriculture and improved labor and capital mobility, which will reflect on the performance of the whole economy. The intent is to change the economic, social and political structure by reducing the political power of a landed oligarchy with creation of a new socially and economically mobile group from the campesino class which will actively participate in society.

Under the law the whole country must be incorporated in agrarian reform zones by December 1972. Once declared an agrarian zone all properties over a specified maximum area (depending on the region, soil and conditions of development) are subject to expropriation. Thereafter properties may be distributed to the original workers or operated as a unit (or consolidated unit of several expropriated haciendas) by the government until such time as it can be turned over to the beneficiaries for some sort of communal operation. It appears likely that this later form of organization will be prevalent e.g. the "sociedades agrícolas de interés social" (SAIS), in the Sierra, and the sugar corporations on the Costa. Further, in the case of current small property owners the present policy is directed to towards creation of communal enterprises to achieve economies of scale, vertical integration and marketing levelage. This would be supported by a range of programs designed specifically for agricultural workers and minifundia. These include promotion of labor unions to improve the bargaining of farm workers; social security; subsidized credit and extension to small farmers; cooperative promotion; and special programs of adult education and industrial development in rural communities.1/

Under the current agricultural plan a total of around 15 million Ha. distributed to 370, 000 families will be directly involved in agrarian reform by 1975, i.e., 43% of estimated potential beneficiaries (1, 022, 000 families).2/

1/ See evaluation of agrarian reform in "Domestic Efforts and the Needs for External Financing for the Development of Peru" CIAP/484, OAS, Washington D. C. April 5, 1971.

2/ H. Van de Wetering "La Reforma Agraria: Un Enfoque Dirigido a medir su Impacto en la Economía Provincial", Programa Iowa-Peru, Estudio N° 14, Lima, Mayo 1970.

It is evident that the whole agrarian reform process is in a state of flux. A vaste range of question related to sequence and implementation remain unanswered. The primary aim here is to prescribe how AID inputs, either financial or technical, might be programmed into this fluid situation in order to assist the GOP in the achievement of priority goals.

It is felt that if AID's efforts are focused on the 15 million ha. and 370, 000 families listed above, plus the administrative processes involved in implementation -- the scope is sufficient to occupy the limited resources available and at the same time have expectation of a meaningful impact.

The recommendation is that AID technical and financial assistance can be most appropriately applied in supporting selected aspects of the agrarian reform program related to priority commodities working from the local situation (reform unit or district through the region to the national level (where necessary) on an integrated production -- marketing system to achieve major short-term impact, which might be replicated to accelerate achievement of the GOP economic and social development goals in the sector. Within this context the above projects were subjected to the analysis outlined in Charts N° 1 - N° 5 to determine the areas of concentration for AID.

A Simplified Systems Programming Model for Regional Marketing

Column 2, Chart 3, contains a systems development scheme for integrating local markets at the regional level. The agrarian reform unit is used as the mechanism of developing and integrating a production-marketing system on a regional base. The decision making features of the agrarian reform unit which require internal integration and management within the unit have been identified under the headings: production, marketing, administration, and planning.

The local units, agrarian-non-agrarian are indicated to be amalgamated locally, and then regionally, as specified. To do this a viable infrastructure must be created, and the local units must be institutionalized by sub-region, and then regionally. The next step would be inter-regionalization, and then development of a national market system.

In the absence of an existing national infrastructure relative to markets and production units, this building block approach is the approach that must be taken for efficiency, and for accomplishment. A procedure to determine the requirements of the structures, facilities, and linkage is set forth in the market statement section of this Chapter.

Relative Prices and Returns

To select among projects one of the basis is relative costs and returns, and another basis is expected total demand and supply requirements. Projected demand and supply requirements are contained in Tables 11 and 12, Chapter IV. Cost returns evaluations for crops are contained in Chart N° 4, and for livestock in Chart N° 5. The attached table contains prices of major products for 1965 thru 1970 for comparison in trend, and relative value. While price provides an indication of relative profitability, the real indicator of profitability is net returns per hectare times the number of units of output which can be sold.

Striking opportunities exist to increase net returns by minimizing costs per unit of output, and be increasing yields relative to costs. Figure 14 shows the range in costs of rice production in the north coast and Selva, at yield levels of 2400, 4400, 5400 and 6400 kg/ha. of rice. The cost reduction per kg with successive increases in yield, based upon these prices is 25% on the average and 40 percent overall. Taking two average yield levels, 1800 kg/ha and 5000 kg/ha the average variance in kg/ha was S/. 1.56 at 1800 kg/ha, and S/. 1.48 at 5000 kg/ha, at the lowest yield level the variance was 64 percent of average direct cost, and 56 percent at the higher yield level.

In other words, the low cost producers have about 50 percent less costs than the high cost producers at each level of yield and the high yield producers have about 40 percent [1/] lower costs

---

1/ Can be achieved by judicious use of cultural practices, improved seeds, fertilizer, and water.

FIGURE 14

ESTIMATED RELATIONSHIP OF DIRECT PRODUCTION COST HA. AND YIELDS HA. RICE, NORTH COAST AND SELVA, 1970

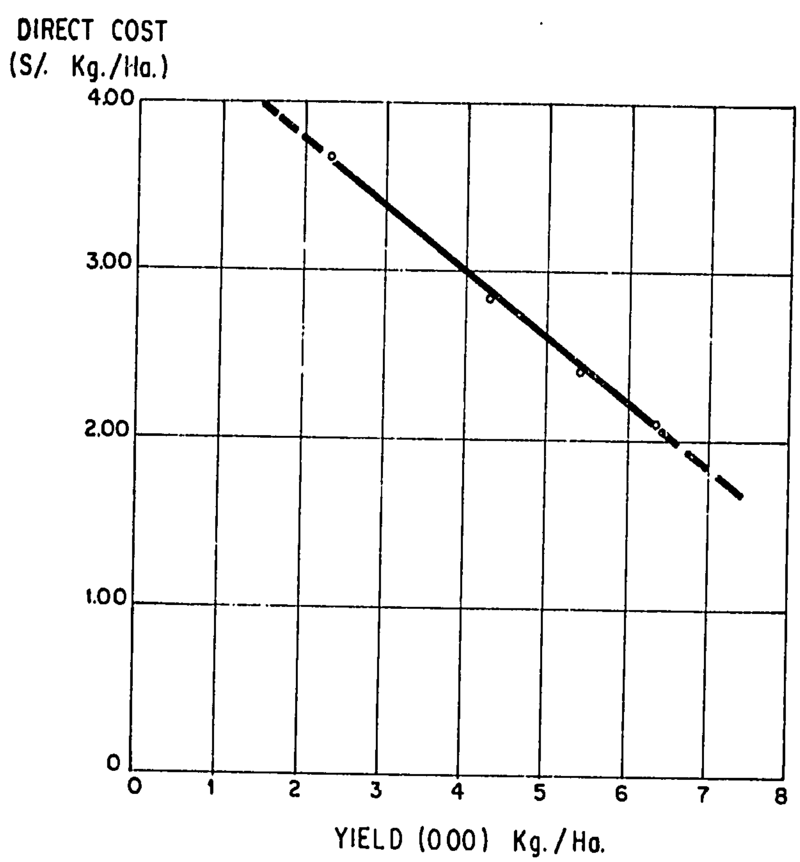


Table 18

Prices of major products for the 1965 through 1970 period

		1965	1966	1967	1968	1969	1970
	(1.1)	2.10	2.35	2.52	1.34	1.34	NA
Corn	(1.2)	3.30	3.40	3.50	3.67	3.70	3.60
Wheat	(1.3)	3.05	2.84	2.90	3.98	5.49	NA
	(1.4)	4.36	5.79	5.85	7.76	8.47	7.45
Rice	(2)	2.54	3.90	3.22	5.02	5.02	5.02
Beef	(3)	22.30	15.50	11.67	18.00	18.72	NA
Pork							
Cotton	(4)						
Tanguis		28.48	28.74	31.91	28.91	26.33	28.00
Pima		32.42	34.08	38.30	42.11	39.92	41.43

(1.2) Prices for corn for poultry feed production are fixed by agreement between producers and millers.
(1.4) Wholesale market prices at Lima.
(2) Price to producer as guaranteed by the Government. The basic unit is the fanega equivalent to 138 kilograms. Starting 1971 prices are fixed on a per kilogram basis.
(1.1, 1.3, 3) Prices derived from dividing total national value over total national production volume.
(4) Prices are in dollars F.O.B. per seed free qq equivalent to 46 kilograms.

Sources: Dirección de Comercialización del Ministerio de Agricultura
Oficina de Estadísticas
Asociación Nacional de Productores de Arroz
Cámara Peruana Algodonera

than the low yield producers per kg/ha. These cost relations make a large differences in net return per hectare, and in total returns. Costs need to be studied because, as demonstrated, the cost reduction to increase net return opportunities are significant. A large share of high per unit costs is a result of poor cultural practices, poor seed, poor technique, and an unwilligness to use high cost purchased inputs such as fertilizer. It takes a package assistance program and time to overcome skill and knowledge handicaps, but it takes a minimum price, price stability, and a well laid out and efficient market system to instill confidence in the producer, and producer incentives to capitalize upon the production increasing, cost reducing opportunities available.

2. A Simplified Crop Production - Marketing Programming Model, Chart N° 4

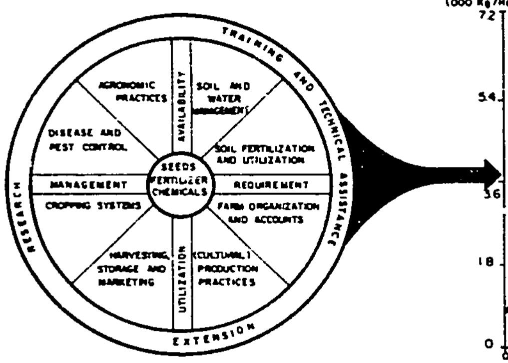
A. Introduction

Rice was selected to be representative of the components, component elements, and relationships bearing upon an integrated crop production and marketing system. The reasons for selecting rice as the representative crop were that: (1) production practices are well established and are consistent over time, (2) more data is available on the production and marketing of rice, than other crops (3) specific policies can be considered, water and price policy for example, and (4) two relevant issues can be directly dealt with: (a) a possible transfer of the location of the center for rice production, and, (b) a possible future surplus of production. The rice production marketing model prepared is an intensification of an in-

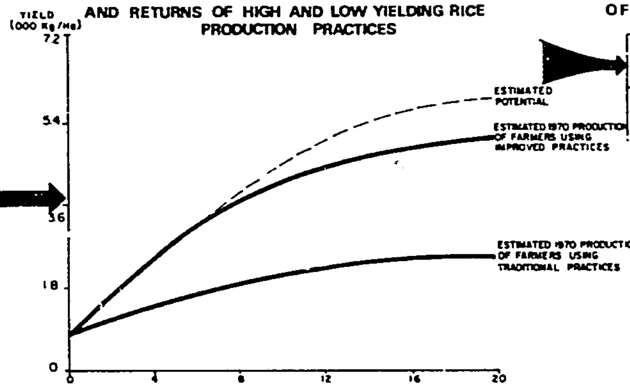
CHART Nº4

DIAGRAMATIC RELATIONSHIP OF RICE PRODUCTION AND MARKETING IN PERU, 1970 WITH NATIONAL WEIGHTED AVERAGE YIELD ESTIMATED AT 4528 Kg/Ha AND AVERAGE NET FARM COSTS OF FERTILIZER.

FARM LEVEL INTEGRATED APPROACH, FOR INCREASED PRODUCTIVITY



REPRESENTATION OF TOTAL AND MARGINAL COSTS AND RETURNS OF HIGH AND LOW YIELDING RICE PRODUCTION PRACTICES



FERTILIZER INPUT (BAGS OF 46 Kg) PER Ha.

A RETURN WITH IMPROVED PRACTICES

UNIT OF FERT INPUT KG/HA 1/	TOTAL YIELD KG/HA	Δ YIELD (KG/HA)	TOTAL COST (SOLES)	Δ COST (SOLES)	TOTAL RETURNS (S/ 2.02 = KILO)	Δ RETURNS (SOLES)	$\frac{\Delta R}{\Delta C}$
0	1,545 0	727 7	50	—	3,121 00	—	—
83 6	2,272 7	1,409 1	550	500	4,591 0	1 470	2 94
167 2	3,681 8	863 7	1100	500	7,437 0	2 846	5 69
250. 8	4,545 5	454 5	1600	500	9,182 0	1,745	3 49
334. 4	5,000 0	250 0	2100	500	10,100 0	918	1. 83
418 0	5,250 0		2600	500	10,504 0	404	81

B WITH TRADITIONAL PRACTICES

UNIT OF FERT INPUT KG/HA 1/	TOTAL YIELD KG/HA	Δ YIELD (KG/HA)	TOTAL COST (SOLES)	Δ COST (SOLES)	TOTAL RETURNS (S/ 2.02 = KILO)	Δ RETURNS (SOLES)	$\frac{\Delta R}{\Delta C}$
0	900 0	—	50	—	1,818 0	—	—
83 6	1,496 0	596	550	500	3,021 9	1204 0	2.40
167 2	1,946 0	450	1100	500	3,931 0	909 0	1. 81

1/ UREA 46 % AVAILABLE N

EVALUATION OF PROFITABILITY

LEGEND
- P = PRICE
- P_1 = PRICE OF COMMODITY BEING PRODUCED
- P_2 = PRICE OF AN ALTERNATIVE COMMODITY
- Δ = AMOUNT OF CHANGE IN PRICE

NOTATION. THIS TYPE OF EVALUATION APPLIES ONLY TO COMPETITIVE RELATIONS, NOT TO COMPLEMENTARY OR SUPPLEMENTARY CROP ROTATIONS

1 FOR A SINGLE CROP $\frac{\text{COST (Ha)}}{\text{Kgs / Ha}} \div \frac{P}{\text{Kg}} =$ (1 (PROFITABLE IF RATIO IS LESS THAN 1)

2. FOR ALTERNATIVE CROPS

A) AT THE MOMENT $\frac{(\text{Kgs/Ha})P_1}{(\text{Kgs/Ha})P_2} =$ (1 NO CHANGE IF RATIO IS GREATER THAN 1)

B) OVER TIME . $\left(\frac{\Delta P_1}{\Delta P_2}\right)\left(\frac{P_2}{P_1}\right) =$ (1 (NO CHANGE IF RATIO IS GREATER THAN 1)

AGGREGATE PRODUCTION ESTIMATES OF RICE FOR PERU 1970

A WITH IMPROVED PRACTICES

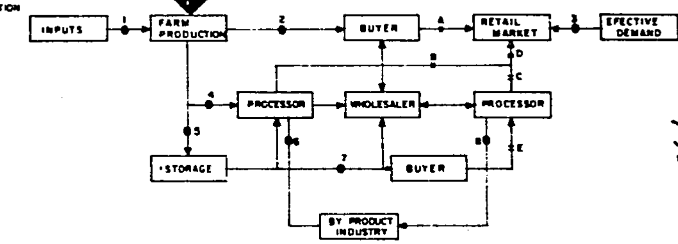
Nº FARMS	AVERAGE Kg/Ha	AVERAGE M.T/Ha.	AVERAGE Ha/RICE	TOTAL/M.T
10,000	5 700	5.7	10 2	581,400

B WITH TRADITIONAL PRACTICES

Nº FARMS	AVERAGE Kg/Ha.	AVERAGE M.T/Ha	AVERAGE Ha /RICE	TOTAL/M.T
4,000	1,600	1.6	5 0	32,000

1/ 1970 ACTUAL = 612,737 M.T.
2/ ESTIMATE = 613,400 M.T., AV. YIELD 4,528 M.T. / Ha

DIAGRAMATIC REPRESENTATION OF THE RICE PRODUCTION AND MARKTING SYSTEM IN PERU



● PRIMARY CONSTRAINT POINTS

1 INPUTS NOT AVAILABLE, OR NOT UTILIZED
2 PRICE TO FARMER DOES NOT REFLECT TRUE VALUE
3. DEMAND RESTRICTED BY INCOME
4. IMPERFECT MARKET TO FARMER
5 STORAGE NOT AVAILABLE
6 VALUE OF BY PRODUCTS NOT INCLUDED IN FARM PRICE
7. IMPERFECT MARKET TO FARMER

▪ SECONDARY CONSTRAINT POINTS

A. NO ROADS
B. NO MARKET FACILITIES
C. IMPERFECT COMPETITION
D. PRICE DOES NOT COVER COST
E. TRANSFER EFFECT FROM D

puts model, without having to expand land areas to increase production. An extensive margin, i.e., land expansion, is considered in the livestock model in Chart N° 5.

The rice model Chart N° 4 considers two levels of cultural practices and one level of production intensification; fertilizer, however, the model also can consider all factors as a variable, or can consider them 1, 2, or more at a time. The model provides for selecting the economic optimum for each input variable evaluated, and further provides for transition determinations between crops. The market system constructed is a conventional system and the primary and secondary constraints represent judgements based upon preliminary knowledge.

Subjected to the test of estimating the weighted average yield of rice, and total rice production in 1970, the model:

1. Estimated weighted average yield within 19 kg/ha of the published figure.
2. Estimated total national production within 763 metric tons of the published figure.
3. Estimated optimum use of kg of N per hectare for the weighted average yield equal to research estimates.

Also the model estimated:

1. The number of farms producing rice, and the average number hectares in rice per farm
2. The number of farms with above average yields, and the number of farms with below average yield.

3. The number of farms by location, by hectares of rice, and by yield levels.
4. The apparent economic optimum of use of kg of N per hectare for high yielding farms.

The main ability of the model, however, is its ability to forecast production with changes in input intensity, and its ability to judge how marketing technology and infrastructure will be able to handle increments in output. It is quite easy to predict maximum output of rice with increase of fertilizer with no changes in cultural practices or lands dedicated to rice. These estimates, which can be reached immediately are:

1. A maximum of 793, 000 metric tons of rice, at the farm;
2. At a maximum average use of fertilizer of 250 kg of N per hectare.

These estimates are well above the projected demand for rice to 1980, and well above the estimated present capacity of the market.

The prediction capability of the rice model can be easily extended to models for other crops, or to new areas of production. The requirement is for solid input-output data on yield response to inputs, a knowledge of components, and the size of the coefficients of the factor relationships of the systems. No elaborate mathematical formulations are involved. It is of interest to note that the model is able to estimate the number of farms, yields and the average hectares per farm, without elaborate sampling procedures. We did not find these estimates in official published statistics. The 122, 000 hectares in rice estimated for 1970 by the model is the best statistical approximation available.

The rice yield (weighted average) estimates of Chart N°4, for 1970 are (combining both yield lines) 4528 kg/ha., compared to the official government figure of 4519 kg/ha. The farm yield estimates, from Chart N° 4, are 5000 kg/ha using 180 kg/N (experimental data estimates are 5800 kg/ha), and the yield estimates are 6500 kg/ha using 250 kg/N, the optimum yield (broken line, Chart N° 4).

Chart N° 4 also contains estimates not readily found in the national data. These are (1) number of farms producing rice, (2) number of rice farms on the Costa and in the Selva, (3) size of farm in rice by each region, (4) the difference in yield of the high producing and the low production farms, and (5) the number of farms in each yield level. Without these data it is not possible to forecast yields relative to different kinds of inputs, estimate the aggregative production over time, nor to determine whether increases are best achieved through increases in hectares, or by yield increases.

Chart N° 4 [1/] estimates the maximum response capability

1/ Also see Carmen-Cuba, Miguel "Yield of Rice as Affected by Fertilizer rates, soils and Meteorological Factor, Ames Iowa, 1968, p. 97.

B. Costs and Returns

Table 19: Estimated Costs and Returns to Rice as a Basis for Prediction

Estimated Costs and Returns (Kg) Chart No. 4 Estimates		Estimated Costs and Returns (Kg) (National Estimates)
Price	5.07	5.07
Costs 1/		
Direct/ Indirect	3.54 1/	3.68 2/
Fertilizer	.034 3/	.03
Total	3.57	3.71
Profit		
Priceless Costs	1.50	1.36
Difference 0.14 4/		

1/ Weighted average costs-such as, pesticides, machinery, labor, animals, water, sales, interest, management.

2/ Weighted average costs - as in footnote 1, plus fertilizer.

3/ Fertilizer as 46 percent Urea, priced at .034 soles per kilo; fertilizer costs are calculated in costs per kilo of yield

4/ Difference could be caused by chance, real difference is, therefore, assumed to be zero.

of rice producers with no change in farms or land area devoted to rice to be 793, 000 metric tons, an increase of 180, 000 metric tons over 1970 estimated production. However, since it was further estimated that 50 percent of the high yielding producers were below 1970 average yield, and 67 percent of the rice producers in the Selva, yield response to improvements in cultural practices and farm management would probably be even greater than production response to increase use of fertilizer. The main production changes considered necessary are improved seeds, fertilizers, labor use, mechanization, and cultural practices. For the majority of farmers to achieve the predicted maximum average yield, would perhaps take 5 years on the Costa, and as much as 10 years in the Selva.

Since the Selva has the resource capacity, and since the Costa rice producing areas have a higher return use capacity than to produce rice, a transfer process of rice production to the Selva is a logical assumption. Transfer could be accomplished by differential prices incentives, by technical and financial support, and by creating storage facilities, local processing, and/or an all-weather major highway across the Andes. As an intermediate step, subsidized freight cost of processed rice might be considered.

There are several substantial reasons for transferring rice production from the Costa to the high Selva. First, rice is not as high value a crop as wheat and corn; both of which are in deficit supply, and both of which are important in direct human consumption. Corn is also an important feed for poultry, milk animals, and hogs, all of which are deficit commodities. Second, rice, even at a supported price of S/. 5.07 cannot support costs of production when related to real cost. An increase in the price of water for example, of approximately S/. 1.5 per kilo of output, would cause the costs of about 5000 rice producers on the Coast to fail to make a profit, and a water price of S/. 2.0 would cause the costs of about two-thirds of the rice farms to be higher than their income from rice is not economical on expensive irrigated land without continuous subsidy, and subsidies have proven, historically, to create an artificial system that tends to be self perpetuating and uncontrollable unless strictly regulated.

Rice production in the Selva should be based upon mechanization and should be in larger than average size units. The minimum average size to justify mechanization should probably be 5 - 10 hectares (see study on this point prepared for Far East, headquartered in Taiwan.) The area of initial concentration should be in the Jaen - Bagua[1/] where growing conditions are good, water is no problem, and where yields compared to Costa yields, and where two crops a year are potentially possible. Public assistance to develop infrastructure will be required. The transfer process,

---

1/ See report "An Inter regional Comparison of Development Potentials and current Allocation of Public Sector Expenditures in the promotion of Rice Production", Tom Alberts, October, 1970, Lima, Peru.

including inducement of the transfer if necessary, of rice production to the Selva will likely take five or more years. Since time is a factor in changing farms from one crop into another, it will probably be necessary to provide technical assistance on production techniques to both the Selva and the Costa.

The technical assistance package should include a crop production agronomist with skill in land and water management, cultural practices, and crop protection (see Chart N° 4); and an agricultural specialists on farm economics and marketing. A development plan should be prepared which outlines and itemizes all of the requirements of establishing a successful rice production program in the area. The policy and expenditure requirements can be directly derived from the implementation plan. In this regard, inputs which will probably be required with respect to policy, is a price differential, and with respect to public expenditure, will be a production and investment credit, and with respect to a capital investment roads. A cooperative or corporate form of providing production and marketing services and inputs for farmers should be considered. A "model" agrarian reform unit may be the more logical overall structural arrangement. Several well grounded models are available for consideration. In any event, a small core technical staff, 2 to 3 which can draw upon consultants, and technical missions as needed, should be included in the program from start to maturity.

Variables, which must be dealt with directly, are fixed production relations in the Chiclayo area. These relations are due to: (1) dependance upon price supports to plan a floor under the price, (2) lack of knowledge of how to produce and market alternative crops, such as corn, wheat, and sorghum, and (3) the economic relationships between those crops, and rice. The indications are that wheat, corn, and sorghum are presently close to rice economically, and could, in the near future, surpass returns from rice. Rough calculations in the area indicate 1970 net returns from rice to be S/. 500 better than corn and S/. 600 better than wheat,[1/] on the average, at present average yields. Much higher yields of wheat and corn can be obtained with little appreciable increase in costs and technology.

3. A Simplified Livestock Production - Marketing Programming Model, Chart N° 5

a) Introduction

Peru has a deficit supply of livestock and livestock products. Foremost among these is a deficit supply of meat, particularly beef cattle. This study concluded that while yields from present

---

1/ Estimated as follows for the North Coast in Soles:

	Corn (kg/ha.)	Wheat (kg/ha.)	Rice (kg/ha.)
Average yield	2500	1500	4528
Average 1970 Cost	1.30	1.20	3.71
Average 1970 Price	3.47	4.50	5.07

Net difference - S/. 20 kg (approx)

CHART Nº5

DIAGRAMATIC RELATIONSHIP OF A BEEF CATTLE PRODUCTION - MARKETING SYSTEM INVOLVING LAND DEVELOPMENT AND RESTOCKING *

Factor Relations

A. CAPITAL INVESTMENT COSTS

1 ADD 300,000 HEIFERS
PLUS 10,000 BULLS

2 CLEAR AND IMPROVE LAND
AT 7826 SOLES PER HECTARE
150,000 HECTARES = 1,173'900,000 SOLES

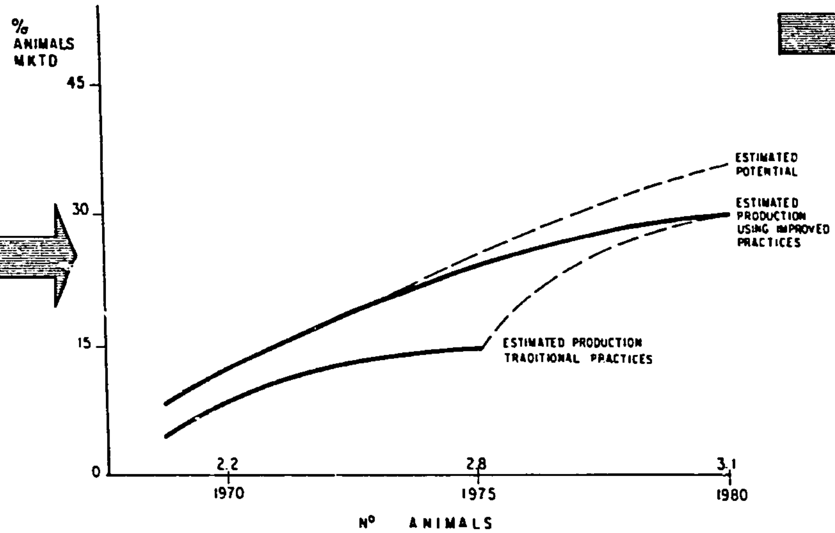
B. ANNUAL RECURRENT COST

3 FERTILIZE PASTURES
AT 43 SOLES PER HECTARE
HECTARES = 6'450,000 SOLES

4 PASTURE MAINTENANCE
AT 600 SOLES PER HECTARE
HECTARES = 90'000,000 SOLES

5 REPRODUCTION
a) BREEDING CONTROL
b) HEALTH
AT 43 SOLES PER HEAD

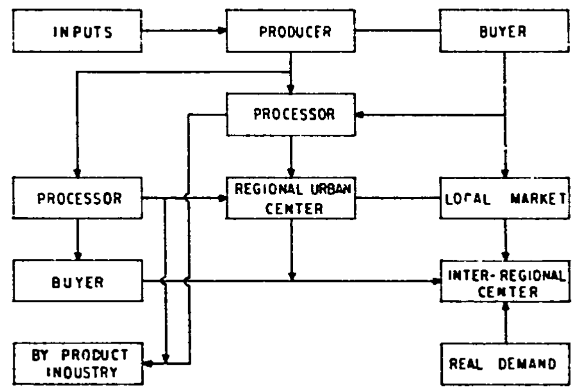
Input - Output Relations - 1980



Influence of Land Development and Restocking on Number of Animals Marketed

YEARS	Nº ANIMALS (TRADITIONAL)	Nº ANIMALS (IMPROVED)	TOTAL ANIMALS	TOTAL PRODUCTION MT	INCREASE IN PRODUCTION M T
1970	308,000	—	308,000	22,400	—
1975	357,500	99,700	457,200	35,063	12 663
1980	375,500	124,800	500,300	38,654	3 591

Marketing



151

DIB E ESPINO

* SIMILAR INCREASED PRODUCTION CAN BE PROJECTED FOR DAIRY AND SHEEP

herds of beef cattle should, and certainly could be, improved. However, what is really needed immediately is a large restocking program of breeding animals. The second conclusion is that the restocking should be done where the associated costs of providing pastures and feeds can be minimized. The single area in Peru with the highest potential in both regards is the Selva, far and away an area with a much higher animal carrying capacity ratio, and at present a low animal incidence than other areas. Millions of hectares of high forage production capacity lands are available in the Selva.

Chart N° 5 is based upon rapid expansion of the beef cattle base, by rapid restocking and land clearing. The following assumptions were made of initial costs:

Unit	Number	Av. Cost (US dollars)	Total Cost US Dollars (000)
Animals			
Heifers	300, 000	100	30, 000
Bulls	10, 000	250	2, 500
Land Clearing and Pastures Estimate	200, 000	180	3, 600
		Total initial investment	36, 100, 000

These costs do not include costs of transport of animals or annual maintenance and fertilizer costs of pastures. Pastures in the Selva area will probably need about 100 kilograms of fertilizer (N-P) per hectare.

b) Costs and Returns

The average annual yields of livestock (beef) in terms of percentage off-take under traditional production systems and under accelerated production model are explained in Chart N° 5. Yields as indicated from both, reflect current traditional and experimental systems data. Chart N° 5 also estimates the gains that may be made from improved animal production practices over a 10 year span, and the levels of increased production necessary to narrow the gap in domestic meat requirements and current national production.

The introduction of 310, 000 high quality breeding animals maintained under favorable conditions will supply about 1/3 of the projected 35000 MT deficit in Peru in 1975. In order to meet the 74, 000 MT deficit projected for 1980 it will be necessary to replicate the restocking from offspring from the original importations, and augment land development programs to provide adequate pastures. To meet the deficit would also require an increase in the average slaughter weight of available cattle in 1980 by 200 kg and increase slaughter offtake by 28 to 30 percent as indicated in Chart N° 5.

The main production changes necessary to correct national meat deficits will involve substantial land development in the Selva, improved production in the Sierra and Costa, plus improvement in pasture and forage management as well as in animal health control.

In order to maximize the short term (10 year) output of meat, it will be necessary to utilize massive mechanical systems to clear land for pasture development. It will include technical assistance inputs in terms of skilled animal husbandrymen, introduction of new forage species, and development of meat processing facilities. A part of the major costs may be derived from revenues from production. However, the major inputs will have come from credit for capital investment.

	Meat Production Factors	
	in Peru	in U.S.
Average carcass wt.	160 kg.	230 kg.
Average age of slaughter	5 years	3 years
Average annual yield of meat (per annum)	45 kg.	60 kg.
Average annual offtake	13 %	40 %
Average annual calf crop	45 %	90 %
Average mortality to weaning	15-20 %	7-9 %

The average carrying capacity for native pastures in the Selva is less than an animal plus its calf per hectare. Improved pastures will more than support double this number.

It is possible, under favorable management conditions, to attain a daily weight grain of one kilogram per day. Under excellent management in the tropics it will be possible to produce 1000 kg. of beef per hectare annually. Such production subsumes a carrying capacity which can be achieved on highly improved well managed pastures, under optimum conditions.

The introduction of 300, 000 head of heifers will result in a heifer replacement factor of 110, 000 at the end of the second year, assuming that losses are minimal and that offsprings will be equally devided between male and female. Each succeeding year for the next three years will add a like number, and thereafter available replacements will be compounded until the end of the fifth year when a certain number of old cows must be marketed.

1. Agricultural Research, Extension and Development as a System

Agricultural progress lies in a combination of (a) agricultural research on key problems, followed by (b) a strong extension program to carry the knowledge gained by original research (& adaptation of research) and (c) a development program that allocates land, supplies production inputs, credits, infrastructure, and assures marketing and pricing to stimulate producers.

A. Agricultural Research

Agricultural research should be organized and administered as a generalized function, making appropriate use of all of the internal and external competence viable. Agricultural research should be a means of supporting national goals; and it should be a means of testing the feasibility of the goals themselves.

(1) Socio-economic research should maintain a continuing process of collecting and evaluating statistics on the status of the agricultural economy, and of people served by agriculture.

(2) Production economic studies are needed to measure the impact of new technology on production efficiency, and to project the significance of such technology.

(3) Marketing research should aid in identifying weak points in marketing systems, and suggest methods of reducing costs and losses.

(4) Physicial and biological types of agricultural research should evaluate natural resources for agricultural production and develop technology to make more efficient use of resources.

(5) Crops Research crops research needs to develop a "package" of production practices, which would include research on soil and water management practices, fertilization, crop protection, and harvest and storage methods.

(6) Livestock Research the concept of the "package approach" is also valid for livestock enterprises. The major components of a successful livestock enterprise include: (a) feed supply and animal nutrition, (b) animal husbandry (management), (c) animal health and genetic improvement.

B. Organization of the National Agricultural Research Program

The national agricultural research program should be organized to have a national research center to undertake studies leading to solutions of major agricultural problems; supplemented by regional stations to concentrate on unique problems in the ecological zones where the enterprises or commodities are produced, and field stations where the applicability of packages of improved production practices can be carefully field tested.

C. Utilizing the Research Capabilities of a University

An Agricultural University has several unique functions. It trains young people through the baccalaureate and graduate levels. The University staff engages in research to keep abreast of scientific progress, and to guide graduate students. It is feasible for a National Agricultural Research organization to capitalize on the availability, competence and interest of a University staff in research by contracting for the conduct of specific research.

D. Agricultural Extension

To assist in the utilization of the results of research in stimulating production of any agricultural commodity, is the function of agricultural extension. This result can be accomplished by: (1) campaigns to influence farmers to increase productivity by following a "package" of improved practices, (2) helping insure that the production inputs are available to growers, and (3) helping find, or develop market outlets at reasonable prices.

Research should supply basic information, and Extension should contribute the direction and force to apply the information effectively.

C. General Observations on GOP Strategy

The population of Peru is growing steadily, and rural population is now less than 50 percent of the total population. Per capita food production has been declining steadily and only about 27 percent of domestic food production is reacing urban markets. This percentage, when adjusted for expected increases in urban population and incomes, has a predictable price increase and lower income consumer effect.

At the same time, the use of agricultural inputs has been declining, the use of fertilizer is way down, and the producer is exhibiting an apathy, if not distrust, toward the economic and institutional systems of agriculture. The use of inputs can be expected to continue to decrease as increasing numbers of producers lose confidence in the system. From these relationships, inflation of food prices can be expected to continue.

The basic question is how can this situation be changed? The next question is what are the steps needed to revitalize agriculture and turn it from its present path? The development goals for agriculture in Peru are the right ones, and agrarian reform has much to commend it, but steps are being contemplated contrary to the achievement of these development goals. Building high cost dams mortgage the future of agriculture and takes away necessary financing for agrarian reform. Agriculture is being dealt with on the basis of zones which are not consistent with ecology. Infrastructure in agriculture is lacking, planning and implementation is not integrated, and production and marketing systems are not being institutionalized. Resources are fixed in less than optimal uses by cost subsidies, and other lines of production are being discouraged by price ceilings. The producer lacks confidence that he will recover his costs, and fears that due to land policies he may be penalized for being too innovative or efficient. Price policy, particularly meat for example, is contradictory to increased output and is reflected in the attitude of the producer not to produce.

The policy should be focused directly upon what is wrong with agriculture; such as, a lack of incentive, a lack of effective production-marketing systems, and a lack of viable institutions which integrate the farmer, the system, and the urban sector.

These conditions, and relations of conditions have significant meaning to Peru's agricultural development strategy. An illustration; by calculating net returns to what is presently the highest value crop on the Costa, namely cotton, and cultivating this crop on all the new irrigated land, the returns will not cover a reasonable rate of interest on public investment funds to the Treasury, if all of the net return are used. Admittedly these calculations are very rough, and were based upon limited amounts of 1964-1965 data; however, the costs of the time lag, other capital costs such as farm structures, or possible change in export prices and opportunities were not included.

The possible social cost in agriculture is considered elsewhere in this report, In this regard, it has been pointed out that the excessive investments in large capital structures may well have a depresant influence on the remainder of agriculture, and, as a consequence, upon being able to; (1) maximize social-economic benefits in the short, and longer run, (2) benefit a small segment at the expenses of the larger rural groups, (3) and may delay a "turn around" in agriculture for an immeasurable amount of time. Rough calculations made with no turn around in agricultural productivity, project a future possible food price inflation rate of up to 20 percent per year.

In this regard, for short run impact, the logic dictates a limited number of projects, especially where social welfare problems are of pressing magnitude; therefore, two types of evaluation comparisons are required; (1) to weigh aggregative social-economic benefits of alternative projects to select the best project, and (2) to consider alternative ways of helping the groups that are involved in the alternatives not selected. One way is to tax the gross value added by the project for what might be called maximum social benefit reasons. For the lack of a better title this might be called "maximum transfer for maximum social benefit".

Little is to be gained by lamenting that "Peru's" agricultural sector is deteriorating regarding production and marketing per capita. What is needed is a plan of action to correct the situation. This study indicates and locates the production opportunities, and has isolated and indicated the nature and location of the gaps that must be closed; which are mainly the absence of an integrated systems strategy in planning, failures in identifying the requirements of implementation, failure to focus and concentrate, and the absence of a viable institutional framework.

Starting at the production level, the priority production alternatives should be exploited by order of priority through the development of integrated production-marketing systems, and by actions and policies which will generate incentive and create capacity to economically exploit the resources available. With equalization of opportunity, this procedure will also maximize the social objectives. The focal point is the institutionalizing of production and marketing systems. The technique is to build these systems starting at the farm and effectuating the use of a building block approach. There are no technological problems standing in the way of this approach, and there are no human or physical resource problems. There are problems of institutions, incentives, and management. Within a limited commodity and project focus, a direct attack must be made quickly and concertedly upon: (1) markets and marketing improvements, and (2) producer incentives. The total task is no short run assignment, but the task is going to have to be accomplished by successive completion of short run projects, which are accumulative and additive steps toward the ultimate goal of a complete system. In this way a long run planning-implementation framework must be provided from the beginning, but the program for achievement, practicality, and financial reasons must be multi-time phased. An inter-phase time period that is often used is 5 years.

In a simplified way a multiphased planning-implementation strategy might be devised as follows, dealing with inputs to the farming system for a given commodity in a given area.

PLANNING-IMPLEMENTATION SYSTEM

Producer (s)

Policy	Markets	Incentive	Operations
Price	Structures	Net Price	Management
Financing	Organization	Inputs	Planning
Institutions	Management	Services	Training
Other	Other	Technical Assistance	Research

One thing that must be kept in mind at all times, is that whatever the end product, it can only be created at the local level. Therefore, studies and plans which do not recognize this can provide neither the requirements or institutions for project implementation. Macro-economics cannot do this; only micro-economics and production people can do this.

The above proposition can be restated for diagramatic presentation and simplification as follows:

PLANNING ← ANALYSIS

PLANNING

1. Prices
2. Costs
3. Policy
4. Concentration
   a) Product
   b) Area
5. Projects
   a) Requirements
   b) Specifications
6. Infrastructure
   a) Inputs
   b) Transport
   c) Structures & Facilities

Local-National Integration
Production-Marketing Systems

ANALYSIS

1. Added Value of Alternatives (MVP)
2. Multiplier Effect (ME)
3. Sufficient Indicator Indices
   a) Economic
      1. MVP + ME
   b) Social
      1. Employment
      2. Income
      3. Nutrition
4. Role of:
   a) Agrarian Reform
   b) Private Farms
   c) Private Agr - Business

Institutionalization
(Implementation)

Local Institutions ⟷ National - Regional Institutions

Banks and Credit	Agr. Business Inputs	Agrarian Reform	Markets and Services	Extension	Finance Education Research Planning

Volume II, National Plan for Agriculture, May 1971, sets forth precisely the same concerns as this analysis. The report recognizes stagnation in agriculture, the rather complete absence of marketing as a widely effective institution, the probable food supply deficit and its bearing upon food import requirements. The list of commodities of concern is practically the same as the commodity concentration group this evaluation has determined as priority. The dilemma is whether to concentrate upon export commodities, or upon domestic food production. Export commodity concentration might be argued on the basis of the natural debt situation, particularly the short term debt. This is a counsel of despair, as far as agriculture is concerned.

Agriculture is not the area to concentrate for increasing exports except for the relatively few crops presently being exported such as: sugar, cotton, coffee, cocoa, and possibly tobacco. The investments costs are too high and the maturity time is too distant, as has been shown. The export market is highly competitive, and sales and prices are uncertain except under expert hands. And to accept an export emphasis as a sole objective would meritably penalize the future of better than 90 percent of the rural sector.

At the same time, a carefully developed and executed vegetable industry shows real promise as an export venture with domestic employment, income and nutrition significance of outstanding dimensions for the Costa on the high-cost irrigated lands, particularly for the South Costa of Peru. The time to maturity of this undertaking could be relatively short. Plenty of capable assistance, and outstanding seeds and plant materials are readily available.

Peru should not attempt to become self sufficient in wheat production. The costs are too high considering alternatives and the possibilities relative to domestic competition from other commodities, geographic limitation, and import-export "trade-off" opportunities. To exploit wheat, the domestic program should aim at 50-60 percent of domestic needs. However, Peru should start a concentrated, sharply focused, research program on oil seeds, seeking to fulfill domestic requirements fully in 8 to 10 years.

The next opportunity, second to a vegetable industry, should be the development of a fruit industry based on domestic consumption and export market from the low and high Selva. The potential in Peru to exploit the world market in tropical fruits is equal or better than for vegetables.

At the same time, one need not be in Peru long before recognizing and being dismayed by the unorganized, uncertain, and highly variable nature of present fruit and vegetable production and marketing, and to become concerned that the potential of these two industries is not being utilized, particularly, when conventional new food crops, which face severe international competitions, are postulated for export concentration.

There are opportunities also, to move concertedly and systematically, into forestry and fisheries for export; both of these products can be developed further. However, any exploitation should be done on analysis of the location, demand volumes, and probable prices of the possible products. These ventures are high-cost, and sophisticated demand requirements have to be met.

The challenge of the future is to be able to deal with exports in such a way as to support, and enhance, a central thrust upon agriculture for the domestic markets, generally, and upon rural social and economic welfare, specifically. The aim cannot afford to lose sight of this central objective. The stakes are too high, and the issues too critical, not to have policies and a program which permits agriculture to play its proper role and to make its rightful contribution to national progress.

Historically, major problems of the rural sector have been:

1. Rapid rates of Ministerial personnel turnover, and inflexibilities in policy.
2. Deficient and highly variable public financial support of agriculture.
3. Proliferation of responsibility to the point where decisions are without significant meaning and projects are without significant impact.
4. Concentration of investments on the Costa, at the expense of more viable national economic and social projects in other regions.
5. Treatment of products and production processes in agriculture as though they all had short-run solutions.
6. The lack of national recognition of agricultural and rural people so that people are neither attracted, retained, or motivated by agricultural endeavors.

CHAPTER VI
EVALUATION OF PAST AID PROGRAM AND FUTURE REQUIREMENTS

Chapters II, III, IV and V clearly outline the dificiencies of past GOP programs in agriculture. The rather clear indication is that little, if anything, in the way of constructive well defined and sharply focused program exists in agriculture in a systems sense, and in the sense of adequate governmental support of agriculture. The lack of confidence of the producer, and the inability of the agricultural system to instill confidence and incentive is well demonstrated by the decline in production the past 10 years. The main points of the argument of the preceding chapters are for revitalizing the agricultural sector by fully reorganizing the sector so that the emphasis of agricultural policy orientation will be upon: (1) the priority commodity group, (2) a regional concentration, and (3) will concentrate on the factors which, in fact, will get agriculture moving. This also means that agriculture must have a viable institutional framework within which to operate effectively.

In summary, the preceding chapters say that the approach should be to:[1/]

1/ The methodology of approach is contained in Charts 1 and 2, Chapter II (point 1, above). The methodology of development of integrated production and marketing systems is contained in Charts 4, 5, Chapter V (point 2, above). The methodology of the agrarian reform context, and the infrastructural requirements is contained in Chart 3, Chapter V (points 3 and 4, above).

1. Take a priority commodity focus with regional concentration
2. Develop integrated production and marketing systems for each commodity
3. Operate in the social-economic context of agrarian reform
4. Build or remodel the necessary institutions and infrastructure

Given this as the viable context for program planning and implementation, and policy orientation, an evaluation was made of the possible contribution to these ends for USAID agriculture programs, with the following conclusions:

A. Supervised Credit

A search of USAID files disclosed only two definite documents on the AID credit loan, (AID Loan 527-L-047). One of these documents was the loan document, November 23, 1966, and the other is a report entitled "An Evolution of Selected Supervised Agricultural Credit programs in Peru, Lima, June, 1968, North Carolina State University. The loan document states that the loan was made to: 1) assist Peruvian agricultural development (of low and medium income farmers), including agrarian reform, 2) finance technical assistance relative to the loan, and 3) finance U.S. dollar cost of goods and services.

The loan document sets forth terms and conditions of the loan, provides that no more than 30 percent of the money is to be used with terms longer than 1 year, and that the amount of principal indebtedness of any farmer is not to exceed 10,000 U.S. dollars, in soles equivalent. The main deficiency of the loan document is that it does not indicate the end product the credit was to address either in time, space, or substance. Therefore, it is only possible to evaluate the credit program as to results relative to the terms and conditions of the loan.

According to accepted terminology the credit loan does not conform to the definition of supervised credit. One of the main things missing is a package of technology to be applied, and technical supervision to insure its application. The second thing is the lack of specific focus on the credit requirement differences in annual versus perennial production practices.

The North Carolina report is of little assistance with regard to these questions, and the USAID program documents contain no evaluation information. In reference to the North Carolina document it is the opinion of this study that the report manual contains too much description of loans and credit institutions, and not enough information to judge the effective use of credit, for making decisions on the uses of credit relative to repayments, and how to make the best economic use of credit funds.

Economically sound loans are those which contribute more to farm income than the costs of the credit. This necessary condition usually requires the application of a package of technology, and technical supervision, at all but advanced stages of modernized agriculture. Further, if credit funds are limited it is necessary to rank the uses of credit by economic (and/or social)priority. Presumably, the objective of credit is to increase total agricultural and individual farmer income. Credit is also used to bring about structural change. In these cases, however, since the public benefits, the pay off (and repayment) context is social.

Judged in economic terms, credit authorities need data on productivity values (MVP) of capital in alternative uses relative to: (1) a given product, and (2) between alternative products. These propositions state that whenever a choice of production techniques to produce a given product exists, an economic choice must be made as to relative costs and pay off. Correspondingly, alternative products must be compared both at a given moment in time as well as the present value of the prospective net cash flow over time. Credit can be advanced on all loans as long as the marginal value (added) productivity of credit is greater than or equal to credit costs. If price or climatic variability add an element of risk with respect to the actual realized value, future values may be discounted by a derived coefficient of risk.

It appears that many of the credit loans in the past have been made for purposes which did not yield returns equal to costs. In fact, many loans may have been made under conditions which yielded negative returns. This may have been due to the terms and conditions of the loans, and it may also have been due to loans which proved unprofitable, providing; thereby, little incentive for repayment.

The above argument is not concerned with safe loans, rather it is an argument for sound credit procedure. It is quite evident that additional work needs to be done to develop an effective lending procedure, and this will require a special study on "the marginal productivities of loan funds for alternative short run farming situations and long run uses." Suggested questions that might be addressed by such a study are:

1. Effects of credit on the adoption of technology (capital-labor substitution problem).
2. Effects of credit on optimum enterprise combinations.
3. Effects of credit on efficient use of other inputs such as land and water.
4. Effects of pressures placed on marketing and distribution systems due to credit availability (i.e. effect on prices).
5. Identify the bottlenecks in input market distribution systems and infrastructure of the economy that prevent effective use of credit.
6. Examine the role of capital in forming the structure of the agricultural sector (e.g. cooperatives vs. private enterprise).

Not only is the above study needed immediately, it should be short-term - not more than 3 months. However, it is the argument of this study that AID financed credit should be focused upon the priority commodities in the context of Agrarian Reform as set forth in Charts 2 and 3. Further, the credit impact upon productivity and employment of projects or activities to be financed should be weighted in terms of their relative contribution to GOP strategy to achieve the agricultural development objectives, Chart 1.

B. Marketing

Marketing of agricultural commodities in Peru generally consists of large numbers of small, low-volume, wholesalers and retailers linked together by traditional means. Little integration exists in the market system; and storage, transport, means of transport, adequate processing, and quality control are notably absent. By and large, efficient market systems based upon effective integration of local, regional, and inter-regional market structures and facilities do not exist.

The AID marketing loan proposal on self-service food marketing chains, and private full-line wholesalers and technical assistance on marketing policy is considered to be outdated by this study. The specifications of column 2, Chart 3, are considered to take its place.

In column 2, Chart 3 a diagramatic layout for the development of an improved market system based upon the regionalization of local markets and upon agrarian reform is set forth. In these terms, a market formulation procedure should be undertaken which would address the following questions:

1. Describe and evaluate present agrarian reform and local marketing processes.
2. Determine technical and economic improvements upon structures, facilities, and marketing processes.

3. Establish a framework for integrating and regionalizing agrarian reform unit marketing.
4. Determine whether this marketing framework can also be effectively used for purchasing supplies and services.
5. Determine the possible ways and means of integrating other local markets into the regional system.
6. Set up a means of inter-regionalizing marketing covering terminal and sub-terminal points, and import-export trade.
7. Determine public expenditure requirements to provide the essential transport linkage, storage, and processing facilities.

Primary dependance would be placed upon agrarian reform to establish the regional markets, with credit and technical assistance. Training in marketing, management, and market development would be required. The government would be expected to finance the national network linkage to make the regional system viable at the national level. It is proposed that the development of the system start on a sub-regional (2-3 unit) basis, and be confined to 1 or 2 leading commodities to start. The frame of analytical reference for the proposed market system is Charts 2 and 5.

C. <u>Iowa State University Program</u>

The purpose here is not to go into detail on whether the contractor has met the goals specified in the contract - this is fully documented in AID annual evaluations - performance has clearly been of superior quality. The questions to be addressed are: (i) Were the goals appropriate or achievable? (ii) If not, what might have been more suitable objectives? The issue of how the program might be re-structured in order to support the evolving strategy for agricultural development is taken up later in this Chapter.

The stated objective is "to improve the conditions under which the planning process is carried out "with efforts to be concentrated in--selected entities to develop 'nuclei of competence' in planning research--for the agricultural sector "aimed at "institutionalizing planning and research for agricultural development".[1/] While all reports on the contract stress the importance of coordination between the Iowa and NCSU groups, achieving linkages and an impact on policy decisions and action programs of the GOP related to agricultural development, building and institutionalizing the planning process, two factors have effectively precluded any measurable progress along these lines: (i) The instabilities operating on the situation from all sides, notably changing AID and GOP personnel, policies and budgets, and (ii) lack of any framework of integration resulting in unspecific goals with ad hoc interpretation and decision making by the changing personnel.

The idea of creating an "island" of excellence in a "sea" of mediocrity in the civil service makes little sense unless parallel efforts are being made to generate other "islands" elsewhere in the government structure. The "topping off" of salaries to artificially maintain

1/ "Project Agreement on Agricultural Planning and Studies", AID Dec. 6, 1970 such "islands" must be regarded at temporary at best, and may create distortions which create unnecessarily severe changes at such time as the system returns to equilibrium.

It is abundantly clear that Iowa's forte has been in providing research experience, on-the-job training and formal U.S. training (30 professionals trained to MS or PhD level over 8 years) to a wide spectrum of Peruvian professionals in the INP, UNA, Banco Central, BFA, and OSPA, in relatively rigorous quantitative economic analysis primarily aimed at the macro level. Given the chronic instability of the GOP institutions and bureaucracy, which can hardly be expected to show significant improvement in less than a period of 5-10 years, a case may be made for seeking as wide a dispersion as possible of well trained professionals. The professionals would fall into 2 groups: (i) those who rise to administrative levels and appreciate the value of soundly conceived economic research in decision-making as well as have a common ground for professional coordination with administrators in other agencies, and (ii) research directors who can provide economic analysis of alternatives (at both macro and micro levels) in which administrators will have confidence.

The record of both Iowa and NCSU in INP, OSPA and UNA, demonstrates the impossibility of developing a professional cadre by focusing exclusively on the work of one institution. If this proposition is accepted, together with the need to place the Iowa technical assistance effort within an integrated framework of GOP policy formulation and development programs for agriculture, then the lines for refocusing the program may be directly drawn from the analysis in Chapter V. The general lines are;-- orient the Iowa State and NCSU programs towards training and economic research in support of the agrarian reform planning, staffing and implementation, to establish competence in micro economic analysis (not to exclusion of macro) in support of program and project formulation and implementation (i. e. farm management), marketing and public administration, and strengthen Peruvian efforts to develop a graduate program in economics. The precise structure of a graduate program will be largely influenced by the finding of the INP study on the needs and means of providing advanced training in economics due for completion in October 1971.1/ The above aspects are elaborated in Chapter V within the specific context of GOP goals and strategy for agriculture.

D. North Carolina State University Program

As in the above discussion of the Iowa State University program, the issue is not the extent to which the contractor has complied the conditions and objectives of the contract. Nevertheless, it is evident from the NCSU evaluation2/ and AID performance reports that the program has been executed under extremely fluid and highly variable GOP policy conditions. Further, the goals set out, namely (i) to assist in development of the Direcciones de Investigación y Promoción in the Ministry of Agriculture and the UNA in order to contribute to improved

1/ Janet C. Ballantyne "Review of Economics Programs in Peru", Ford Foundation, Lima, December 1970.

2/ NCSU evaluation draft, Lima, June 1, 1971 "efficiency of production, storage, distribution and marketing" and "increase the per capita supply of essential nutrients",[1] are extremely vague. Although the agreements and program documents call for full integration of activities, in such statements as "programs were designed to coordinate production and marketing components through integrated research, extension and fomento"[2] the fact is that this has not been attained, i.e., the traditional discrepancy between the theory and practise. NCSU can in no way be blamed for this situation - performance within the limited technical areas within which NCSU found itself confined was more than creditable, - what was lacking was a decision framework which could be used effectively by both AID and the GOP to guide and orient the program. Thus, it is axiomatic to state that if the NCSU program is to be made more effective some reorientation is required, and further, the pre-requisite to such reorientation is a decision framework which is wholly consistent with current GOP policy for agricultural development(see Iowa State Statement).

As indicated above, problems in effectiveness of technical assistance do not appear to be rooted in any lack of theory on linkage, integration, coordination etc. Rather, the failure point may be

---

1/ "AID Proag", No.527-11-110-060, Lima, May 21, 1971.

2/ "AID Country Assistance Program FY 1967 Peru", Part II Section I, Lima, October 1965, P. IV-A-3.

identified as an inability to rigorously specify the problem (particularly with respect to institutional aspects, the probabilities of non-programmed events, and potential consequences of changes in policy and personnel) and design a flexible program accordingly.

It must be recognized from the outset that biological research is not something which should be discontinued from one day to the next. The first step in reorienting the NCSU program will be a thorough appraisal of all on-going projects to determine the minimum phase-out time which will allow a given piece of research to be brought to the point where some meaningful conclusions can be drawn. The precise projects to be phased out and the new ones to the added will be drawn from the discussion of projects and priorities for AID assistance, below.

The training of professionals and building of a sound technical center of learning and research in the agricultural sciences (whether it be the UNA and/or others) is a long term concept, and will be essential to a sustained execution of GOP policies for the sector. However, recent experience of the UNA demonstrates the hazards of placing too much hope on a single institution. The vehicles to be chosen by the GOP for training must be evaluated and technical assistance given in those areas which will be specifically in support of those agrarian reform projects that are identified as priorities with specific emphasis on training to meet the production, marketing and administrative problems which are readily foreseeable in these projects.

The same reasoning applies to the focus of NCSU efforts in research. In a number of areas [1] available research results are more than adequate to meet the technical needs for immediate success in the priority projects. The need is in other commodities, adaptive research in some cases i.e., plot testing, efficiency of water use in irrigation, the sociology of motivation and innovation among campesinos (adoption of new technology) under conditions of communal operation of land, technical questions with respect to design of storage, transport and marketing systems, and farm management. In all cases it is to be expected that the focus would be on specific integrated systems projects with policy reference and with maximum effort to take full advantage of problem-solving, and generalizing from such experience to regional and national levels.

An internal review and evaluation is being made by NCSU addressing their present program in this broad context of institutions and policy. The results of the evaluation are available in a separate report.

Framework Developed to Determine AID Staffing Requirements

The framework in Chart 3 has obvious implications for USAID agricultural assistance programming. The assistance needs of Peru's agriculture is a concentration upon developing effective agrarian reform units and creation therein of an administrative and decision making proficiency. The second thing is consolidation of the agrarian

1/ See NCSU evaluation, op. cit Chapter III (rice, beans, potatoes, etc.)

reform units into efficient production systems, concentrating on the priority commodities. The third thing is to help build an effective marketing system and to achieve the incorporation of the agrarian reform units into this system.

An assistance innovation that should be considered by the USAID Director is the possibility of providing a top flight analysis team to assist the Planning Office of the Ministry of Agriculture and the USAID Agricultural Office. This top flight analysis team would provide continuous assessment of progress in achieving project objectives, be staffed by senior level, broad gauged, widely experienced agriculturists with at least one with proven qualifications in systems analysis, and sector analysis. This team would be expected to provide USAID and the GOP with evaluation analysis and planning.

It is visualized that this team would work out of the Agricultural Office of USAID, and would: (1) formulate programs in concert with USAID and the Ministry of Agriculture, (2) develop projects and help find staff to implement the projects, and (3) provide continuous consultation and advise to the projects.

The focus of the foregoing assistance to USAID would be to provide direct assistance in institution building, and integrated production-marketing systems, centering upon agrarian reform. The areas of concentration, which must be integrated with respect to each other are:

Team Concentration Area	Numbers of: Leaders	Projects
Sector Evaluation Analysis	1	1
Macro Demand/Supply Studies	1	1
Production and Marketing Systems	2	2
Private Sector Development	1	1
Farm and Institutional Management	1	1
	6	6

The leaders would provide the analysis frame, the analysis, coordinate and work with the government, utilize consultants, and develop staffing and project implementation procedures in two phases: (1) phase 1 - analysis and project format determination, and (2) Phase 2 - staffing and project implementation. These seven positions would not seriously affect the number of contract positions available, and would provide flexibility in leadership, staffing, and project selection and project mix over time. Additionally, 2-4 man-years should be left open each year to bring in short term consultants, or teams on specific assignments.

The logic of the above argument indicates alternative B, Chart 2 as the logical choice of the USAID assistance and that alternative AB would only be considered as a combination choice depending upon the staffing and backstopping requirement. This outcome would only be true if the alternative AB activities had direct and specific application to: (1) production-marketing systems development, (2) directly contribute to project planning and implementation procedure and, (3) made "grass-roots" farm level input. The viable U.S. assistance role of the future is the role of senior key project leadership in an active problem solving sense. Research and training, then play a backstopping problem-solving role on problems identified and sharply focused in a development framework.

The Private Sector

While agrarian reform is, and must be, the focus of the inputs in agriculture in creation of the production-marketing system, the place and role of the private sector should not be neglected. The agrarian reform units should not be expected to, and should not, for economic stability and economic growth reasons, extend themselves beyond becoming production and marketing specialists. A competent, private sector with viable policy support can shore up and enhance the capabilities of the agrarian reform units. Retention and building of the private sector is needed in such things as seeds and plant materials, fertilizers, machinery and equipment sales and repairs, production and other technical services, protein supplement feeds, and dairy herd replacements. All of these services are specialties and require high degrees of competence in management. The axiom of excellence is specialization, and the axiom of specialization is division of labor. It would be remiss if the strength of a viable private sector was not recognized.

Relevance of Chart 3

Chart 3 utilizes the approach concepts and logic of Charts 1 and 2 in deriving the planning-implementation gaps (Column 1); and the systems integration methodology in deriving the marketing constructs (column 2). The recommendation of taking agrarian reform as the development unit related to priority commodities is expanded upon later in this section. It is apparent that a coordination gap exists among the program aspects of USAID technical and financial support to agriculture with respect to each other, because of a failure of identification of the relationship of the aspects they are focused upon, and because there is no integrated systematic structuring of the GOP agricultural development program.

The identification of the development gaps in the GOP system provides an opportunity to focus AID's program to integrate and concentrate it, and thereby to gain a multiple and a multiplier effect.

Concerted steps must be taken immediately to establish a viable markets and marketing (demand/supply relations) system. A suggested way for developing a regional marketing system, based upon local markets and agrarian reform units is illustrated in Chart 3. These agrarian reform oriented markets are integrated into a proposed national marketing system, including input-export trade. The factors, and factor relations are considered to be sufficiently identified to provide a basis for implementation planning. This attack upon the marketing problem is considered to be the most relevant and economical approach, and the one with the best chance of success.

A. Diagnostic Representation of Present Program (Column 1)

1. GOP Agricultural Development System

The intent of the foregoing presentation is to focus U.S. assistance squarely upon the institution gap, the integration gap in planning-implementation, and thru the instrumentation of developing effective production-marketing systems from the ground level up, for priority commodities, with regional and sub-regional concentration. The primary sub-regions of Phase I implementation should be: Costa, north, central, south; Sierra, central, south; Selva, from Pucallpa north.

Column 1, Chart 3, groups the GOP system in agriculture by functional categories: (1) planning and strategy (administrative and analysis levels), (2) implementation (action and technical levels), and (3) research and extension (support levels). This classification was derived from Chart 2, relative to the functional requirements of Chart 1 as to the specification of the development goals. See center section, evaluation and analysis Column 3, Chart 1 and the sub-section on Production and Marketing Systems; the development planning matrix, Column 5, Chart 1, traced through Column 4 to Column 1, Chart 1.

Then from Chart 1 a determination was made of the place of existing and nature of the development gaps in the system. The gaps were identified as being greatest at the action level, institutions, infrastructure, inputs, private sector and public expenditures. Since planning and the farm are not integrated it cannot be assumed that research and extension are integrated and focused, particularly in the frame of reference of the present GOP goal structure.

Constructive suggestions are provided in this report for development of an integrated agricultural development program in Chart 1. The methodological elements are contained in Charts 1 and 2 to provide a framework for establishing effective production-marketing systems in an agrarian reform context Charts 4 and 5, and in a regional-national marketing framework, Chart 3.

2. USAID Agricultural Assistance

The evaluation purpose of USAID counterparts portion of Column 1, Chart 3, is to illustrate how the AID program corresponds to the major gaps in the GOP functional operations in agriculture. The Iowa program can be said to be indirectly related to policy, but does not have a sufficient macro-micro integration to be as effective as might be. The credit program obviously needs recasting, and focusing on the priority commodities. It is not now integrated into an effective production-marketing system, and is too geographically restricted. No information is available on the relation of credit to credit needs. The marketing proposal is not valid in the development context of this report. The North Carolina program needs to be integrated into a total package of assistance approach, and must deal with integrated systems. Both the Iowa and North Carolina programs must be: (1) integrated, (2) focused upon an integrated systems development of production and marketing of priority commodities, on an area concentration basis, and must be directly concerned with the policies at issue, and with the building of national institutions to integrate the components of each commodity system. Commodities are the only means of obtaining distributive growth impact on each region of the country.

Relevant criteria to evaluate the composition and contribution of the present USAID agricultural program are: (1) critical mass, (2) relationship to other internal and external inputs, (3) difficulties of being plugged in at every level, and (4) relation of present inputs to the organic needs of development.

B. Project Selection Procedure, Chart 3

Chart 3 specifies that USAID assistance be oriented to Column 3, through an institution building relationship of which the market systems representation is but one. A set of projects needed in this regard is listed in the third column. This set of projects is representative, and is not to be considered complete. This column is included to illustrate that eventually everything comes down to projects, and to priorities with respect to projects. Column 3 is included in Chart 3 to indicate what kinds of projects might be involved.

The list of projects from which this representative set was selected, was narrowed down by relating the entire set of projects to Charts 2 and 1, to determine the probable contribution of each to the GOP agricultural objectives, and to assign weights relative to priority.

The actual projects recommended are contained in the last section of this chapter.

On these grounds, the USAID agricultural program does not have critical mass with regard to the development gaps identified.

The probable marginal value increments of intensification of the NCSU projects is likely very small, and the Iowa State program could achieve additional value contribution by assuming an active role internal to agrarian reform at the field level. The alternative would be for NCSU or some other University or the USDA to assume this role, in concert with Iowa State's or some other University's, or the USDA, efforts at the macro analysis level. In this case, the NCSU "in-depth" projects would have to be weighted against the research and technical assistance of agrarian reform production and marketing systems. To gain critical mass input, and necessary integration of agricultural assistance, this working relationship is considered to be the only alternative. This alternative might be backstopped by continuing some elements of the program at La Molina dealing with the basics of research and training on the priority commodities, and broadening the program to include training on social institutions, but this backstopping would not be the main thrust of the assistance as herein prescribed.

In the future, the USAID must consider US assistance as a part of a total package. This means U.S. assistance in concert with other sources of inputs. Especially is this true in those cases where the U.S. is providing a substantial financial support to international research and technical assistance networks. A second mandate, in this regard, is to view the AID centrally funded research as an opportunity to program this type of research assistance and staff talents directly into the development framework requirement of this country. Theoretically, the following array of assistance might be arranged:

1. CIMMYT should be called upon to furnish technical assistance and back up research on corn and wheat.

2. CIAT should be called upon to furnish technical assistance and back up research on livestock and forages.

3. IRRI should be called upon to furnish technical assistance and back up research on rice production and mechanization.

4. AID centrally funded agricultural research particularly relevant to Peru's agricultural problems are:
   a) Auburn University - fresh water fisheries
   b) Dept. of Interior - control of vertebrate pests
   c) Texas A & M - Livestock diseases
   d) Un. of Florida - livestock nutrition
   e) Un of California - crop protection and pesticides
   f) Colorado and Utah State - soil and water management
   g) Un of North Carolina - soil fertility

These illustrations provide examples of the kind of assistance which in the most logical way might be called upon and which is being paid for in total or in part by U.S. dollars. It would be doubtful whether a future agricultural assistance program in Peru should be developed without weighing the availability of these kinds of resources against needs.

C. <u>Conclusions From Column 1 Chart 3</u>

1. A development gap exists between planning and the farmer concerning the entirety of implementation: infrastructure, institutions, inputs, public expenditures, and support of the private sector.

2. A communications gap exists from the top to the farm level, and a reverse communications gap also exists.

3. As a result, the functions of planning and implementation are not integrated with respect to the farmer, and, therefore, with respect to agrarian reform.

4. Consequently, effectively integrated production and marketing systems have not developed, and will not develop until integration of planning and implementation is accomplished.

5. The present USAID program is not integrally related to: (a) the development and institutionalizing of production-marketing system, (b) the corporation of the farmer and agrarian reform into the process of institutional, economic, and social growth, and (c) the determinants of the place and role of the private sector.

In the above context, improvement of the U.S. contribution to Peru's agricultural development includes the following:

1. The program should concentrate on production-marketing systems of priority commodities by region, as set forth in this study.

2. The program should be directly related to and integrated with agrarian reform at the farm level.

3. Research, training, and credit should support with the production-marketing development components integrated with respect to each other and to policy requirement determinations.

The analysis in Chapters II-V concentrated on developing requirements of a critical mass of inputs to generate a significant quantum response in output. The constraints on a generalizable approach to increased output from the agricultural sector, are that financial and technical resources are limited, and that time is short. These constraints force a focus upon priority commodities, and regional, (and/or area) concentration. Therefore, throughout this study it has been necessary to maintain an integrated systems approach to the agricultural sector which, of necessity, went far beyond the bounds which may be contemplated for AID assistance.

I General Country Project Recommendations

The following set of projects were selected from among the production opportunities of the priority commodity group, with specific reference to regionalization for national impact, subject to condition of focus upon the four national objectives (Chart 1), and subject to the further condition of area concentration. The parameter of the output objective is an average annual growth in rate of output by product, supported by increasing the average annual budget for agriculture to 7.5 percent for projects of concentration and an additional 10 percent for general program.

<u>1971 - 1975</u>

1. Area and Inter Regional Integrated Production Program on Rice, Wheat, and Feed Grains: North Costa - North High Selva
2. Non-Ruminant Livestock (Chickens and Hogs) Expansion - North Costa
3. Inter-Regional Livestock (cattle, sheep) Feeding Program; for Central and North Costa, and Sierra
4. Feed Grains Program: Costa
5. Integrated Pasture and Beef Cattle Restocking Program: Selva (Pucallpa)
6. Pasture and Nutrition Improvement Program, Dairy and Sheep: Central Sierra
7. Local and Regional Marketing Improvement: Costa and Sierra

8. Special Studies on above projects
   a. End Product Impact of Historic Policy
   b. Planning an Integrated Production - Market System
   c. Credit needs and effective application of Credit
   d. Development of an Integrated Area Program and Requirements for Implementation
   e. Place and Role of Private Sector Agri-Business
9. Production Research
   a. Oil seed
   b. Farm mechanization and capital formation

1976 - 1980

1. Vegetable Production, Processing and Marketing: Central and South Costa
2. Tropical Fruit Production Processing and Marketing: Selva
3. Livestock Improvement Program, Cattle and Sheep: Sierra
4. Livestock Improvement Program, Dairy: Costa and Sierra
5. Integrated Production - Marketing Systems on milk, livestock, potatoes and feed grains
6. Integrated Dairy and Vegetable Production Scheme: South Costa (Arequipa)
7. Effective Support of Agrarian Reform by Agri-Business

8. Special Studies
   a. Demand and Supply Relations: Export
      1. Vegetables
      2. Fruit
      3. Fish
      4. Forest products
   b. Means and Costs of Providing Employment and Income Distribution in the Rural Sector
   c. Comparative Advantage in inter regional trade
9. Production Research
   a. Integrated Production Systems
      1. Livestock - Pastures
      2. Livestock - Feed grains
   b. Vegetable, Fruit and Oil seeds
   c. Crop and animal disease and pest control
   d. Yield increases
      1. Cereals
      2. Cotton, sugar, coffee

II Illustrative Recommendations and Strategy for the USAID Agricultural Program: 1971 - 1980

A. Introduction

It would be premature to identify, the order of priority for projects in which AID assistance should be considered. Chart 3, Column 3 gives an illustration, based on a first approximation, of some of the apparent higher priority areas drawn from the "areas of concentration".

In the future the frame of assistance reference should be broadened to include social as well as economic processes and must be policy oriented. An essential condition of assistance is the willingness of the GOP to support the Minister of Agriculture to implement decisions.

In the frame of reference of the GOP agricultural objectives, a focus upon policy, and commodity and regional concentration; and relative to present programs, the following courses of action appear to have the highest immediate relevance:

1. Apply analytical leadership to determinations of the highest order Planning-Implementation framework and staging of the development of integrated production-marketing systems for Agrarian Reform.

2. Develop a master plan for integrated area development based upon maximizing enterprise combinations and rotations, and interarea transfers.

3. Undertake studies which will provide diagnostic guidance on institutionalyzing the production-marketing and area development systems for policy.

B. Action_ Programs

Part 1

Immediately develop a plan, incorporating the macro and micro elements of an integrated area agricultural development scheme for the North Coast and North High Selva, as outlined in Chapter IV.

Part 2

Then undertake an intensification program for agricultural development of the North Sector.

a. Elements for the Costa

1. Make a gradual transfer of rice production from North Costa to the Bagua area of the High Selva.

2. Utilize the lands and water alternatives released by transfer of rice, to bring into production additional corn, grain sorghum and cotton and/or wheat.

3. Use the augmented grain production to support expansion of poultry enterprises, and the development of swine enterprises

4. Accelerate the development of beef finishing enterprises in the Costa, with forages, crop by-products (wheat and rice bran, cotton seed cake,

cobs, hulls, etc.), and grains produced on Costa lands.[1/]

Part 3

1. Subregional production-system in support of agrarian reform in the Sierra, possibly based initially on Cahuide and Tupac Amaru. This may be supported by research on farm management, capital formation, and project administration.
2. Pasture and feeding improvement for dairy and sheep production in the central and southern Sierra; with support of IVITA, the University of Florida animal nutrition project and the Texas A and M animal diseases project.
3. Institutional (or organizational) and macro-economic aspects connected with design and implementation of the above projects within an agrarian reform context; with support of the ISU team.

1/ This type of operation is based on feeding calves and young bulls from dairy operations (Lima, Cajamarca, North Sierra, etc.) to slaughter size. This could be augmented by purchase of young calves, carrying these on calf-starter rations, and finishing on forages and other feeds.

Part 4

a. Land Development and Beef Cattle Restocking-Selva

1. Undertake detailed feasibility study of beef cattle intensification program in the Pucallpa area involving land clearing, pasture establishment, and stocking with purchased livestock.

2. Prepare detailed plan for developing an integrated production-marketing system of beef. The plan should include farm production, roads and processing, and marketing.

3. Draft an overall plan for implementing the phases of the program.

C. Present Projects

1. Integrate the rice program into the broader program (see previous section).

2. Integrate the forage project into the broader program of Parts B and C.

3. Phase out in 12 months:
   a. Present potato project
   b. Present bean project

4. Recast the credit program in terms of a 3 years action program based upon the findings of the recommended study (this chapter).
   a. Contract with an institution such as Stanford Research Institute to conduct the study.

D. Staffing For Overall Project Leadership

Take 5-7 of the present contract ceilings and develop a core staff of leadership as a working group, one for each of the following areas of subject matter concentration (as heretofore in this Chapter described).

1. Sector Evaluation Analysis
2. Macro Demand/Supply Analysis
3-4 Production and Marketing Systems
5. Private Sector Development
6. Farm and Institutional Management

It is worth reiterating that AID assistance should: (i) be coordinated internally and with the government as a package, (ii) have a priority commodity and regional focus using a production-marketing systems approach to development, where research, training and credit directly support such systems and (iii) be related to, an integrated with, the agrarian reform at the farm level.

III Implementation

A. Introduction

A major conclusion regarding implementation of the recommendations is that the Ministry of Agriculture must take the lead in planning, organization, and staffing to formulate program and implement projects. This is the only way to assure the development of technical leadership capacity and long term progress in agriculture. USAID advisers should not do the research, hire technicians, or supplement salaries. That is, the adviser should not perform functions which country personnel are capable of doing. Even if the country does not have a needed capacity, or skill, and the job is essential, the AID adviser should advise and counsel a Peruvian; he should not take over the function or its responsibilities.

B. Agrarian Reform

Agrarian reform is an organized way of increasing agricultural production, and at the same time accomplishing essential social goals. To achieve these ends agrarian reform must have production and marketing viability. Essential viability of agrarian reform can be achieved by a step by step integrated process of technical and financial assistance. Inputs must be provided, credit must be available, training must be done, a research base must be created, and production and social incentives provided.

C. Organizing for Implementation

The two main ways of organizing for implementation, and for providing technical and financial assistance are: (1) the vertically integrated production-marketing system approach, and (2) the development area horizontally cross-sectional approach. This study accepts both approaches and recommends utilization of both.

The vertical approach is essential to developing local to regional-to national production-marketing systems. This approach, however does not provide for adequately balanced farming systems on an area basis. Therefore, the vertical system needs to be supplemented, whenever regionality of development is the objective. An example of both approaches being applied simultaneously is outlined in USAID recommendation B, Part 2, and the vertical integrated system in Part 4.

The Minister of Agriculture might want to consider following the above procedure utilizing a small (2-3) technical commodity implementation group providing direction and management for an implementation plan for each of the 14 commodities. The technical group would prepare and carry out an integrated production-marketing plan either a commodity line, or on an area basis, using the concept of this study.

Special use should be made of the Planning Office of the Ministry to work with each of the commodity groups, and to work and advise cross-sectionally between commodity groups. The Planning Office would, of course, be responsible for the overall master plan of agricultural development.

APPENDIX A

Trip Reports by Evaluation Team

A1	La Molina, Pucallpa, Arequipa (Caton, Paz, Nelson)
A2	Arequipa (Brookshier, Eberhart, Sprague)
A3	Huancayo (Caton, Paz, Carmen Cuba)
A4	Pucallpa (Moro, Konnerup)
A5	Yurimaguas, Chicalayo (Brookshier, Sprague, Carmen Cuba)
A6	Yurimaguas (Sprague)
A7	Chiclayo (Sprague)

APPENDIX A1

Trip Report

April 21-25

Michael Nelson
Douglas Caton
4/27/71

I La Molina - April 21

A. The University

The University has about 2, 200 students, with a declining percentage taking degrees in agriculture. Over the past two years the University has lost from 65-70 teaching staff to the government, and to other agencies. Some have accepted jobs with external agencies such as FAO. One of the main losses has been economists.

La Molina University has an informal relationship to the 12 other Peruvian Universities which have programs in agriculture, no formal relationship with the Agricultural Ministry, none with extension, and only an individual working relation with the national research stations. Students come mainly from Lima and the adjacent areas.

The location of La Molina as an Agricultural Center has limited relationship to agricultural development problems east of the Andes. A central agricultural University with research component for this area should be in planning for the future. An alternative would be to strengthen one or two of the existing institutions rather quickly.

Not much seems to be known about the relationship of the supply of agriculturists and employment, or about the relationship of the training being received, and the type of trained personnel required.

A widely held opinion is that vast numbers of specialists in farm management, marketing and sociology will be required to implement the agrarian reform policy of the GOP.

The University should ask itself this question: What human resources would it take to increase agricultural products at a 5 percent per annum rate, compounded. Likewise re-training has not been addressed relative to increasing the quality of professionals. The distinction of "institution building" and the role of research on problem solving has apparently not been made. The school could be materially strengthened by a formal tie in with the adjacent GOP research station.

Limiting Factors

1. Enough trained staff
2. Facilities and services
3. Environment for agriculture

4. Incentives and rewards

5. Linkage with national research and extension.

B. The National Research Station - GOP

Five departments were visited: wheat, beans, pathology, potatoes and entomology. An extension program review discussion was also held with Director Segura. Projects of emphasis are potatoes, beans, rice, and livestock nutrition (forages). Limiting factors are money, trained people, facilities, and weaknesses in linkages to universities and to extension.

The staff is small and decidedly overloaded to have impact. How effective linkage to extension can be, until the extension complement and support is upgraded is questionable. Extension is not specialized, and the service as well as farmers, may have difficulty handling communications on research results in written form.

The research being done needs to be concentrated and focused, on high priority problems of the key crops. But just how this effort should be implemented beyond planning with all the limiting factors present is a conundrum.

The questions of goal structuring, determining what to work upon, and factor analysis relative to rates of increase appear to be well understood by the Director. The staff appears to be quite capable, and the facilities in some departments are modestly adequate.

With respect to the deficit commodities, only wheat and livestock are receiving priority consideration. The report of Proyectos de Investigacion Agropecuaria contains an impressive list of projects but the projects by sheer numbers do not square with the facts of available time, staff, and funding.

Limiting Factors

1. Proliferation of effort
2. Number of people
3. Number of highly trained senior people
4. Money to get a large array of jobs done correctly
5. Possible breakdown in linkage to the farm.

II Pucallpa - April 22-23

1. Team members

Mike Nelson

Douglas Caton

Manuel Moro

Luis Paz

2. Coverage

A. Livestock

Visited the national research livestock and forage experiment stations, and reviewed the entire program on livestock production. Research is being done on meat, milk, pastures, reproduction, and nutrition, under the direction of Dr. Manuel Moro. The research being done is applicable to the lower tropical forest areas (low Selva) of Peru, of which a total of 20-30 million Ha. are considered suitable for pastures. In the Pucallpa region there are about 12 million hectares suitable for pasture. To increase the rate of livestock production in Peru by 5% per annum three things are needed:

1. Land clearing
2. Improved grasses
3. An adequate supply of breeding animals

To sufficiently increase animal production would require about 300,000 new heifers (available in Mato Grosso) and about 200,000 hectares of new pasture. Land clearing costs about $90.00 per hectare by machine method. The animals would have to be obtained from Colombia and/or Brazil. At $100 a head the base cost for animals would be $30,000,000. Each clearing machine can average 250-300 hectares per year.

The cattle at Pucallpa are cross-bred between Criolla and Zebu or Brahma. The area is relative disease-free of the main livestock diseases, and a concerted effort is being made to keep diseases out. The pasture experiments are with grasses with proven records in the tropics; such as Pangola. Because the soil is not fertile, legumes are being tried as a partial substitute for nitrogen fertilizers, but fertilizer is being used, and are needed, in all cases. The two principle elements being applied are N and P.

The University station has about 10 staff, plus two FAO consultants on livestock, and forages. The staff estimates they will be able to make some general recommendations short of 5 years. Actually, some things could be done short of five years: land clearing, re-vegetation, and road improvement. A decision should be made as to how much land to clear each year. The minimum amount would be somewhat governed by the rate of herd build up. Water, however, is in plentiful supply.

A number of additional things need to be worked upon, particularly cattle reproduction. The average accrual rate of take off of cattle averages 14% for the nation, compared to a 50% rate in the U.S. Fertility and net calving percentage could be doubled easily by nutrition, management, and controlled breeding. Right now 80% of the cattle of Peru are in the Sierra.

An improved livestock production program will need to start with two things:

1. Agreement upon a blood line
2. Concentration on a single significant area

Obviously, a land clearing scheme would need to provide rather sophisticated maintenance to check jungle regrowth. Animal diseases should be tightly controlled, which is an additional reason for area concentration. All of the cleared land should be fertilized.

One particular circumstance that favors Pucallpa as a place to start is the existence of an all weather surfaced road to Tingo Maria, and thence to Lima.

Limiting Factors

a) Money

b) Trained people

c) Feeder roads

d) Entrepreneurs

e) Need to use expensive fertilizers for pasture maintenance

B. Hogs

One hog farm was visited which supplies breeding stock to other farmers. The breeds on this farm are standard American types; Duroc, Berkshire, Yorkshire and Londroce. The price the farmer swine breeder receives is about 3 times their value as meat animals. The farmer has the problem of maintaining quality, finding replacement stock, and having higher costs for care and feeding of his hogs. This farm is a well run operation, with technical help and money from the BFA. (Agricultural Development Bank)

C. Peppers

The colonization program at Pimentel was visited for technique rather than product. The colony is 50% Japanese, 50% Peruvian, and is a cooperative. The Japanese prepared the plan, and brought with them from Brazil the technical knowledge on how to produce peppers. The operation on 5,000 hectares is an obvious success.

Limiting Factors

a) Alternative crops

b) Group decision making

c) All weather roads

d) Price discounting

e) Failure of Japanese to fully participate in decisions.

BFA provides credit, and helps run the cooperative.

D. African Oil Palm

Visited a small oil palm plantation and nursery operated by the Ministry of Agriculture. Estimated that 3-4000 ha. of oil palm within a 100 km radius is sufficient to justify an oil processing plant. Failing this, palm nuts can be exported for specialized oil extraction in Europe, or crushed for animal feed. There appears to be an unlimited area physically capable of palm production. Fertilizer is not required for palm oil production.

III Arequipa - April 24-25

1. Team members

   Douglas Caton

   Luis Paz

   Michael Nelson

April 24 - Visited the San Isidro section of the La Joya irrigation project. Looked over the dairy cattle center, plus sheep fattening and guinea pig breeding operations run by the Ministry of Agriculture; also the community center, machinery pool, storage facilities and school serving the San Isidro cooperative.

We were accompanied on this trip by the director of the cattle breeding center, ministry supervisor of cattle program, and representative of the agricultural planning office (Min. of Agriculture) in Agrarian Zone VI (Arequipa).

The cattle is based on Holsteins imported from Holland and U.S. Heifers raised and sold to colonists at fixed price; sold as bred heifers at 18-22 months of age. The plan is that this center will be sufficient to build up a herd of 9,000 adult milking cows for La Joya at full development of 8,000 ha. under irrigation. In addition the center will also service the herd build-up on the proposed 67,000 ha. Majes irrigation project.

All dairy operations will be based on intensive use of forage, particularly alfalfa. With some purchased supplements, it is expected that the carrying capacity will be 3 milk cows per ha.

No consideration has been given to running the cattle center as a self-financing state corporation, nor to turning it over to a federation of dairy cooperatives.

In discussions with the ex-president of the San Isidro cooperative, a number of questions were raised with respect to GOP operations, regarding production plans on new irrigation projects.

1. The cooperative had, to a large extent, been imposed. There remains considerable farmer resistance.
2. Extension services have been wholly inadequate, i.e. the agent appeared to neither understand the problem nor the solutions.
3. There had been no testing of varieties, planting dates nor cultural and irrigation practices investigated prior to settlement. Colonists were doing their own experimentation.

4. The land development was far ahead of the capacity of the cattle center to supply heifers.

5. Credit for the cooperative requires unnecessary paper-work, and the Banco de Fomento Agropecuario had not been sufficiently specific in their instructions on pre-requisites for loan applications.

6. The BFA made errors in accounting of outstanding balances which aggravated friction with the cooperative, stemming from the Banks conviction that cooperative loans led to nothing but problems in processing, super-vision and recuperation.

7. The cooperative was not adequately coached by the bank, or other GOP agencies, in operating its credit funds.

8. The services of the cooperative were only of real benefit to a few of the more active members.

9. It would have been preferable, from a social viewpoint, to concentrate colonist housing in urban centers.

April 25 - Meeting in Arequipa with the director of Agrarian Zone VI and his team, attended also by the president of the Southern Dairymen's Development Fund.

Reviewed the procedure used to prepare the 3 components of the zone's agricultural plan 1971/72;

- horizontal projects in extension, research, credit, infrastructure, agrarian reform.
- vertical projects for the 10 primary commodities covering production promotion and marketing.
- capital investment projects.

Also reviewed long-range program for irrigation expansion (67,000 ha.) and improvement, plus the history of AID financed credit over the period 1965/70.

The planning appeared competently carried out, and integrated with both national level agriculture sector plans, and other sector plans in the zone. Problem will be financing and inter-agency coordination in the execution.

Long range program could become overly committed to expansion of very expensive new irrigation areas, at expense of other areas such as developing a source of genetic stock, marketing, animal feeding and fertilizers. The financial AID credit program has been widely diversified, mainly in short-term credit and animal purchase. There was a sharp drop-off in credit in 1969/70 due to the GOP decision to withdraw and reallocate funds to other zones. Although AID financed credit is a relatively minor part of the total credit available in the zone, the wide fluctuation raise the issue of regional areas of concentration and continuity with respect to agricultural development.

The La Joya project is the major capital investment program in this Agrarian zone, amounting to 89 million soles during 1971/72. There have been many delays and changes of plan over the past 20 years. The current bottleneck is financing for housing on Area 2 of San Isidro, and credit to finance cattle, land development and production.

Milk production in the zone has grown at 15% annually over the past 2 years in response to a price increase of 5°3.2 to 5°4 per litre. Of this increase the producers are required to place S.0.20 in a development fund for the dairy industry. It appears that the

10,000 milk producers in the southern region (including Tacna, with the aid of this farm, may form a dynamic private sector group.

Principal limiting factors on expansion of dairy industry

1. Problems arising from monopolistic milk plant (Leche Gloria) which buys 90% of total output (200,000 litres/day) and has capacity to buy twice this amount. Friction arises over companies measurement of milk deliveries and fat content.

Solutions proposed:

- have the producers "fund" by shares
- develop confidence in company's integrity
- develop competition (producers' coop)

2. Problem of obtaining adequate heifers to stock the expanding program. Argentina unsuitable due to T. B.; Holland imports are expensive; U.S. breeds preferred but more expensive.

Solutions proposed:

- accept line of credit from Dutch government to import
- negotiate favorable U.S. credit to import
- over the long-run develop local specialized breeding capacity sufficient to supply all Peru.

3. Insufficient supply of cheap concentrates. Since forages have progressively replaced wheat in the zone, wheat by-product and balanced feeds are in short supply.

<u>Solutions proposed:</u>

- import feed to break the monopoly
- state price regulation
- development of specialized production in the zone to supply feed mills
- promotion of more concentrate production in other areas
- develop a feed supplement industry as a producer's cooperative.

A request was made that a Mission be sent to Arequipa to discuss how technical assistance (and possibly finance) could be provided to the private sector and Zone VI office to promote integrated development of the dairy industry, and advise on the feasibility of vertical integration proposed above and heifer supply problem.

Arequipa provides a classical opportunity to apply a commodity production-marketing development program in a single priority region.

APPENDIX A2

Arequipa Trip Report

May 21-23

C. Brookshier
S. Eberhart
H. Sprague
5/25/71

May 21, Friday p.m.

Called at office of Agrarian Zone VI, and reviewed agricultural situation and plans for this zone.

CROPS DATA FOR DEPARTAMENTO AREQUIPA

Maize	9,910 Ha	Beans	3,670 Ha
Potatoes	7,000 Ha	Barley	3,660 Ha
Cotton	5,800 Ha	Sugar Cane	2,100 Ha
Rice	3,800 Ha	Onions	1,500 Ha
Wheat	3,700 Ha	Grapes	800 Ha

Arequipa has elevation of 8,000 feet. The climate is very dry (below 5 inches rain), and is generally sunny. Frosts may occur during May - August. Maximum temperature reported for November - February of about 85°F.

Agrarian Zone VI extends from the Sierra to the Coast. Includes irrigated areas of Arequipa and La Joya projects (new and old), and the proposed Majes project. The Pampas Majes project covers 67,000 ha.; and is to be irrigated with water carried from Rio Colla to the Rio Mina. It will require 10 years to complete.

The La Joya project is irrigated with water from Rio Chili. The developed area is 3,500 Ha.; and the area now being developed is 6,500 Ha.

Arequipa is a city of about 250,000 population. It is the principal market for all agricultural products of the region. Milk production predominates. Milk is mostly delivered to the Leche Gloria milk processing plant in Arequipa. Leche Gloria is jointly owned by GOP and International Milk Company (Carnation). There is an International Milk Co. Manager, (Jones), but few other U.S. personnel. Leche Gloria produces only condensed and evaporated milk (as is true of the milk plant at Cajamarca). The product is made from 60% local milk and 40% milk powder from New Zealand. There is a GOP regulated price paid to farmers (4.20 soles/kilo) which is sufficient incentive to sustain farmer interest.

Our host for this trip was Luis Juarez Galiano, Ing. Agronomo, for Agrarian Zone VI. Sr. Juarez was very helpful in providing much information and in supplying transportation in the vicinity of Arequipa, to the Majes area, and the La Joya irrigation project (one hour drive from Arequipa).

Other background information on the agriculture of Departamento Arequipa: Wheat yields about 2000 Kg/Ha; Maize 3,000 to 3,500 Kg/Ha; fertilized with 100 kg N, to 50 Kg P_2O_5, and 0 kg K_2O/Ha. Alfalfa occupies about 50% of the irrigated areas, and it is all used as feed for dairy cattle; it is either grazed by cows tethred in fields, or cut by hand and carried to cattle yards for direct feeding. The alfalfa area is estimated as 36,000 hectares. New irrigation projects (La Joya) are put in production by planting all areas to alfalfa, before land is turned over to settlers.

Barley, wheat, and potatoes are grown at higher elevations in the Departamento where natural rainfall or irrigation permits. In irrigated projects, rice is grown at lower elevations as a summer crop, and beans are grown as winter crop. Onions are a high value crop in the Arequipa area, but the market price fluctuates rather widely.

In the La Joya project, alfalfa is the principal crop (70%), but Maize is also grown to supplement alfalfa as a feed. Since maize is most productive in summer, there will be advantage in making silage but this use is now quite rare. La Joya has an altitude of only 5,000 ft., so crops will grow at all seasons.

In the proposed Majes project, which we visited May 21 (about 1 1/2 hours by auto from Arequipa), the plain is suitable for irrigation, but the soil material as sandy loam, and stones will make tillage difficult. It will probably be necessary to have concrete lined canals throughout; or to use sprinkler irrigation. A sprinkler irrigation system will require pipe and pumping for pressurized delivery of water. It is believed that this system might double the efficiency of water use. The stoniness may emphasize the advantages of perennial crops such as elephant grass, coastal bermuda, grass-alfalfa mixtures, grapes, olives, and tree fruits. The Majes area's climate would probably permit good growth of Napier grass (elephant grass), one of the most productive tropical grasses. Napier grass has good nutritive value when heavily fertilized and cut periodically at about 3 ft. height. Coastal Bermuda should be evaluated in Majes area, and other low elevation irrigation projects in Peru.

The extreme stoniness of the areas viewed on our trip, is cause for concern as to the economic potential for the area. The heavy expenditure for providing irrigation water might be more fruitfully applied to other projects. However, this is a matter of governmental policy, which may over-ride technological considerations.

May 22

A.M.: Visit to field trials of crops. (with Peace Corps volunteer).

Field plots at Leche Gloria plant: Comparison of oats for winter green feed, cut at various growth stages. Planted in February, the crop is in head. The Mantaro #15 variety has yielded 58 tons/ha of green weight. This field test is measuring yields when cut at different stages of growth. The earliest harvest made at about 2. ft. height, is making good regrowth. Another experiment is comparing 36 oat varieties. Also there are tests of various perennial grasses. It was reported that Harding grass looks good. (Suggested consideration of Panicum antidotale and tall fescue for this altitude; and Bromegrass, orchard grass and tall fescue at higher altitudes). Elephant grass does not thrive at altitude of 8,000 ft. (too cold), but is productive at altitudes below 5,000 ft. (La Joya).

The combination of oats in winter and maize in summer is useful, particularly since alfalfa is too high in protein for heavy feeding of cattle, despite current practices. The variety, Moapa (from California) is nipped by frosts in winter at Arequipa, but does well at La Joya. Ranger Alfalfa is reported to be very good at higher altitudes (above 8,000 ft.) We suggested that Vernal and Du Puits varieties should be compared with Ranger, for the Sierra.

Since Moapa alfalfa is nipped by frost at Arequipa in winter months, it was suggested that other California non-hardy types be tested, particularly at La Joya (elevation 5,000). They have an alfalfa variety test (36 varieties) which should yield useful information. There is a fertilizer experiment at 150 Kg/ha, P_205; but the 3 year results shows no phosphate response. An inspection of fields suggests deficiencies of Mg and possibly sulfur. Plant tissue tests and soil tests plus field fertilization are needed to find any factors that prevent response to phosphate.

A well has been sunk to 30 meter depth at Leche Gloria, to tap the underground water supply. It was tested with a small pump on 24 hour test, and yielded 1200 gal. per minute, with a draw down to 12 meters. The extent of this aquifer is not known. A large pump is an order, and further tests will be made when the pump is installed. There appears to be limited geologic information available on underground aquifers in Peru. Also, technical information on the most effective use of water on farms is very limited.

Milk Farming Visits - May 22

P. M.: We visited several farms where the "Dairy Herd Improvement" Program is under way, through efforts of Peace Corps Volunteer, Robert Blake, working within the Agrarian Zone VI. Blake appears well qualified; grew up on a mid-west dairy farm, and is a graduate of the College of Agriculture, University of Illinois. He now has 50 farmers participating in DHI, versus 25 farmers two years ago. Dairy farming is based largely on Holstein-Friesian cows; some imported from Holland by GOP and sold to farmers on long term loans. Other dairy cows were imported from Argentina.

Best Farmer in DHI - Mr. Ponce;

He is a good businessman and manager. He spends most of every day managing the farm. He has 9 hectares of land producing feed for 20-25 milking cows, plus dry cows and heifers. He keeps cows in yards where shade and water are provided, and cuts green feed and carries it to the animals. This is better than the common practice of tethering animals in fields; it avoids excessive exposure of animals to sun, and allows water whenever animals desire it. In field tethering, animal get no water from early morning until mid-afternoon, which is not enough for high producing cows. Ponce's cows are all pregnant. These Dutch cows were purchased at a price of 26,000 soles. The loan from the GOP carries 9% interest, with 2 years of grace before payments are due and is payable over a ten year period. He is increasing his herd to 40 cows by producing heifers, and buying good animals from neighbors. He feeds concentrates at milking time, in concrete mangers. His milking "parlor" is a concrete slab, that handles 4 cows at a time. Concentrate feed is mixed by a local dealer; based largely on wheat bran. Cows now average 4,800 liters of milk per year. The best cows produced 7,750 liters in their second lactation. He is now paying 14,000 soles per month on his loan. His milk check from Leche Gloria is 40,000 soles per month. Ponce is selling some bull calves to farmers for breeding purposes; and some cows when attractive offers are made.

He sells some fluid milk to the foreign community and others who come to his farm for milk. He spreads the manure upon his pasture, especially on new seedings. Ponce's yards and buildings are adequate; he has avoided building expensive structures.

Farmer No. 2 is Juan Miguel Arenas

He is building facilities for 40-50 cows, but not buying cows until the installation is complete. The estimated total cost is 125,000 soles. This farmer has capital of his own. He is trying to follow Ponce's example. Peace Corp man, Robert Blake, is counseling him on the construction and plans for his installation. Blake is counseling about 100 other farmers in the total area. An estimate was made that there are 65,000 milk cows on 4,000 farmers in the Arequipa milkshed.

Farmer No. 3 is M. Llerena.

He operates 5 hectares. He has 12 milk cows, 20 ewes and lambs, a few yound heifers and some dry cows. His best cows produce 5,000 liters/yr., and he participates in DHI. He keeps all cattle in one yard, where he also milks. One heifer recently aborted (brucellosis, suspected) but this animal is not isolated.

Sanitation is at low level. He pastures his herd on alfalfa fields from 7 a.m. to 3 p.m. His herd has the usual mastitis problem (probably aggravated by excessive use of alfalfa, which is too high in protein for balanced nutrition).

Each DHI participating farmer contribute 20 soles per month, per cow, to cover costs of the DHI program. All farmers who market milk at Leche Gloria are assessed a small sum per Kg. of milk, which goes into a special fund for improvement of milk production. This sum now totals 36 million soles, and is on deposit at the Agrarian Zone Development Bank. A meeting is imminent, at which participating farmers, through their representatives, will discuss how to use this fund. We suggested to Blake that a management program be considered, to include a coordinated treatment of (a) feeds and nutrition, (b) animal health, (c) dairy husbandry, (d) animal improvement, and (e) marketing practices. There is now no coordination between DHI and artificial insemination programs, now with the skimpy animal health services.

La Joya Irrigation Project - Visited on May 23.

This irrigation project is located about 1 hour drive from Arequipa, at an elevation of 5,000 feet. There are 3 stages of development; one area is about 5 years old, another is in the second year, and the third is being leveled, ditched and seeded to alfalfa, prior to occupation by farmers. The older area was allocated at 10 hectares per family, but the newest area will allocate only 6 hectares per family.

There appears to have been very little in the way of a pilot farm or experimental station to identify local problems and demonstrate good management practices. The visual symptoms of mineral nutrient deficiencies are quite pronounced on beans, potatoes and alfalfa. These symptoms suggest that magnesium and sulfur are so deficient that crop yields are seriously affected. The corn crop appears to be suffering from phosphate deficiency, and it is probable that the other crops are also deficient. However, phosphate deficiency may be masked by other deficiencies. These apparent deficiencies should be identified more accurately by routine soil and tissue testing, and by field fertilization.

Alfalfa fields seem deficient in vigor, probably because of mineral nutrient deficiencies. However, there appears to have been no attention to forage grasses, alone or in mixture with alfalfa, to produce greater yields of feed more nearly balanced in nutrient composition than alfalfa, for feeding dairy cattle.

The soil at La Joya is quite sandy, with low water holding capacity; cement lined ditches are used for distribution of irrigation water to fields. Flood irrigation of the rather small plant beds is difficult, because the borders of sandy soil break down quickly and distribution of water becomes quite uneven. We were told that a team of Israel engineers had been making a study of this project; and that the use of sprinkler irrigation would be recommended. This sprinkler method of irrigation has been extensively used in other parts of the world, and is much more efficient than ditch irrigation on sandy soils.

Milk appears to be the main commodity produced at La Joya. We were told that milk is sold mostly to Leche Gloria in Arequipa, but in addition some is purchased by private milk processing companies in Arequipa, who market it as fluid pasteurized milk. The dairy herds are mostly Holstein Friesian cows, and are fed by tethering on alfalfa fields.

The technical assistance being provided settlers on this project could be very greatly improved by utilizing available technical knowledge. Additional information that would help some farmer's production problems, could be provided by a pilot farm that conducts field trials on crop production, and evaluates important dairy animal management practices.

Trip Report

APPENDIX A3

May 15-18

Huancayo Agrarian Reform Units

Luis Paz
Miguel Carmen C.
Douglas Caton
5/19/71

Huancayo Agrarian Reform Units

a) Cahuide Sais

b) Tupac Amaru Sais

Description:

A. Cahuide Sais, Headquaters, Huancayo

Manager: Ernesto Velarde

7 Haciendas - 300 Hectares (approx.)
29 Community
1 Service Cooperative

Principal Products: sheep, cattle, dairy products, alpaca.

B. Tupac Amaru Sais, Headquarters, Huancayo

Manager: Máximo Rojas
Assistant Manager: Oscar Rizo Velarde

6 Haciendas - 300 Hectares (approx.)
19 Communities
1 Service Cooperative

Principal Products: same as Cahuide Sais

Both of these agrarian reform units could well serve as models of organization, management, and programs. Both appear to be progressively handled, and the participation of the communities, internal and contiguous to the units, is forward looking. Both reflect what can be accomplished with astute leadership, and an understanding of development construction.

Deficiencies:

1. Technical and financial support of production and marketing.
2. Trained administrative and field leadership.
3. Adequate roads, structures, and facilities.
4. Equipment and transport.
5. Marketing proficiency.
6. Farm management analysis.
7. Incorporation of principles of decision making in planning.
8. Tendency to proliferate activities, and to keep records without apparent specific purpose.

9. Tendency to become over organized, and dependance upon the top echelon for all decisions.
10. Need for feasibility studies and analytical proficiency.

Trip Report

APPENDIX A4

May 20-22

N. Konnerup
M. Moro

Pucallpa

The Pucallpa area has developed rapidly in the past few years, with the urban population now reaching close to 70, 000. Clearing the jungle chiefly for livestock production, has progressed slowly but steadily over the past ten years as a result of government and private investment. The major constraints on more rapid development are low soil fertility, and transport and marketing costs in relation to prices for commodities produced in the area.

While the low soil fertility and costs of fertilizer preclude significant crop development, natural and improved pastures under good managment permit a respectable annual cattle offtake of 25-28 percent.

Two major units, the Ministry of Agriculture supported San Jorge farm of 3000 hectares, and the IVITA research station of 1500 hectares,will carry at least 2 cattle per hectare. Efforts are being made to develop improved pastures including introduction and cultivation of legumes. The Ministry of Agriculture unit, with virtual unlimited potential for expansion, is designed to provide breeding stock for otherlivestock enterprises in the area, and the IVITA station is concerned with applied research in pasture and forage, development, and in animal breeding and health control.

The Ministry of Agriculture station is currently developing an accelerated stocking program involving a number of brahma and European breeds.

The IVITA station has been supported, in part, by a UNDP/FAO program due to phase out in 1972. Thereafeter the young Peruvian staff will be without senior scientific guidance unless continuing support is made available from other sources.

Both the Ministry of Agriculture and the IVITA operations have utilized 3 alternative methods of bringing jungle into pasture production. The costs per ha. are listed below.

Hand clearing	S/. 1,800 ha.
Tree crusher	3,915 ha.
Tree crusher plus windrowing (much superior)	7,830 ha.
Annual maintenance after clearing	600 ha.

The potential for further livestock development is virtually unlimited, but in order to make such operations profitable a rational market system must be developed. It would appear that a slaughter facility should be developed in the high Selva (Tingo Maria) and that meat might be transported to coastal urban areas in insulated (not refrigerated) vans.

Field Trip

Rice Production and Research at
Yurimaguas & Chiclayo

Miguel Carmen Cuba
4/22/25

A. Yurimaguas

1. Rice Production

There are 8, 000 has. under rice cultivation in the Yurimaguas area, and 3, 200 rice producers. The total rice production changed from 25 TM to 12, 000 TM in the period 1949-1970.

The 99% of the farms are small having an average of 2 has. Locally produced paddy is milled at the San Ramón rice mill.

In the virgin soils after clearing the land and doing all the preparation work, it is possible to have two rice crops per year on the same fields; this could take one year. During the second crop when the rice is at least two months old, manioc (cassava) (yuca) or banana (plátanos) could be planted between the rice plants in the fields. When banana is planted the field could be used for several years; if not, the land stays without crops for 6 years. After six years the vegetation covers again the soil and it becomes what is called "Purma madura".

The average rice yield is the 1800 - 2000 kg/ha. of paddy rice using the local variety "Carolino"; and the yield for the IR-8 is 2, 800-3, 000 kg/ha. It is estimated that 90% of the farms use "Carolino" variety and about 10% IR-8 variety.

The farmers do not use fertilizers of any kind. In Yurimaguas it is possible to grow rice through all the year, taking care that the growing period will not be included in July and Augsut because of the small amount of rain falling during these months; and to avoid the attack of "pericularia oryzae" disease which is higher in these months.

It is possible to have two crops a year, the first one from September to January and the second one from February to June. After the second crop, a rotation could be included. At present, there are 100 has. of rice planted with IR-8 variety and 20 producers which are using this variety.

The price at which EPSA (Empresa Pública de Servicios Agropecuarios) buys the rice in the Jungle region has been recently changed from S/. 5.07 to S/. 4.10 per kg. of paddy rice. However, if it remains at S/. 4.10 kg. it is still possible that the farmers will continue growing rice; the principal reason is because the rice is the main commercial crop for the region; and besides that they do not include within the cost of production the family labor costs.

The cost of clearing the land (Purma 8 years or virgin forest) is estimated at S/. 2,000/ha. doing the work by hand (hacha y machete). In the case of virgin forest which has more trees but less bush, the total amount of work is almost the same. Using machines, the cost of clearing is about S/. 4,000/ha. (DC-6).

2. Research work in Rice

The research work in rice is carried out at San Ramón Farm, which is located at 15 minutes from Yurimaguas, going by car, with canoe passage over the river. San Ramón Farm is cooperating with GOP on research; having donated land for this purpose.

At San Ramón there are 10 has. devoted to experiment in rice including seed propagation plots. This is a branch station of the research station at Chiclayo. The research is carried out mainly on cultural practices and seed propagation. In total they are conducting 18 field experiments.

In 1970 they seeded 1 ha. to each of the following varieties: IR 578-8, IR 578-43, IR-480-5-59-2 and 1/4 ha. of IR-4-2- variety. The average yield of these varieties on new land is 4, 200 kg/ha. without fertilizer. The local Carolino variety increased its yield from 1600-1800 to 2, 200 Kg/ha. of paddy grain when the distance between transplanted plants changed from 70-80 cm to 30-40 cm.

Fertilizer response: In field experiments the yield of the variety IR-4-2 was 3, 000 kg/ha. without fertilizer and 5, 000 kg/ha. when 120 kg. N/ha. (urea), 100 kg. P_2O_5/ha. (superphosphate) and 100 kg. K2O/ha. (potassium sulphate) were applied.

B. Chiclayo Research Station

1. General Consideration

In Lambayeque Department there are 75, 000 has. under irrigation. From these 23, 000 has. are devoted to rice, 30, 000 has. to sugar cane and 22, 000 has. to other crops. It is possible that fully using the water supply impounded by the Tinajones dam, the total area could be increased by 10, 000 has.; this new area will be located in the New Valley sector.

The diversification of crops is desirable in Lambayeque. In the lower part of the valley the alfalfa crop could be increased while in the northern part (Mochumi, Pueblo Nuevo) more area could be devoted to wheat and oil seed crops. In 1971, there will be 1, 000 has. of wheat (Huascaran varieties) in the Pueblo Nuevo Sector.

In 1970 there were 17, 000 has. under rice and in 1971 27, 000 has. were devoted to rice.

The water is distributed in the valley to allow only one crop in the year. The water will be distributed according to the following irrigation modulus:

Sugar Cane	22, 000 M^3/ha.
Rice	18, 000 "
Cotton	12, 000 "
Corn	6, 000 "
Pulse	4, 000 "

2. Northern Regional Agricultural Research Center (CRIAN). - Vista Florida

In the Agrarian Zone II the research work is carried out in Vista Florida Experiment Station near Chiclayo, and Huarangopampa Sub-Experiment Stations (Bagua) high Selva and San Ramón (low Selva).

The Vista Florida Experiment Station has 340 has. which were expropriated from Vista Florida Sugar Cane plantation. From this area, 24 has. are used in rice field experiments; the rest of the area will be used in rice seed propagation and field experiments for other crops.

In rice, the research work is mainly concentrated in the testing and production of new varieties, use of fertilizer, and improved cultural practices.

Minabir 2 is a local improved variety used on about 80% of the total rice area in Lambayeque Department. Under experimental and farm conditions the Minabir 2 experimental yields are 7 - 8 TM/ha., and farm yields are 5. 0 TM/ha. respectively. For IR-8 under these conditions the yields are about 11 TM/ha. in experimental fields, and 7-8 TM/ha. for farm yields respectively.

The low temperature at flowering time has a great effect on rice yield. The minimum that rice plants can tolerate without harm at flowering stage is 15° C. (59°F). In 1967 - 68 the low temperature in April and May was responsible to some degree for the decrease in total rice production in the Northern part of the coastal region.

The 930 - 2 - 6 strain with a growing period of 180 days and a yield of 12. 4 TM/ha., is a very promising variety as an intermediate type between the late maturing varieties (Minabir 215 days), and the early maturing varieties (IR-8) (155 days). Also the 930 - 2 - 6 variety has a better quality than the IR-8 variety.

Among the early maturing varieties (155 days growing period) there are 10 candidates. The IR 930 - 31 - 1 which came from Colombia has a yield of 11 TM/ha. ; this variety could be a solution for a double cropping year in the high parts of the Valley (Chongoyape Sector).

Some of the old varieties give better yield than the new ones under traditional condition in water management and stress in the region.

In Jaen y Bagua (high Selva)48 strains are now being tested. This region has 20, 000 has. on rice production. About 90% of the farmers use only one variety, (Radin China, late maturing variety).

Fertilizer experiments are carried out using 14 different varieties, and levels of nitrogen (0, 80, 160, 240, 320, 400, 880 kg/N ha.). Response to N have been obtained with IR type varieties up to 480 Kg N/ha. ; however, the optimum economic level seems to be around 320 kg. N/ha. At farm level, the present average use of N is 150 kg N/ha. for Minabir, and 300 kg N/ha. for IR-8. No phosphorous or potash are applied.

The early varieties mature 10 days earlier when established by direct sowing than when they are transplanted.

Peace - Corps members are helping in Extension Work conducting demonstration plots in farms. There are 11 Peace Corps members working in the field; each one carry out 15 mini-kits. In each mini-kit seed of 5 varieties, fertilizer and herbicide needed for treatments are included.

3. Ferreñafe (near Chiclayo)

There are 14, 000 has. of rice grown in Ferreñafe area; 9, 000 has. in the lower part and 5, 000 has. in the higher part. In the higher part it will not be possible to grow rice but it will be possible to grow oil seeds and alfalfa. A limiting factor for promoting oil seed crops is the lack of an oil seed processing plant.

In the lower part of Ferreñafe after rice harvest, it is feasible to grow another crop, using additional irrigation.

A very important problem in Ferreñafe is the poor drainage system. There is the possibility that if the drainage system is not improved a great amount of the cropping area will develop a soil salinity problem.

The yield of Minabir variey is 6, 000 kg/ha; and that of IR-8 is 8, 000 kg/ha.

In Ferreñafe there is a Cooperative Rice Mill which capacity is 10 TM/hour. The storage capacity is 828 TM of paddy rice. In 1969 it milled 8, 970 TM of rice, and in 1970 the amount was 13,800 TM. The breakdown of rice in the milling process is as follows:

From 138 kg. of paddy rice (1 Fanega).

Polvillo	7-9 kg.
Ñelen	1-2 "
Suciedades	1-2 "
Arroz	92 "
Pajilla	35 "

APPENDIX A6

Field Trip

Beef Cattle at Yurimaguas

Howard Sprague

Domingo Loero, Jr., owner of the Hacienda San Ramón has been conducting a limited program of beef production on cleared land of the jungle area for a number of years. At present there are 430 head of mixed Zebu & Criollo stock, on 180 hectares, on the well established pastures; the year-round stocking rate is 3 animals per hectare. There are 14 fenced pastures, all planted to Guinea grass (probably, Panicum maximum), established by vegetative planting. Livestock graze each pasture 3 to 6 days, and are then moved to another pasture where feed is most plentiful.

Since this hacienda is in the low Selva, which has well distributed and abundant rainfall, this operation may have wide significance for future development of the jungle area. Elevation is 600 ft at Yurimaguas. On the basis of experience gained to date, a feasible program of jungle development for livestock would include the following:

1. Removal of merchantable timber, where this is economically feasible.
2. Using large crawler-type tractors, cut off all woody growth with a blade, a few inches below ground level. Windrow all vegetative growth, and burn when dry enough. Rains are most abundant October to March.

3. Plant upland rice for at least 2 years to supress all woody regrowth, to yield income for this period.
4. Plant the land to improved grasses and legumes, and begin pasturing as soon as forage plants are well established.

The reported livestock performance is very good. Young stock reach slaughter size in 2 years; with average dressed weight of 120 kg. (Live weight about 240 kg. (530 lbs.). 70% of the mature cows produce a calf each year, and there is low mortality, since feed supply and water are always plentiful. All stock looked quite healthy. There appear to be no disease problems of consequence; although there are some regular preventive vaccinations (FMD, etc.). There is a minimal tick problem; when ticks are noted the animals are sprayed. Need for this is infrequent. It was reported that there are no problems with predators or other pests. The animals live in the pastures, and require very little attention or labor.

Management of pastures consists mostly of rotating the grazing herd to follow feed supply. Woody growth is suppressed by spraying with 2, 4D, or occasional hand clearing.

Marketing of livestock will constitute the major constraint on this enterprise in the Selva. Local marketing at villages and cities in the Selva is now sufficient to provide a market for this San Ramón enterprise. At present, marketing in coastal cities is feasible only by air transport. Perhaps the Bolivian airlift for marketing livestock in Peru would provide useful data on costs.

There is limited outlet for meat consumption in Iquitos; but water transport of slaughtered beef to other eastern markets out of Peru may have possibilities. Completion of adequate roads to the Peruvian coastal area will be necessary to support a jungle livestock program that would make a significant contribution to meeting Peru's needs for meat.

If, or when, marketing constraints appear to be subject to effective resolution, it will become quite essential to make a soil reconnaissance of the region to select the most promising areas for development. A detailed soil survey should follow to identify specific areas of soil types best suited to this type of enterprise. Aerial observations suggest that suitable extensive areas may be available.

Field Trip

Chiclayo

Howard Sprague
4/22/71

Alternate Crops for Irrigated Lands

At present, irrigated lands in this area are largely cropped to rice. Alternate crops should be evaluated, since water is the scarce resource in this area and rice requires more water than other crops. Rice is now allocated 63 acre inches of water yearly, maize and yuca - 46 acre inches, and cotton 27 acre inches. Since this is a present movement to raise the unit price of water delivered to farmers, and other crops may be given high priority to meet national goals, performance data should be accrued for other crops suited to local conditions of land, water supply and climate. It is suggested that the following be evaluated: wheat, safflower, sesame, soybean, and sunflower.

Wheat: Wheat is now grown predominantly in the Sierra with natural rainfall, in 5 agrarian zones.

There has been very little evaluation of high yielding Mexican wheats under irrigation, and none at the CRIAN experiment station at Vista Florida, in the Chiclayo region. Since wheat was formerly grown in this area, the crop is believed adapted to the region. The yields that may be achieved with improved varieties from CIMMYT, with adequate fertilization, and with irrigation and cultural practices practiced at CIMMYT, should be measured. Variations in such practices that influence yields should also be measured. This basic in-

formation is required before judgments are given on the price levels and the assurance of market outlets as possible incentives. Since water requirements are lower for wheat than for rice, and 2 crops per year appears quite feasible, the use of land for wheat production may be an acceptable alternative to rice in irrigated regions. Farmers reported that they are quite willing to grow alternative crops to rice, including wheat, and oil seed crop.
(Note: Other locations that may be considered for augmenting national wheat production are in the Sierra region, in the vicinity of Cajamarca, Huarás, Huancayo, Cuzco, Arequipa, and Puno. The technology for these higher altitudes differs greatly from the irrigated coast region. Different varieties are used; those tolerant to low temperatures. The crop is grown largely on natural rainfall; and present use of fertilizer is minimal. The alternative crops are barley, potatoes, and forage livestock. Reliable data are needed on yields under improved technology, applied to improved varieties, to determine economic feasibility of augmented wheat production in the Sierra. The potential for wheat production in the higher elevations of the Selva may warrant investigation, if GOP policy becomes one of national self-sufficiency with wheat).

Oil Seed Crops: The research station is conduction preliminary agronomic studies on safflower, sesame, soybean and sunflower. For each crop, a very few varieties (soybean-only one), and 2 or more dates of planting, and 2 or 3 plant populations are being tried. These preliminary trials have only limited significance, since the experimental fields have not been properly leveled for uniform application of water. Local areas of soybeans look promising, but dry spots and salinity have damaged growth elsewhere. The other 3 oil seed crops appear to be more tolerant of dry spots and salinity. The general appearance of safflower, sesame and sunflower suggests production potential that would warrant more comprehensive testing of a much larger collection of varieties under uniformly favorable cultural practices, to identify high yielding types.

There is a reasonable possibility that one or more of these oil seed crops will prove sufficiently productive to warrant consideration as a major enterprise for irrigated agriculture. Wheat, an oil seed crop, maize, grain sorghum and rice may become components in an integrated farming system. Storage and processing of these new crops should be rather easily accommodated by expansion of existing rice facilities. Price support levels and an assured market outlet may provide the incentives for production to meet national goals, when the technology of production has been worked out.

APPENDIX A8

Field Trip

Observations and information on Irrigation in the Chiclayo Lambayeque rice growing area

Curry C. Brookshier

The Lambayeque-Chiclayo-Ferreñafe area is blessed with an adequate supply of irrigation water. The supply of water has been stabilized with the construction of the Tinajones dam during 1969. The construction of this dam permits a more stable supply of water throughout the year, and therefore enables the farmers to consider crops other than rice, whereas, before the construction of the dam they were limited only to crops during the summer when the water supply was reasonably sure. As a result of the more stable supply of water, 12, 000 has. of new lands have been developed in the area and are presently being assigned to farmers.

In the areas of Ferreñafe a high water table has developed and lands are being lost to a rapid build up of salinity and alkalinity conditions. These conditions are a result of lack of drainage, unleveled land and pooling of water in low areas.

Water taxes have been very low-.02 soles per cubic meter, but the water reform law has doubled the tax to . 04 soles beginning the next crop year. Farmers are alloted enough water to irrigate 70% of their land in rice. This water could be used for other crops.

The irrigation official of the Ministry stated that the following amounts of water are required to produce the following crops in the area:

Rice	-	63 inches
Cotton	-	27 inches
Maize	-	46 inches
Yuca	-	46 inches
Sugar Cane	-	80 inches (18 months)

Chick peas (gram) are usually grown from the moisture left in the rice lands after harvest of the paddy rice. Translating these water costs to dollars per hectare we have the following costs at the new water tax rate.

Rice	-	640 soles or	$ 14.72 per ha.
Cotton	-	340 soles or	5.52 per ha.
Màize & Yuca		480 soles or	11.00 per ha.
Sugar Cane	-	880 soles or	20.24 per ha.

The farmers of the area are upset that the price of rice is being decreased and feel that the increase in the price of water along with the lower prices means that they will be forced to look for alternative crops.

As mentioned above, uneven land has resulted in poor crop yields and in a build up of salinity and alkalinity. Farmers will be required to attack their problem by putting in drains and by land leveling. The team visited a 11 hectare farm where land leveling had recently been carried out.

The farmer had previously grown the local rice with the maximum dosages of fertilizer; last year's yield had been 6.4 tons of paddy rice. With level land this year, he was able to water his entire 11 hectares rather than the 8 hectares previously (70% of his land) and expects an average of 9 + tons per hectare. The cost of leveling the land was $ 160 per hectare. At the goverbment fixed price of rice of S/ 5,000 per ton the added increased yield will more than two times pay the cost of land leveling. Of course he has more expenses due to higher prices paid for IR-8 seed and an added 100 kg. of Nitrogen per hectare.

APPENDIX B

1.	Trends in Agricultural Output (1960-70)	Fig. 1 Fig. 2 Table 1 Table 2
2.	Per Capita Agricultural Output	Table 3
3.	Individual Crop Performance	
	a) Rice	Table 4 Fig. 3
	b) Corn	Table 5 Fig. 4
	c) Potatoes	Table 6 Fig. 5
	d) Wheat	Table 7 Fig. 6
	e) Beans and Pulses	Tables 8, 9, Fig. 7
	f) Cottonseed - Edible Oils	
	g) Meat	Table 10
	h) Milk	Table 10
	i) Pastures and forages	Tables 11, 12 & 13

1. Trends in Agricultural Output 1960-1970

During the period 1960 through 1970, the average annual growth rate of total real (1963 soles) agricultural output was approximately 1.5%, or only about one-half the 3.1% rate of growth of the population of Peru. Most of this growth occurred during the first seven years of the decade when the growth rate averaged more than 2%. In 1967, a serious drought affecting especially the productive northern coastal area reduced total real agricultural output for 1968 by approximately 7%. The following year showed some recovery, however it was not until 1970 that total agricultural output approached the level attained in 1967. Looked at from another point of view, total agricultural production fell from 20.9% of Gross National Product in 1960 to 14.8% in 1970 (see Table 1).

The 1970 production of agricultural products for internal consumption was nearly 33% above the production of those same products in 1963, while the production of agricultural export products fell by nearly 13% over the same period (see Table 2). The production of livestock products was up by less than 6% in 1970 over 1963, with cattle meat production up by 4% and milk production up by over 7%.

Peruvian agriculture has progressed somewhat better in food production than it has in overall agricultural output. After three years of practically no growth (1961 to 1963), food production showed a decided upward trend until affected by the drought in 1968, which reduced production by some 10%. The following two years showed considerable recovery, but the 1970 level of output was still about 3% below the level attained in 1967. However, compared with the 1961-65 average, total food production had risen 7% by 1970.

2. Per Capita Agricultural Output

The lack of significant growth in total agricultural output combined with the high population growth rate in Peru resulted in a steady deterioration in total agricultural production per capita during the period 1960-70. In 1970 per capita total agricultural output was only 80% of the average for 1961-65. (See Table No. 3)

The situation was only slightly better in the production of food crops. In this case the steady deterioration over the decade resulted in a per capita food production for 1970 equal to only 86% of the average for 1961-65. Per capita food production increased in only four of the ten years of the decade, including 1969 and 1970 which were recovery years associated with the low production of 1968.

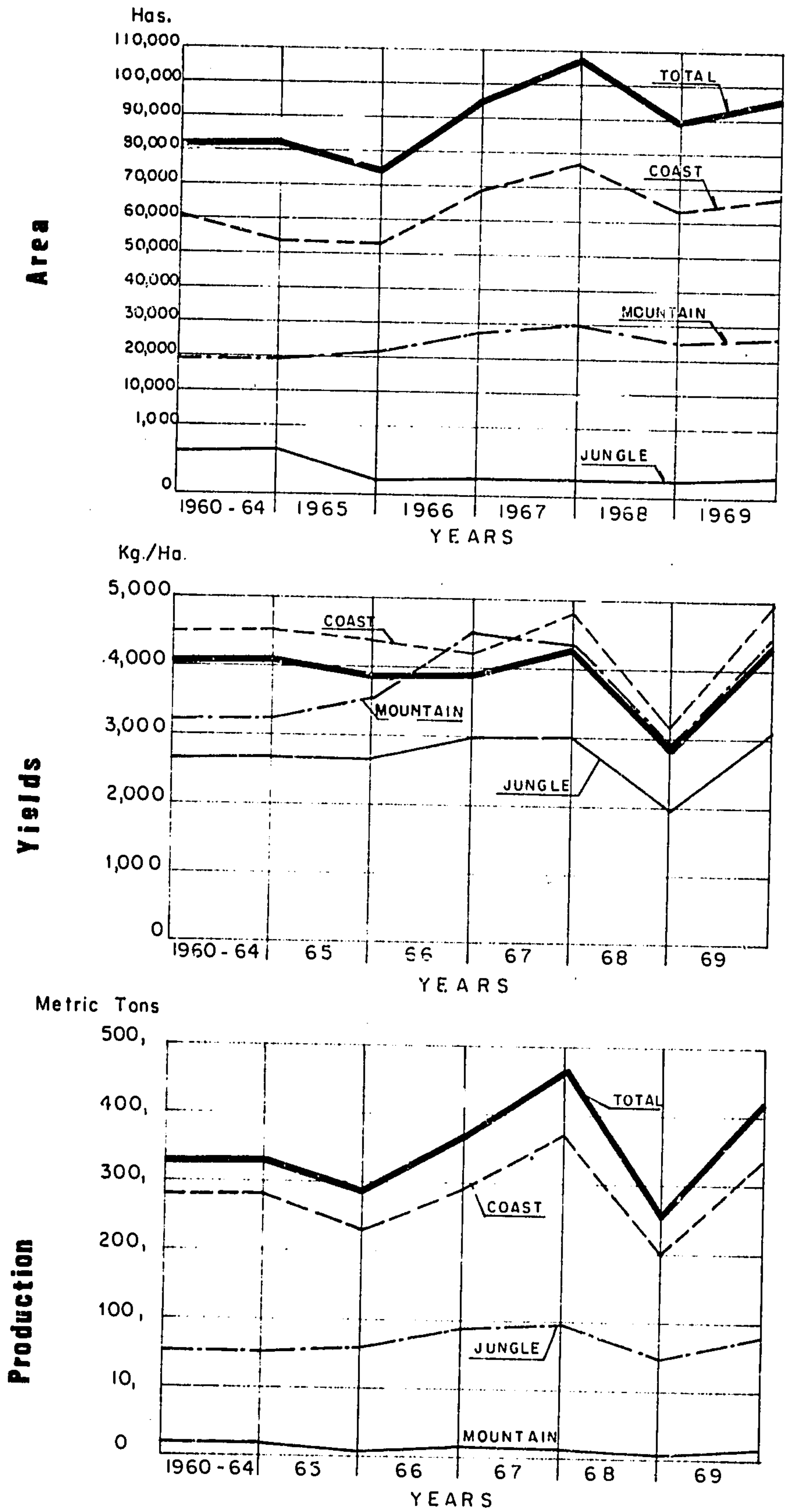
3. Selected Individual Crop Performance

a. Rice

By 1969 the production of rice in Peru had risen 37% above the average for 1960-64, due partially to an increase in area devoted to rice (up 30.5%) and partially to an increase in yields (up 5%) (see Figure 3). After a year affected by drought (1968) and a year of some recovery (1969), production increased dramatically in 1970 to a level 82% above the 1960-64 average. Again, this was due partly to increased area devoted to rice (up 67% above 1960-64) and partly to increased yields (up nearly 9% above the base period). Production in 1970 compared with

App. B Fig.3

RICE



1969 rose 47%, with area planted rising by 45% and yields by only 1.5%.

On the basis of the data given above it appears that the increase in production over this period was caused primarily by increased land devoted to rice rather than to increased yields, and to a large extent this has been the case. However, it must be remembered that as additional land is devoted to rice use must be made of increasingly marginal land with respect to the production of rice with the result that average yields are reduced. In those cases where the additional land going into rice is withdrawn from the production of some other crops, the new rice land would be less marginal with respect to the production of rice and, therefore, the diminution of yields would be less. The extent to which this has been the case cannot be determined from the available data, but a comparison of increases and decreases in land devoted to various crops indicates little, if any, inverse correlation; that is, if fact, most crops tend to increase or decrease in area rather than vice versa. One can only say that increased yields probably contributed relatively more to the increased production over this period than the table indicates.

Approximately two-thirds of the land devoted to rice is located on the Coast with the balance located in the Selva, but the Coast accounts for 80% of the total production because of the higher yields obtained there. In 1969, the last year for which regional data are available, average rice yields in the Selva were only 60% of those on the Coast in spite the fact that since

1960 yields have increased nearly 100% in the Selva. Rice yields in the Sierra in 1969 were only some 10% below those on the Coast, however very little rice is grown in the Sierra.

b. Corn

The production of corn in 1970 was 28% above the average 1960-64 output, accounted for by an increase in area planted of 11% and an increase in yields of approximately 16% (see Figure 4). Most of the increase in area planted had occurred by 1967, as had the improvements in yield, and while the area devoted to corn suffered during the drought years, surprisingly yields were hardly affected at all.

The production of corn is divided about 60 - 40 between Coast and Sierra with only a small amount produced in the Selva. The Coast has about one half the amount of land devoted to corn as the Sierra, but yields there are about three times those in the Sierra with the resulting higher total production. Yield improvements have been most pronounced in the Sierra, although even there the improvements have not been spectacular.

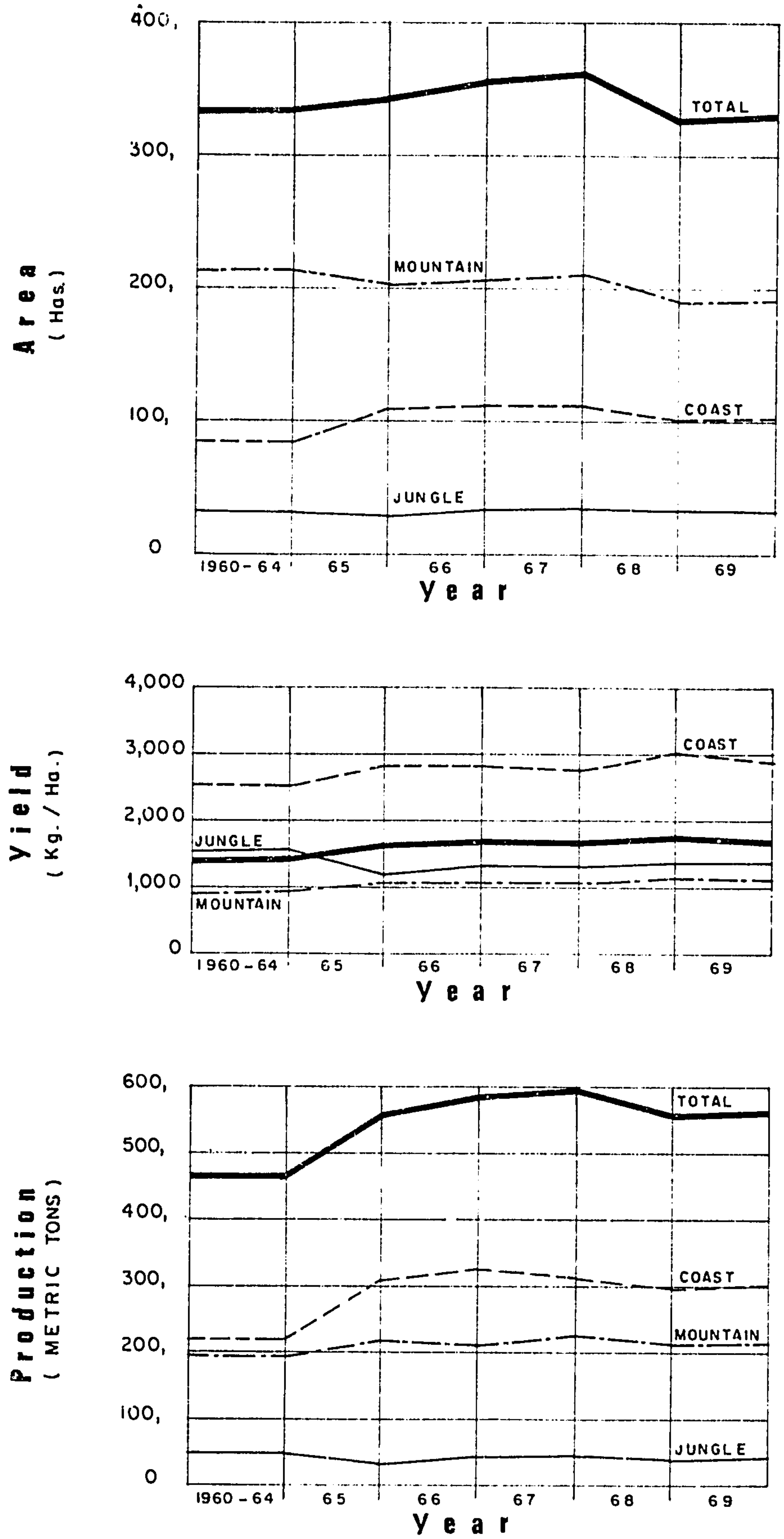
c. Potatoes

The production of potatoes has risen more than 55% over the average 1960-64 output, with area devoted and yields both contributing significantly to this growth (see Figure 5). Over 90% of the 1969 output was produced in the Sierra, where yields were less than one-half those on the Coast, however there had been no significant improvement in yields in either area up to the end of the 1969 harvest.

258

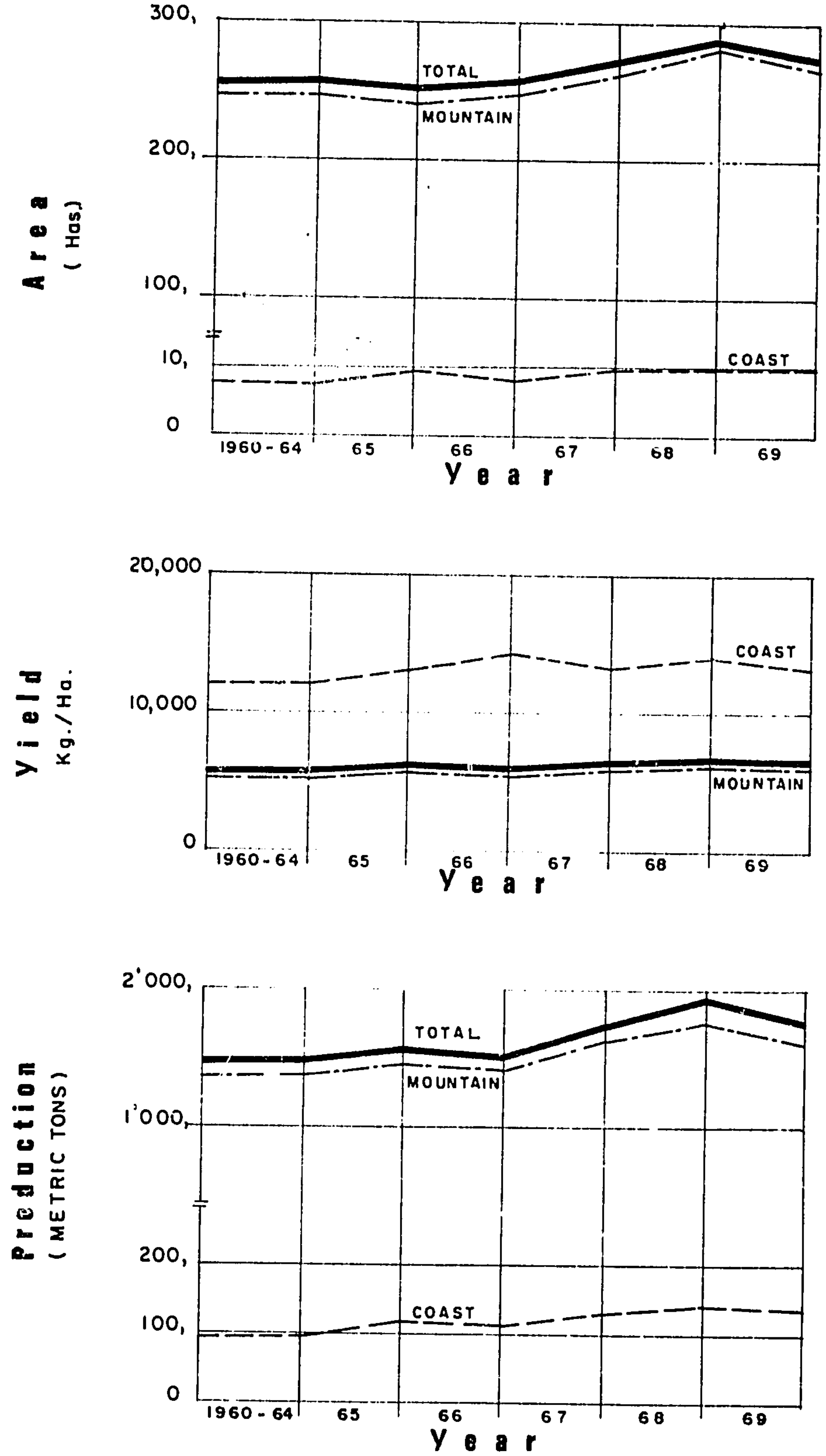
App. B - Fig. 4

CORN



App. B - Fig. 5

POTATOES



In 1970, yield improved by an average 14% (Coast and Sierra) and over 10% additional land was devoted to potatoes resulting in an increase in production of nearly 30% in one year. Regional data on yields and land use are not available, thus making it impossible to determine the location of the improvements.

Wheat

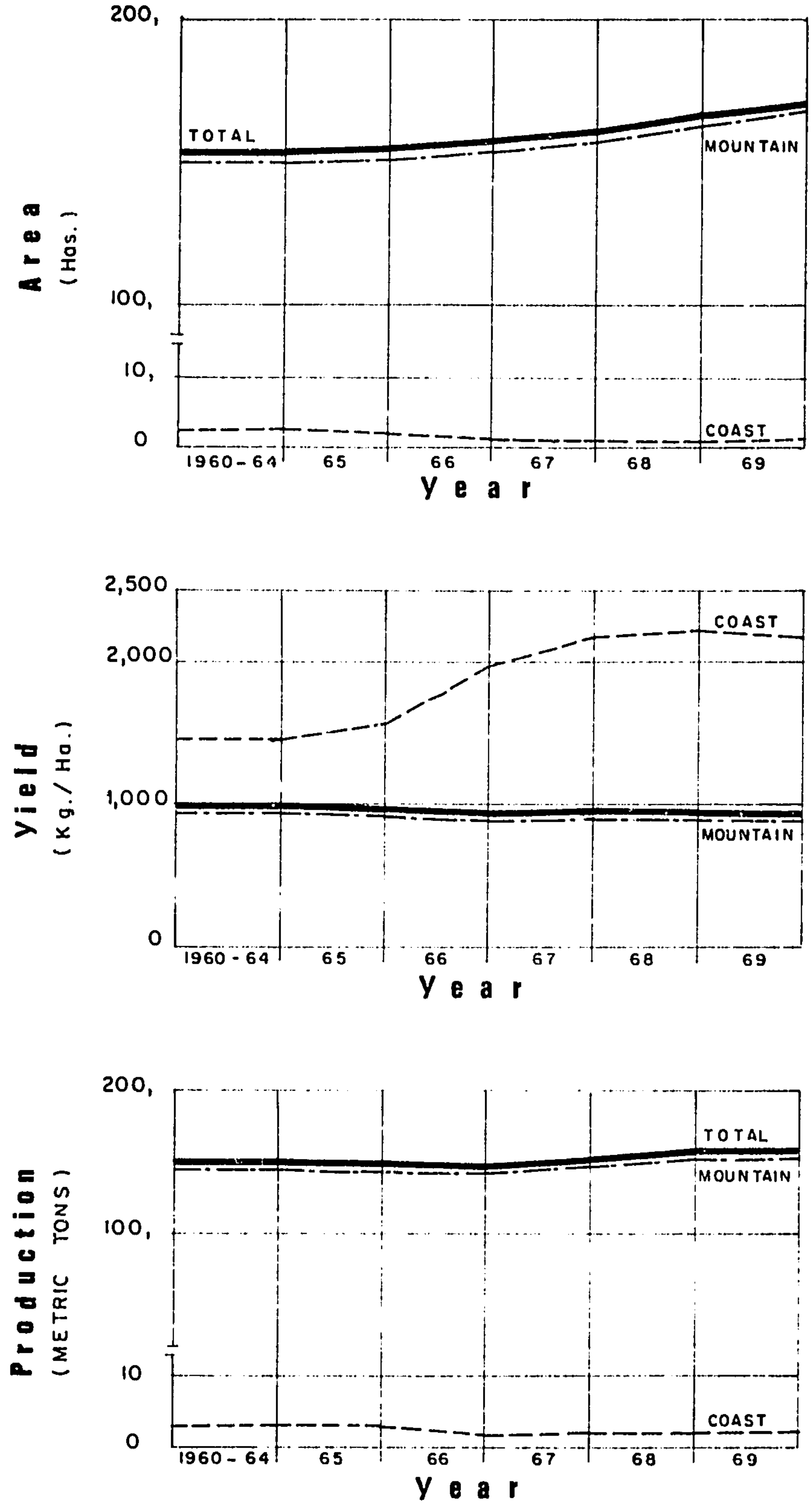
Practically all of the wheat produced in Peru is grown in the Sierra, however the greatest improvement in yields has been achieved on the Coast (see Figure 6). In fact, based on the 1960-64 average, yields had fallen by 1969 by 5% in the Sierra where 12% more land was being used, while yields over the same period had increased by 47% on the Coast where the amount of land devoted to wheat had fallen by 55%. As a result of these developments, total porduction of wheat had increased by slightly less than 6% by 1969 with an increase in land devoted to wheat offsetting a slight decrease in average yields.

Regional data are not available for 1970, however total production of wheat decreased nearly 9% from the 1969 output as a result of a decrease in the area devoted to its production. Average yield did not change from 1969 to 1970.

e. Beans and Pulses

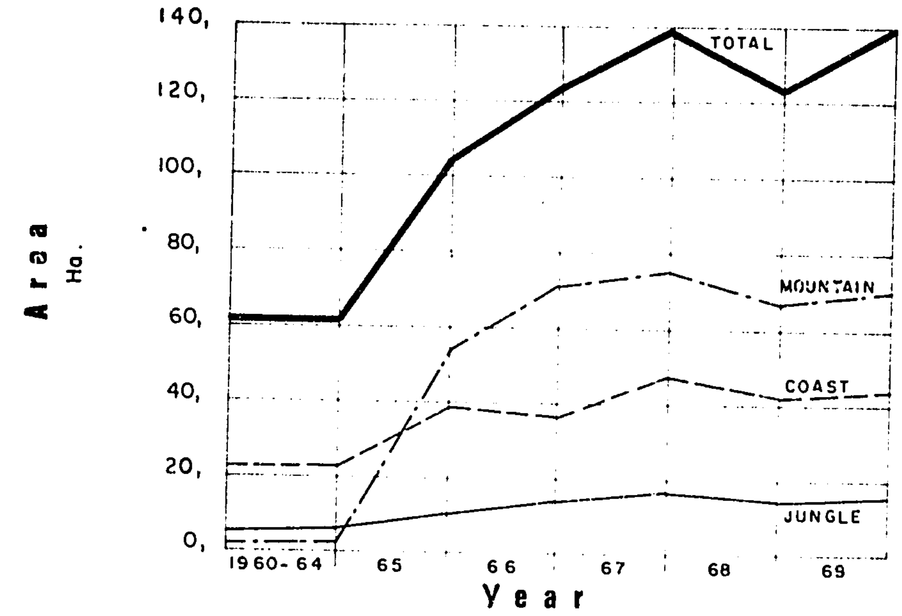
Through 1969, the production of beans and pulses had fallen over 3% from the average 1960-64 output, with a decrease in yields of some 54% offsetting an increase in area devoted to these crops of 125% (see Figure 7). Thus, in 1969 the average yield was

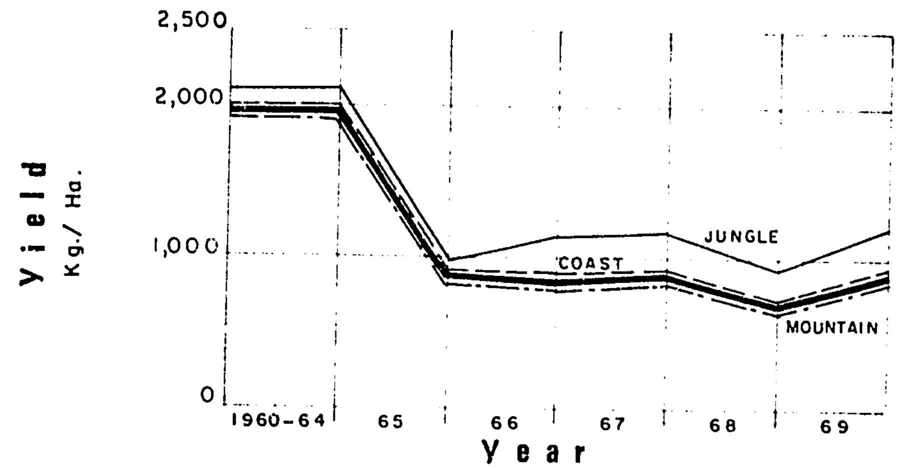
WHEAT

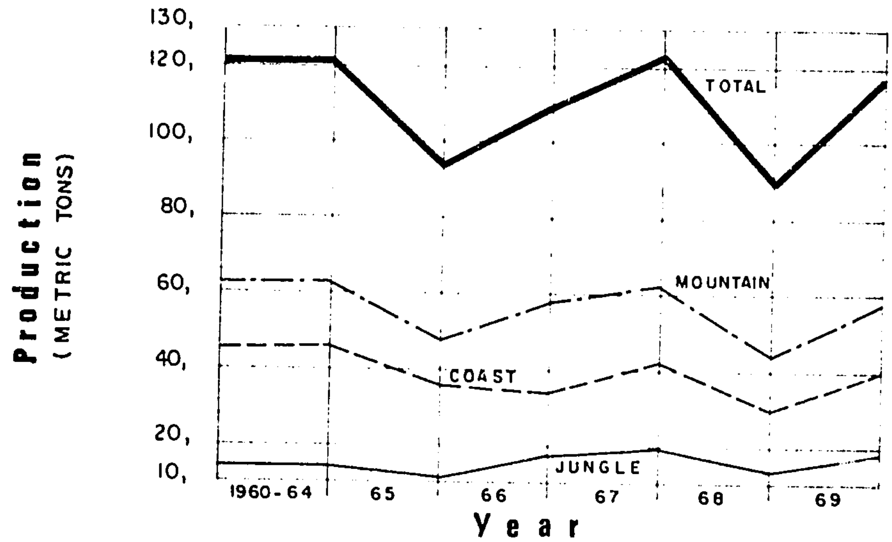

200,
TOTAL
MOUNTAIN
Area
(Has.)
100,
10,
0
COAST
1960-64
65
66
67
68
69
Year
2,500
COAST
2,000
Yield
(Kg./Ha.)
1,000
MOUNTAIN
0
1960 - 64
65
66
67
68
69
Year
200,
TOTAL
MOUNTAIN
Production
(METRIC TONS)
100,
10
COAST
0
1960 - 64
65
66
67
68
69
Year

App. B. Fig. 7

BEANS & PULSES







less than one-third that of 1960-64, which when combined with the 125% increase in area, resulted in a slight decrease in output.

By 1969 yields had decreased significantly in all three areas, Coast, Sierra and Selva, and land utilized for these crops had increased substantially in all three areas. Only in the Selva was the combination of these two factors such as to increase total production of beans and pulses.

In 1970, the area devoted to beans and pulses fell by 17% and average yield fell by another 5%, thus reducing output by over 12%. Regional data for 1970 are not available.

f. Cotton Seeds - Edible Oils

The output of edible oils in Peru is derived almost entirely from the production of cotton seeds. Over the period from 1965 to 1969, the production of cotton seeds fell by over 35%. Data on area devoted to cotton seed, yields, and regional dispersion are not available. In addition, there is no data available on production for 1970.

g. Meat

The production of cattle meat in 1970 was nearly 4% below that of 1964, and 5% below the 1969 production. (Table 10). The level of output has fluctuated very little over the period 1964 to 1970, with no discernible trend. The per capita production of cattle meat fell by 20% over this time period. Regional data are not available for the production of cattle meat.

h. Milk

Milk production, which had risen by 43% over the period 1964 to 1967, continued to increase until 1969 when it reach a level nearly 54% over the 1964 production(Table 10). In 1970, production fell slightly to a level 52% above 1964.

Per capita milk production in 1970 was 25% above that of 1964. Regional data are not available for the production of milk.

i. Pastures

The production of pastures in 1969 (the last year for which data are available) reached a level 72% above the 1964 production due to higher yields, up 23%, and to a larger amount of land devoted to pastures, up 40%. (See Table 11) Regional data are not available.

Forages

A 13% increase in yields from 1965 to 1967 accounted for a 10% increase in output of forages over the same period in face of a 2% drop in area harvested (see Table 12). However, by 1969 production had fallen to a level nearly 4% below the 1965 level as a result of a drop in yields to a level some 4% below those of 1965. Regional data are not available.

The readily attainable yields of forages grown in the Costa, and market prices to producers of such forages are shown in Table 13. These data suggest that forage production to support both milk production and beef finishing, now constitute profitable enterprises where both forage and livestock enterprises are nearby so that transport is feasible.

Table 1

Total Real Agricultural Output, Total Real Gross National Product, and Percentage Total Real Agricultural Output of Real Gross National Product 1960-1970

(Millions of 1963 Soles)

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Agriculture	13,386	13,940	14,612	14,275	14,946	14,875	15,089	15,361	14,350	14,667	15,386
Gross National Product	64,175	69,411	75,836	78,710	84,098	88,146	93,186	94,711	95,353	96,688	103,746
Agriculture As % G.N.P.	20.9	20.1	19.3	18.1	17.8	16.9	16.2	16.2	15.0	15.2	14.8

Source: Banco Central de Reserva

Table 2

Indices of Total Agricultural Production of Agricultural Export Products, Production of Agricultural Production for Home Consumption, and Production of Livestock Products
(1960 through 1970)

1963 = 100

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Export Production	90.0	92.7	97.9	100.0	98.1	93.8	93.6	80.9	84.5	76.5	86.8
Internal Consumption	96.4	95.9	98.9	100.0	108.6	115.6	118.4	127.7	116.0	123.5	132.7
Livestock	81.1	83.8	85.9	100.0	105.9	100.1	102.7	103.2	105.0	106.0	105.5
Meat	87.7	91.1	92.9	100.0	107.7	97.5	99.9	102.3	103.7	104.1	104.1
Milk	66.7	69.4	71.8	100.0	104.2	106.0	107.4	102.0	107.0	107.5	107.5

Table 3

Per Capita Real Gross National Product and Per Capita
Real Agricultural Output
1960 through 1970

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Gross National Product Per Capita	6,338	6,661	7,066	7,117	7,404	7,502	7,699	7,585	7,407	7,285	7,582
% Increase	-	5.1	6.1	0.7	4.0	1.3	2.6	-1.5	-2.3	-1.6	4.1
Agriculture Per Capita	1,322	1,338	1,361	1,291	1,316	1,266	1,247	1,230	1,115	1,105	1,124
% Increase	--	1.2	1.7	- 5.1	1.9	-3.8	- 1.5	- 1.4	- 9.4	-0.9	1.7

Source: Central Reserve Bank

Table 9

Projected Domestic Apparent Demand, Projected Domestic Supply, and Projected Deficit for 1975 and 1980 for Selected Product

(Thousand of M. T.)

Crops	Production	Proyected Domestic Apparent Demand		Proyected Domestic Supply		Proyected Deficit	
	1970 1000 M/T	1975 1000 M/T	1980 1000 M/T	1975 1000 M/T	1980 1000 M/T	1975 1000 M/T	1980 1000 M/T
Rice	487.0	701.4	893.9	699.0	921.0	- 2.4	-27.1
Corn	725.0	1,012.3	1,501.5	987.7	1,493.0	-24.6	- 8.5
Wheat	154.0	955.9	1,214.1	174.2	199.1	-781.7	-1,015.0
Potatoes	1,656.6	1,957.3	2,206.3	2,026.5	2,260.0	69.2	53.7
Beans and Pulses	68.5	112.3	133.2	110.9	163.8	- 1.4	30.6

Source: Dr. H. Van de Wetering, IOWA Universities Mission to Peru.

Table 10

Production of Cattle Meat and Milk

1964 to 1970 Plus Percentage Change for Selected

Years

(Metric Tons)

	MEAT		MILK	
1964	81,242		498,549	
1965	73,974		714,007	
1966	75,143		725,337	
1967	75,714	-6.8	714,007	43.2
1968	77,535		729,767	
1969	82,587	1.7	761,889	53.7
1970	78,176	-3.8	752,300	51.8

Table 11. - Production of Pastures for 1964 to 1969

Plus Percentage Changes for Selected Years

(Metric Tons)

Pastures

	Area	%	Yields	%	Production	%
1964	218,220		29,846		6,513,030	
1965	210,100		42,050		8,834,650	
1966	267,650		36,592		9,793,920	
1967	278,330	27.5	36,711	23.0	10,217,780	56.9
1968	291,920		36,319		10,602,377	
1969	305,435	40.0	36,696	22.9	11,208,390	72.1

Table 12. - Production of Forages 1965 to 1969

Plus Percentage Changes for Selected Years

(Metric Tons)

Forages

	Area		Yields	%	Production	%
1965	33,100		16,908		559,680	
1966	29,585		17,991		532,268	
1967	32,375	-2.2	19,049	12.7	616,727	10.2
1968	35,645		16,941		603,878	
1969	33,250	0.4	16,215	-4.1	539,155	-3.7

Table 13

A. Yield and Price Information about Forage Crops, Central Coast

Information Provided by W. L. Johnson, North Carolina

State University Mission, Lima

Crop	Yields attainable experimentally	Best farmer yields*	Market price
	(Metric Tons per hectare per year)		(Soles per kg.)
Forage corn**	150	110	0. 30
Napier grass	300	250	0. 20***
Hybrid forage Sorghum ("Sordán")	240	180	0. 30
Corn - Sordán rotation****	200	130	

* Conservative "guess-timates"

** 2 1/2 harvests per year

*** Seldom available on the market

**** Plant Sordán in Nov. Harvest Jan., Mar., late April. Plant corn in May, harvest in October.

<u>Alfalfa</u> - very little is grown near Lima. The following information applies to Northern Coast (Chimbote, Trujillo, Lambayeque)

Best experimental yield - 200 Metric Tons green forage/ha./year

Farm yield - 130 MT/ha./yr. (green forage)

Alfalfa

<u>Price</u>: for hay, delivered in Lima

Average	S/.1.80 per kg.
Price Range	S/.1.50 - S/.2.00

B. Costs of Production

The following estimates are made from budgets of presumed inputs. Labor and management costs are included, also interest on circulating capital. A value for land is not included.

	Cost of Production with Best Yields	Cost of Production, with Average Yields
Corn(green forage)	S/.0. 12 per kg.	S/.0. 17 per kg.
Sordán " "	0. 06	0. 09
(Continous harvest)		
Corn-Sordán rotation:		
Corn	0. 12	0. 17
Sordan	0. 10	0. 16
Napier grass(green forage) (Assume 10-year lifetime of stand)	S/.0. 03-0. 05/kg.	
Alfalfa (green forage) (Excludes cost of making hay and transport to market)	S/.0. 07-0. 10/kg.	