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Trends in CIAT Commodities

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CONTENTS

PREFACE

This year's edition of the Trend Highlights marks the first time that there has been a focus exclusively on impact, and significantly the discussion centers on the commodity programs other than rice. Besides reflecting the maturation and the natural evolution of crop research at CIAT, the concentration on impact as well marks something of a departure for economics studies. To date much of the economics research in the CIAT commodity programs has had an ex-ante focus, both as an input into program decision making and as a projection of future impact. Examples of this work encompass both methodological and empirical concerns and cover ground from the development of the HATSIM and other herd simulation models in the Tropical Pastures Program to a methodological extension of economic surplus models. The studies in this volume present something of a natural transition to ex-post studies while maintaining a focus on information input back into the research program.

These studies provide only the first thematic insights into what the broader impact of new technologies might be. The first characteristic, that is particularly salient in the bean and pasture studies, is that the individual varieties tend to exploit only well defined niches, defined either by the production system or underlying edaphic conditions. This is characteristic of varieties which do not necessarily depend on changes in input use or management practices. The second characteristic is that there are preconditions which must be met before the technology is adopted and diffused. This is particularly striking in cassava but appears to characterize beans and legume-based pastures as well. Technological impact is thus dependent on such factors as market development, availability of support services such as extension and credit, a viable seed industry, and a well functioning adaptive research program.

These two themes run counter to the notion of a CICA-8 in cassava, beans, or tropical pastures that will sweep through Latin America, and as well they raise the very difficult issue of how the CIAT commodity programs are to develop a consistent outreach strategy that achieves impact. Nevertheless, as the cassava case suggests these constraints on diffusion allow scope for directing impact to more difficult objectives, such as impact on small farmer welfare. As such, impact assessment studies become a primary means of both directing and optimizing impact. The studies presented in this volume highlight the diversity of approaches to the issue but each emphasizes the basic objective of providing continual input into the research and outreach strategy of the programs.

The presentation of these very early studies is meant to generate comment on how the process might be improved. The intent is to make impact assessment an integral and evolving part of the research process and not just an ex-post benediction.

John K. Lynam
Editor

From Start to Finish:

Impact Assessment in the Cassava Program

John K. Lynam
Willem Janssen
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Impact and adoption studies represented the first real involvement of the social scietists in the evaluation of IARC-generated technology. Most were independent observers and framed their research as a critique. Studies dealt with marketing problems, quality deficiencies, and adoption constraints but the principal focus was on the relation between farm size and adoption rates and on the distribution of benefits. These studies represented the professional concerns of the period and in the end formed an advocacy for the incorporation of social scientists in the process of technology generation at the centers. In hindsight the patterns discovered in those early studies were more changeable than the researchers presumed, but the legacy remains: how can social scientists help link the process of technology generation and evaluation to the socio-economic objectives that were largely defined by those first impact studies ?

Impact studies treat the past and as such they have had three principal objectives. One focus is something of a closing of the books. Agricultural research is costly and is principally financed from public funds. Impact studies provide a measure of the returns to the research investment. This type of analysis, if not always providing guidelines for future funding of research projects, at least usually provides justification for maintaining research budgets. Most studies demonstrate high rates of return (Evenson, Waggoner, Ruttan, 1979), but the sample of research projects is inherently biased, since it covers only those research lines that have attained a significant level of adoption. Investments that never result in technologies leaving the experiment station are rarely analyzed. The evaluation process, thus, is anything but thorough, which reflects the difficulty of characterizing scientific research in purely project terms, difficulties in isolating the effects on research in a complex world, uncertainty about the appropriate time frame for an evaluation and the very real difficulty in maintaining public funding of research budgets.

The second function of ex-post impact studies is to ask what can be learned about the technology from an understanding of the pattern of diffusion and the performance of the technology under farmer management. Such studies sometiemes find that the technology is not achieving the breadth of adoption or the yield increments that were expected or that the technology is generating unforseen second-generation research problems. Early adoption studies formed something of a consensus that hindsight provides powerful arguments for how technology should have been designed but was not. When appropriately conceptualized this type of study can provide a valuable interactive link between research decision-making and a more systematic understanding of technology requirements within target farmer populations.

Finally such studies evaluate the impact of new technology in light of socio-economic, policy objectives. Much of this research has focused on income distribution, that is, the impact of the technology on agricultural employment and wages, on small-farmer incomes, and on prices and increased food consumption of the poor. While demonstrating that improved agricultural technologies can often result in inequitable benefit distributions, such impact studies more often than not fall short of diagnosing correctives. Insuring equitable benefit distribution or skewing benefits to the poor is a complex and inexact undertaking, that can involve such complementary interventions as biasing support services, such as credit or extension, to target groups or the often suggested, but almost never implemented, scheme of taxing beneficiaries and compensating losers. However, usually at the heart of such studies is the assumption that alternative technologies can lead to alternative benefit distributions. This assumption has rather powerful implications. Most importantly, the technological treadmill ceases to be a "natural" law of economics but rather becomes a normative (political) question of both who should appropriate the benefits of public investment in research and, as often happens, who should be implicitly "taxed". At a more practical level, the problem becomes the very difficult one of defining what those alternative design decisions are and how to choose between them. Impact studies to date have failed to supply comprehensive answers to these practical problems nor have they provided systematic evidence for the underlying assumption that technology design can bias benefits.

Nevertheless, the CGIAR system has set for itself very clear income distributional objectives which are to be attained essentially from investment in agricultural research. Moreover, performance standards applied to the individual IARC's are defined in terms of eventual impact and, particularly, impact on income distributional objectives. Thus, impact studies have become something of a recurrent enterprise within the CGIAR system. Yet, such impact studies presuppose technology diffusion and in a sense are an afterthought to the process of technology design and generation. However, if the donor and social science community are to hold technology design (and its creators) responsible for its eventual socioeconomic impact, then a means is needed for projecting eventual impact within the actual process of technology generation prior to its diffusion and for monitoring results during that process. Moreover, since social scientists have been integrated into the centers, this responsibility to a very significant degree falls on their shoulders. At the IARC's then impact assessment should be a continuous process, fully integrated into the research programs.

The economics section with the CIAT cassava program has attempted to adopt such an integrative approach to impact evaluation. The following discussion will utilize particular studies to demonstrate how impact assessment is a continuous and evolving element of the section's activities and how it is incorporated in the research program's activities.

Objectives and Strategy

The issue is how to direct impact of improved technologies without sacrificing, in an optimum world, potential production and efficiency. The process starts with well defined objectives, that necessarily include expected impact of technology on socio-economic goals, and a strategy whereby those objectives might be obtained. The cassava program's objectives have been defined as follows: "The overall goals of the cassava network are to increase small farmers' food supplies and income, as well as to improve food availability for the overall population" (CIAT, 1985). Previous analyses of existing cassava production and consumption patterns helped to define and in turn justify these objectives. Cassava is an essential element in CIAT's crop portfolio which allows the center to attain its income distributional objectives. However, translating objectives into a viable research strategy is a major undertaking and requires a rather detailed understanding of the role of the commodity in an often rather dynamic agricultural economy. Considered in this section are studies that have helped to define and/or confirm a research and development strategy for cassava in Latin America.

A central theme in the development of a research strategy for cassava is the effect that traditional markets have on the demand for improved production technology. In Latin America markets for cassava, and in turn sources of income for cassava producers, are dependent on food markets, and outside Brazil these are essentially markets for the fresh root. The perishability and bulkiness of fresh roots lead to several hypotheses about the marketing and consumption of cassava. These were intensively evaluated on the Atlantic Coast of Colombia, the principal cassava producing region of the country.

The difference in consumption patterns based on rural-urban residence between cassava and other starchy staples is striking (Table 1). Cassava consumption declines precipituously from the point of production, so that consumption in the large cities is less than 20% of that of cassava producers. Neither plantain or rice show such differences, and potato, an imported commodity in the region, exhibits the opposite pattern. These differences in cassava consumption based on residence are not due to any signficant difference in the manner of utilization in the home (Table 2). Cassava to a reasonable extent is eaten in the same meals and prepared in the same manner. The differences arise from the number of meals per week at which cassava is served and the size of the portion per serving. The primary factor resulting in these differences in consumption of cassava are price and convenience. Cassava is more than five times more expensive in metropolitan areas than the opportunity cost to cassava producers. Moreover, implicit costs in buying cassava daily in urban areas makes cassava a far less convenient food than say rice.

The price difference between cassava producer and metropolitan consumer reflects the very signficant marketing margin for the crop. These margins derive from a marketing structure which must move a bulky and perishable crop from many small-scale producers to consumers who buy their cassava in small lots at convenient locations (Table 3). The basic structure of this marketing system is presented in Table 4 and portrays a process which includes assembly in small lots of 800 kg. from small-scale producers, breakdown at the wholesale level into very small lots of 100 kg, and retail distribution. Assembly agents and wholesalers trade in about the same volumes and have similar margins. Retailers must recuperate costs with very small volumes and thus have very high margins. An analysis of costs (Table 5) suggests that the margins are not excessive, especially when viewed in terms of net profit.

The average time required from harvest to move cassava to consumers is 32 hours (Table 6). Such efficiency requires significant coordination and this is achieved principally by arranging sales prior to harvest (Tables 6 and 7). Seasonal price variation is relatively low in cassava due to supply management by storage in the field. However, interyear price fluctuations are relatively high. The latter is in part due to a demand price elasticity of 0.8 and significant weather variability. Price variation, quite stringent quality requirements, and an inherent rationing of market access, in which the farmer very often cannot arrange a sale, all result in making cassava a very risky crop in which to market. A market structure

Table 1. Atlantic Coast, Colombia: Average consumption (kg/capita/year) of some starchy food crops by rural-urban residence, 1983.

	Rice	Potato	Cassava	Plantain	Yam	Number of observations
Metropolitan urban area	69.4	36.6	30.5	64.4	30.5	80
Intermediate urban areas	71.4	35.0	53.5	76.6	30.8	80
Rural areas	66.9	24.2	82.9	67.8	41.9	160
Cassava producers	68.7	8.9	170.4	79.0	85.7	160

Source: Cassava consumption surveys among purchasers and producers, 1983.

Table 2. Atlantic Coast, Colombia: Distribution of cassava consumption over the different meals, by rural-urban residence, 1983.

	Metropolitan urban areas	Intermediate urban areas	Rural areas	Producers
% of cassava consumed at breakfast	30.0	53.5	50.2	42.3
Most important form of preparation	boiled	boiled	boiled	boiled
% of cassava consumed at lunch	69.0	43.6	39.7	49.1
Most important form of preparation	in soup	in soup	in soup	in soup
% of cassava consumed at dinner	1.0	3.0	10.0	8.6
Most important form of preparation	boiled/ fried	boiled/ fried	boiled/ fried	boiled/ fried
Number of meals per week with cassava	4.9	6.3	8.3	11.0
Average portion of cassava served per person (grams)	118	158	191	313
Price (US-$/kg)	0.45	0.27	0.26	0.08
Number of observations	80	80	160	160

Source: Cassava consumption survey among purchasers and producers, 1983.

Table 3. Atlantic Coast, Colombia: Purchasing habits of fresh cassava and other starchy staples, 1983.

	Metropolitan urban areas	Intermediate urban areas	Rural areas
Quantity purchased (kg):			
Cassava	0.86	1.85	1.74
Potato	2.01	2.41	1.57
Plantain	3.2	5.43	4.3
Yam	1.49	3.76	6.29
Rice	5.92	9.11	5.59
Location of cassava purchase (%):			
Market place	12.3	27.5	21.3
Neighbourhood shop	43.2	36.3	20.6
Street	19.7	26.3	36.2
Supermarket	19.7	2.5	-
Other (among with farms)	5.1	7.4	21.9
Reason for buying cassava in a certain outlet (%):			
Close	60	48	59
Buy everything there	17	17	12
Cheap	-	-	14
Type of cassava purchased determined by (%):			
Availability	73	40	52
Quality	26	49	35
More important cassava quality characteristics mentioned (%):			
- High starch content	24	38	42
- Slowly deteriorating	48	35	52
- Taste	48	34	30
Estimation of % cassava deterioration before consumption	15	5	5
Sample size	80	80	160

Source: Cassava consumption surveys, 1983.

Table 4. Atlantic Coast, Colombia: Characteristics of the market structure for fresh cassava, 1983.

	Rural Assembly Agents	Wholesalers/ Distributors	Retailers*
Number of middlemen per municipality			
Rural	7-20	1-8	1 retailer per 200-400 inhabitants
Urban	-	15-40	1 retailer per 200-300 inhabitants
Purchasing price (US-$/kg)	0.098	0.129	0.182
Sales price (US-$/kg)	0.139	0.180	0.309
Sales price as % of farm gate price	141	183	315
Size of purchasing transactions (kg)	800	750	68
Size of sales transaction (kg)	750	100	1.55
Volume traded per week (kg) of cassava	9600	7340	320
Turn-over in cassava/year (US-dollars)	55600	64120	4320
Number of suppliers per day	3.7	1.77	1.0
Number of purchasers per day	3.9	13.4	36.6
Capital goods available:	Warehouse - 25% truck - 11%	Warehouse - 30% truck - 12%	Shop: 40% -
% with income from outside trading	42	18	23
Average number of months per year selling cassava	9.1	11.0	10.3
Information Means:	Visiting farmers, personal contacts with wholesalers	Telephone, contacts with retailers and assembly agents	Contacts with wholesalers
Socio-economic class	Low/middle low	Low/middle low	Low/middle low
Average years in business	8.6	n.a	n.a
Sample size	136	83	252

* Supermarkets are excluded.

Source: Market agents survey, 1983.

Table 5. Atlantic Coast, Colombia: Fresh cassava marketing costs, 1983.

	Rural Assembly Agents	Wholesalers/ Distributors	Retailers	Costs as a % of total margin
Marketing margin (US $ cents/kg)	4.10	5.10	12.70	
Estimated handling costs (US $ cents/kg)	3.65	4.65	9.78	83
of which:				
Labour	0.97	1.16	5.60	35
Transport	1.51	0.60	1.25	15
Deterioration	0.20	1.03	1.82	14
Packing material	0.12	-	-	1
Equipment	0.25	0.60	0.60	7
Working capital	0.22	0.38	0.26	4
Government fees	0.38	0.88	0.25	7
Estimated net profit per year (US-$)	1804	1866	439	

Source: Market agents survey, 1983.

Table 6. Atlantic Coast, Colombia: Characteristics of fresh cassava market conduct , 1983.

	Rural Assembly Agents	Wholesalers Distributors	Retailers*
% that determines traded volume according to:			
- Prior arrangements	39	18	-
- Available supply	-	62	31
- Available working capital	-	13	-
- Time of the year/day of the week	61	-	69
% that determines sales price according to:			
- Prior arrangements	21	2	-
- Available supply	52	75	72
- Fixed margins	26	21	28
Moment of purchase payment			
- Advanced	30	15	26
- Cash	56	42	56
- Delayed	4	37	15
% that arranges purchases in advance	100	45	19
% that sells cassava at day of purchasing	19	76	75
Post-harvest age of cassava at moment of sale (hours)	19	25	32
% that has frequent problems with deterioration	31	70	66
Use of deteriorated cassava:			
- Animal feed or processing	59	60	51
- Waste	41	28	49
Important aspects in quality control	Size, skin colour	Size, freshness	Size, freshness
Purchasing price (US-$/kg)	0.098	0.129	0.182
Sales price (US-$/kg)	0.139	0.180	0.309
Sales price as % of farm gate price	141	183	315
Sample size	136	83	252

* Supermarkets are excluded.

Source: Markets Agents Survey, 1983.

resulting in small volume transactions and significant marketing risk gives small farmers a comparative advantage but results in farmers limiting this risk by planting a limited area in cassava in relation to farm size (Table 8).

The demand for improved technology under such market conditions is limited. The physical root characteristics of varieties, such as skin color, are a proxy for other, established quality factors. Since new varieties are a risky marketing venture, quality characteristics for introduced varieties are stringent and result in a low probability of adoption. Moreover, farmers already limit production because of marketing constraints (Table 7) and would be resistant to risking higher cash costs to expand yields. However, the most important aspect is that not only is there little effective demand for improved production technology but such technology would not achieve the objectives as originally outlined. Because of the high marketing margin, any reduction in production costs would have little impact on retail prices and therefore cassava consumption. Moreover, any signficant yield response could easily saturate what are very limited markets - given the price elasticity and the limited arbitrage possibilities because of time and transport constraints - and because of the price decline and/or lack of market access could result in an actual decrease in farmer incomes.

A cassava research strategy whose eventual goal is impact on farmer incomes can not be based on the hypothesis that improved production technology is sufficient for that end. The strategy necessarily has to include processing and/or storage technology and the development of alternative markets. The hypotheses underlying a consistent strategy then are that (1) development of an alternative market based on processed cassava increases the size of the market, in most cases has more growth potential, and can result in a stable price floor under traditional markets, (2) a more expansive market with a stable price floor would provide incentives for the adoption of improved production technology, (3) small-scale processing technology is most compatible with small-farmer production systems, and (4) wherever possible small-scale cassava producers themselves should do the processing in order maximize the benefits of new market development. The translation of research objectives into a research strategy thus depends on a clear understanding of the commodity system with a view to eventual impact.

Market Development: Organizational Innovations

A fundamental knowledge of the commodity system honed the research strategy, and in most cases in Latin America the initial intervention would be through utilization technology and market development. Expanded demand would in turn provide the environment for adoption of improved production technology. A basic operational assumption in such intervention is that cassava is already competitive with substitutes in many of these markets, especially the animal feed concentrate market. That is, there are constraints on the operation of Adam Smith's hidden hand that have prevented development of these markets based on just price signals. Price incentives have not provided the organizational impetus necessary for market development. The reasons are structural. In the first place a cassava market based on just fresh, food consumption is very fractured, consisting of small, independent local markets with often individual supply

Table 7. Atlantic Coast, Colombia: Marketing characteristics of cassava producers by department, 1983.

	Atlantico	Bolivar	Cordoba	Sucre
% farmers that arranges sales before harvesting	81	62	79	64
% farmers to whom it happened that they wanted to sell but could not find a buyer	60	42	61	64
% farmers that retailed cassava	-	-	7	7
Major sales period	October to December	March to June	June to September	October to January
% farmers that sells cassava:				
In the farm	35	33	54	58
In rural market	43	39	19	28
In regional market	22	28	27	14
Average transaction size (kg)	700	579	1712	342
Reasons why farmers do not plant more cassava (% of farmers):				
Lack of land	43	31	41	35
Lack of credit	15	8	11	9
Lack of labor	6	15	-	-
Difficult to sell	-	36	13	40
Low prices	23	10	33	14
Other reasons	17	-	2	-
Average percentage of unmarketable roots:	20.0	17.8	10.0	5.4
Producer price (US-$/kg):				
Actual price received	0.092	0.093	0.089	0.069
Farm gate price corrected for losses and transport costs	0.070	0.071	0.068	0.065
Sample Size	40	38	74	57

Source: Production and farm marketing survey, 1983.

Table 8. Atlantic Coast, Colombia: Land utilization by cassava producers by department, 1983.

	Atlantico	Bolivar	Cordoba	Sucre
Farm size (ha)	6.1	11.2	9.7	7.4
% farms with crop land	100	100	100	100
Land under crops (ha)	2.7	3.3	3.3	2.8
Area under crops in cassava (ha)	2.0	1.7	2.1	1.5
Area under crops in maize (ha)	2.6	3.1	3.1	2.5
% farms with pasture land	50	42.4	74.8	66.4
Area in pastures (ha)	2.2	3.7	4.5	3.9
Number of cows	1.5	1.6	4.2	3.4
Liters of milk/day	5.9	4.8	10.9	9.0
% farms with land in fallow	46	58	58	31
Area in fallow (ha)	1.2	4.1	1.8	0.7
Sample size	60	65	153	134

Source: Production and farm marketing survey, 1983.

areas. Prices are subject to local supply and demand and therefore differ between markets. Moreover, there is a difference between the sales price and the implicit price at which farmers would supply roots for industrial uses. This difference on the Colombian Atlantic Coast is based on the 13% of roots that must be discarded at harvest because of size or breakage, the transport costs to rural markets, and the cost of unsold roots (Table 7). Correcting the farmers' price for these factors results in a 24% reduction compared to an equivalent price where all roots can be used (Table 7). That is, price incentives for development of alternative markets are masked where market structure is based on urban fresh root markets. Project site selection to avoid local markets with particularly high prices and a firm understanding of the farmers' supply price are crucial to development of alternative markets.

A second operational principle is that the introduction of processing capacity and opening of new marketing channels should not require in the initial stages major adjustments in cassava production systems and supply. That is, development should be evolutionary -- i.e. develop along a classic logistic curve --, to accomodate the learning process associated with management of the processing technology and the adaptive adjustments necessary in output and input markets. The small-scale nature of the processing technology and appropriate design of the diffusion process through screening of credit applications would provide the best assurances of this least risky of growth paths.

The final principle is that market development is a means to rather than a primary source of increases in small farmer income. The governing assumption is that the principal source of income generation would be the potential to put into cassava production underutilized land and labor resources within the farm and to increase cassava yields. The cassava drying plants, the processing technology chosen for the particular case of the Atlantic Coast, provide access to market and need only to operate on a cost basis if farmer managed. This led to the conception that a drying plant could be supplied by 15 to 20 small-scale producers. Both to share the risk of the investment costs and to supply labor for plant management and cassava for plant operation, these farmers were organized in a unit, called farmer associations. The conception then was that these farmer associations would be self-contained units for production, processing, and sales [1/].

Such a strategy needs testing and the testing bridges research to development activities. These principles were tested within the framework of the Colombian Integrated Rural Development Program. In the first three years of the project the number of plants have grown from 1 to 7 to 20. An impact assessment of the twenty plants was undertaken in the 1984-85 production-processing season. Economic viability was already an established fact since over 3 thousand tons of dried cassava were produced in that season. Principal issues in the assessment were the mechanisms determining income distribution and whether the original assumptions underlying the strategy held true. The former issue will be covered in

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1/ The Colombian Integrated Rural Development Program is primarily responsible for the innovation inherent in the farmer associations. The CIAT program helped to adapt then to the particular case of cassava processing.

some detail in the next and last sections; the point to be highlighted here is the value of early impact assessment in the modification of assumptions and strategy.

The notion of the farmer association as a self-contained unit was overturned by events, which in turn had far more utility as a model for income generation and equitable distribution. First, the potential of the plants themselves as a source of income generation was underestimated. Each plant on average paid out over three thousand dollars in wages and almost four thousand dollars in net profits to its members. The oldest plant earned over 16 thousand dollars in net profits. Moreover, this does not consider the equity accumulation in the plant. Second, on average slightly less than a third of processed roots were derived from members' own production. In none of the plants was this figure over 50%. The plants were drawing on a larger supply area than just those farmers in the association. Third, and most importantly, the associations, especially those formed in the third year, were drawing in members with little, if any, land resources. Of almost 400 farmers in the associations by 1985, only 1% had farms over 20 ha. and 42% did not have secure tenancy in land at all. Mean "farm" size was 4.1 ha. The farmers associations', organized around the cassava plants and an unexploited source of income generation, thus became a means of reaching the most marginal groups in the rural population. Organizational innovations prior to introduction of improved production technology could then provide an appropriate vehicle for biasing the benefits of the technology.

The multiple sources of income generation served all its members, with the land owners having a strong interest in cassava sales and members with little or no land, a vested interest in employment and profit redistribution. Although there was some element of conflict here, the associations were bound together by the increasing equity -- through amortization of loans and plant expansion. The small size of the associations was critical in maintaining income incentives of sufficient size. Moreover, the plant provided an outlet for cassava production of non-members, which served to increase the number of beneficiaries even more (see last section). Incorporation of appropriate utilization technology and organizational innovations, arising from an understanding of the constraints on the development of cassava commodity system, into an actual field-level project provided a fine tuning of the strategy and confirmation that cassava could be a means of generating income for even the most marginal producers in a relatively marginal agricultural area. A principal lesson, moreover, is that equitable impact, even as preliminary as in this case, followed from the initial focus on income distribution.

Market Development: New Utilization Technology

While the principal objective of the cassava program in Latin America is to improve small farmer incomes, the question remains whether cassava has a direct role in improving the food consumption of the urban poor. In Latin America malnutrition is due essentially to a lack of sufficient calories and its locus is in the urban areas (Pachico and Sere, 1985). While the primary cause of malnutrition is insufficient income, a primary intervention to increase food purchases by the poor is lower food prices. This has been a primary rationale for investment in production research on basic food staples. However, in the case of fresh cassava -- the principal

Table 9. Colombia: Price and Income Elasticities for Cassava by Income Strata, 1981.

Quintile	Price Elasticity	Income Elasticity
1	-0.84	1.47
2	-0.92	1.23
3	-0.93	0.27
4	-0.92	0.64
5	-0.83	0.04

Source: Sanint, Rivas, Duque, and Sere, 1985 consumption form outside Brazil -- marketing margins normally make up 75% of the eventual price to the urban consumer. Thus, a hypothetical 25% drop in farm prices could result in no more then a 6% drop in consumer prices, assuming constant margins. New production technology for cassava would thus have little impact on the nutrition of the urban poor outside Brazil.

This conclusion, however, does not preclude impact on this target group. Rather, the research focus shifts to how to reduce the marketing margin and how to improve consumer acceptability of cassava. Analysis of a consumer budget survey in Colombia (Sanint, Rivas, Duque, and Sere, 1985) suggested that while fresh cassava consumption by the urban poor was low compared to rural consumption, price and income elasticities for fresh cassava in the lower income strata were high (Table 9). Fresh cassava was far from an inferior good and a significant consumption response would be expected from a fall in price. This conclusion was supported by more in-depth surveys of consumers. Evaluation by urban consumers in two regions of Colombia showed that while cassava was considered as tasty as other carbohydrate sources and thought to be relatively important in the diet, the principal problem was its high perishability and the associated problems of storage, quality, and riskiness (Table 10). A detailed consumption model for fresh cassava showed that consumption levels were affected by distance to market, ownership of a refrigerator, and whether the housewife worked (Table 11). Reducing perishability and improving quality and convenience would have a significant effect on consumption, especially for poor barrios who were often far from markets.

Impact on fresh cassava consumption in Latin America was therefore to be achieved through inexpensive storage technology that would conserve roots from harvest to consumption in the home. Such a storage technology was developed within the program, where by only treating fresh roots with a non-toxic fungicide and packing then in plastic bags storage life of roots could be increased to two weeks or more. The expected result is improved consumer acceptability, lower consumer costs from reduced shopping frequency and losses, lower retail margins through higher volumes and reduced losses, and lower wholesale margins through increased competition and reduced risk. By understanding the complete commodity system from producer to consumer and then focusing research on the most strategic element, impact could he most efficiently achieved.

To evaluate the full potential for impact and the potential constraints on adoption, not to mention the most appropriate strategy for introducing the technology, a field-level pilot project was designed. Only the first stage of consumer testing has been completed and can be reported on. A test panel of 100 consumers in Bucaramanga, Colombia found that the storage technology functioned effectively (Table 12), that there were no major problems in quality changes (Table 13), and that consumption levels would increase signficantly (Table 14). These projected consumption levels with storage technology were put into the same consumption model and factors such as market access, ownership of a refrigerator and the housewife working were found to not signficantly influence quantity consumed. This thus gave insights on where the technology should be introduced in order to maximize and direct impact.

The point can thus be emphasized once again that impact assessment is a continuous enterprise from research planning through evaluation and field

Table 10. Colombia: Attitudes of urban consumers to cassava and other starchy foodstuffs in Bucaramanga and major cities of the Atlantic coast (% of respondents agreeing with statement).

Statement	Cassava	Potato	Rice	Plantain
This product cannot be stored well				
Bucaramanga	88	35	2	19
Atlantic Coast	97	24	1	12
The quality of this product is very variable				
Bucaramanga	92	84	38	56
Atlantic Coast	81	17	3	3
Purchasing this product is always risky because of its quality				
Bucaramanga	90	69	1	8
Atlantic Coast	81	17	3	3
This product is easy to prepare				
Bucaramanga	100	100	99	99
Atlantic Coast	73	66	66	53
This product is purchased the day of consumption				
Bucaramanga	59	51	48	50
Atlantic Coast	83	57	48	52
This product is necessary in our meals				
Bucaramanga	80	93	93	91
Atlantic Coast	48	65	77	83
This product is very tasty				
Bucaramanga	78	91	87	93
Atlantic Coast	70	77	57	86

Table 11. Bucaramanga, Colombia: A Model of Fresh Cassava Consumption in Urban Areas.

Factor	Coefficient
Intercept: per capita annual consumption	75.7 *
Income: change per peso of monthly family income	-.0014*
Number of children in family	-22.6 *
Housewife is employed	-6.9 *
Family has a refrigerator	7.8 *
Barrio with poor market access	-18.2 *
Barrio with reasonable market access	-10.2 *
Barrio with good market access	-5.8

* Coefficient significant at the probability level of 5%

Source: De Haan

Table 12. Bucaramanga, Colombia: Percentage losses in consumer testing of stored cassava.

Barrio	Fresh (%)	1 week storage (%)	2 weeks storage (%)
La Joya	7.8	5.5	5.8
Villa Rosa	0.5	2.3	9.4
Miraflores	2.0	7.9	9.2
Concordia	0.5	2.3	16.0
El Bosque/Campestre	0.0	9.8	33.0

Table 13 Bucaramanga, Colombia: Consumer quality evaluation of stored and fresh cassava

Quality Parameter	Fresh	1 week stored	2 weeks stored
General appearance[2]	2.32[a]	2.23[ab]	2.07[b]
Cooking time (% normal or less)	67%	82%	80%
Texture evaluations:			
floury[1]	1.87[a]	1.68[b]	1.71[b]
glassy[1]	0.19	0.40	0.33
fibrous[1]	0.15	0.09	0.03
soft[1]	1.72	1.56	1.51
hard[1]	0.13	0.43	0.37
Taste evaluations			
bitter[1]	0.13[a]	0.11[a]	0.09[a]
sweet[1]	0.05[a]	0.03[a]	0.01[a]
"deteriorated"[1]	0.03[a]	0.12[ab]	0.17[b]
Eating quality			
general[2]	2.25[a]	2.23[a]	2.14[a]

[1] Evaluation scale: 0 none (not present)
1 little (present to limited degree)
2 yes (present)
3 much (present, pronounced)*

* floury, soft = too much (present, to excess).

[2] Evaluation scale: 0 bad, 1 fair, 2 good, 3 excellent.

Values with different letter superscripts are significantly different (P = 0.05) according to Duncan's multiple range test.

Table 14. Bucaramanga, Colombia: Estimated possible consumption change with commercialization of storable cassava, according to consumers questioned who had stored cassava at home for two weeks.

Barrio	Access to markets	Present consumption (kg/household/week)	Estimated consumption change (%) when:		
			A = B [1/]	A $5/pound more than B	A $5/pound B less than B
La Joya	fair	4.88	+ 7.2	+ 9.5	+ 2.1
Villa Rosa	poor	3.07	+ 27.7	+ 50.8	+ 13.0
Miraflores	poor	2.61	+ 16.9	+ 38.3	+ 5.8
Concordia	good	4.30	+ 7.6	+ 15.1	- 4.7
El Bosque	fair	2.40	+ 15.0	+ 20.0	+ 15.0
mean	3.42	+ 14.9	+ 26.7	+ 8.1	

1/ A = Cassava sold in bags.
B = Cassava sold loose, as at present.

testing to monitoring of adoption. Impact through investment in crop research does not happen automatically at the end of the process of technology development; in many cases detailed planning is necessary.

Market Development and Farmer Response

Cassava utilization technology associated with market development can have a direct impact on incomes in a region but it is the secondary impact on production response that deepens the income generation potential. The hypothesis is that the alternative market, in most cases closely linked to more stable grain prices, will provide a price floor under cassava and because of the reduced price risk, farmers will increase their production of cassava. In the longer term as processing capacity becomes more generalized, a response due to more secure market access would also be expected.

As in the case of market development, the approach to production impact is hypothesis development, modeling or testing of the hypothesis and verification within a project framework. The effect of market development on farmer response was modeled in a programming framework based on farms typical of many parts of Cordoba and Sucre Departments. The impact of the price floor was introduced by truncating the lower tail of the price distribution, i.e. expected prices would rise and price variance would decline. Evaluation of the impact of risk reduction led to the adoption of a quadratic programming farm model. Without going into detail the structure of the model included credit availability and the role of cattle in financing the capital requirements for crops, subsistence needs, cash flow requirements, and rotational patterns as well as income and risk objectives.

The model results (Tables 15 and 16) demonstrate the effect of both production and market risk on cropping pattern and average income. The establishment of a price floor, provided in this case by the support price for sorghum (discounted for protein differentials), results in a significant increase in cassava sales, caused both by some expansion in cassava area and a shift in cassava production system away from yam in the cropping pattern. The result is a significant increase in farm income and even a slight reduction in income variance.

All farms in the relevant range (upto 15 hectares) respond to the establishment of the price floor (Table 17). However, large farms tend to have a greater response, essentially because of the more abundant land resources available to them. Small-scale farmers of three hectares are limited by land availability as well as by the need to maintain cattle as a stock of capital. Assured credit could increase farmer responsiveness in the case of the very small-scale producer. Thus, introduction of processing technology and market development are sufficient to generate an increase in cassava production and in farmer incomes, whereas improved production technology is not sufficient for such an impact.

Verification started in 1985 in the third year of the project when two-thirds of the plants had only been operating one season. 73% of plant members were sampled for cassava plantings in 1984 and 1985. Between the two seasons area planted increased by 17%. Practically all farm size groups planted increased area in cassava in 1985. However, distinct

Table 15. Sucre, Colombia: Optimal farm plan in different market risk situations for a three hectare farm, 1985.

	Farm plan without considering risk	Present farm plan	Farm plan with stabilized prices	Farm plan when drying industry would support prices
Area Planted in (ha):				
Cassava/Maize/Yam	1.76	1.76	1.53	0.91
Cassava/Maize	-	-	0.19	1.02
Cassava	-	-	0.08	-
Maize	-	-	-	-
Pastures	1.24	1.24	1.20	1.07
Cattle stock (no.)	2.13	2.13	2.08	1.88
Credit needed (US-$)	250[1/]	250[1/]	250[1/]	250[1/]
Dual value of credit	2.14	0.27	0.80	0.74
Family employment (mandays)	181	181	177	178
Contracted labor (mandays)	39	39	39	36
Total employment (mandays)	220	220	216	214
Cassava sales (kg)	11314	11314	12180	14353
Maize sales (kg)	1020	1020	1026	1410
Yam sales (kg)	6445	6445	5504	3025
Dual value of rented land (US-$)	436	229	284	281
Farm income (US-$)	2217	2217	2187	2321
Coefficient of variation of income	0.330	0.330	0.276	0.288

1/ Maximum value.

Source: Quadratic Programming Models.

Table 16. Sucre, Colombia: Optimal farm plan in different market risk situations for eight hectare farm, 1985.

	Farm plan without considering risk	Present farm plan	Farm plan with stabilized cassava prices	Farm plan when drying industry would support prices
Area planted in (ha):				
Cassava/Maize/Yam	0.25	2.77	2.08	1.25
Cassava/Maize	4.46	0.07	0.20	1.68
Cassava	1.29	-	2.38	1.06
Maize	-	-	-	
Pastures	2	5.16	3.33	4.01
Cattle stock (no.)	3.6	8.65	5.73	6.8
Credit needed (US-$)	875 [1/]	354	665	328
Family employment (mandays)	373	360	343	355
Contracted labor (mandays)	184	92	154	114
Total employment (mandays)	557	452	497	469
Cassava sales (kg)	54739	19189	41375	34428
Maize sales (kg)	4663	1975	1525	2450
Yam sales (kg)	385	10476	7745	4406
Dual value of rented land (US-$/ha)	226	145	175	177
Farm income (US-$)	5126	3942	4920	4746
Coefficient of variation of income	0.440	0.312	0.303	0.305

1/ Maximum value.

Source: Quadratic Programming Models.

Table 17. Atlantic Coast, Colombia: Model results of farmer response to the development of a dried cassava industry, 1985.

	Present situation	Situation with price sustained by drying industry	Difference	Explained by price increase	Explained by risk decrease	Estimated supply price elasticity (area or production)
Small farm (3 ha)						
Area planted (ha)	1.76	1.93	10%	4%	6%	0.28
Expected supply (kg)	11314	14353	27%	12%	15%	0.65
Middle size farm (8 ha)						
Area planted (ha)	2.84	3.97	40%	11%	20%	1.03
Expected supply (kg)	19189	34428	79%	22%	57%	2.05
Large farm (15 ha)						
Area planted (ha)	3.08	4.25	38%	12%	26%	1.12
Expected supply (kg)	22353	42459	90%	35%	65%	3.27

Source: Market risk questionaire, quadratic programming models.

differences in response were apparent between tenancy types (Table 18). What was unexpected was the very large response of renters. Farmers with very few resources were very responsive to the establishment of the plants. This raises questions about the impact of the expansion of the drying industry on the land rental market, especially if more marginal groups continue to be brought into the farmer associations. For farmers with more secure access to land, there was something of a dichotomy. Land reform beneficiaries increased significantly their cassava area while planting by traditional landowners actually declined. What is influencing these differences and whether they will continue over time remain to be defined. Certainly understanding and reinforcing these developments would further improve the income distributional consequences.

One insight into farmer response comes from relative changes in average area sown (Figure 1). Most of the area increase has come from farmers whose cassava area was well below the optimum as predicted by the model. There is yet to be much adjustment in planted area larger than three hectares. Constraints on adjustment and the period of adjustment are questions that need to be answered, since production response time will start to become a critical issue as processing capacity continues to expand. The hypotheses have primarily been supported; however, the monitoring exercise has deepened the understanding of the process and opened other hypotheses that would aid in widening the number of beneficiaries.

Impact monitoring is critical to a process where quite major technological and economic change is introduced into a quite stable, small farm economy. Insights into the structure and dynamics of technical change have expanded the potential of the project, at least in terms of its income distribution consequences. In this case the impact of the drying plants on non-member producers, the expanded role of farmers with insecure tenancy, and whether in fact larger farmers will provide the bulk of the production response are issues that will be more fully researched as the project progresses. The research has aided in incorporating ever more marginal beneficiaries within the scope of the project. Appropriate criteria for plant location and membership in farmer associations has reinforced these developments. Moreover, the more detailed model now provides scope for repeating these results in other countries. Such early impact assessment thus allows potential for maximizing objectives as cassava projects are replicated across tropical Latin America.

Production Technology and Yield Improvement

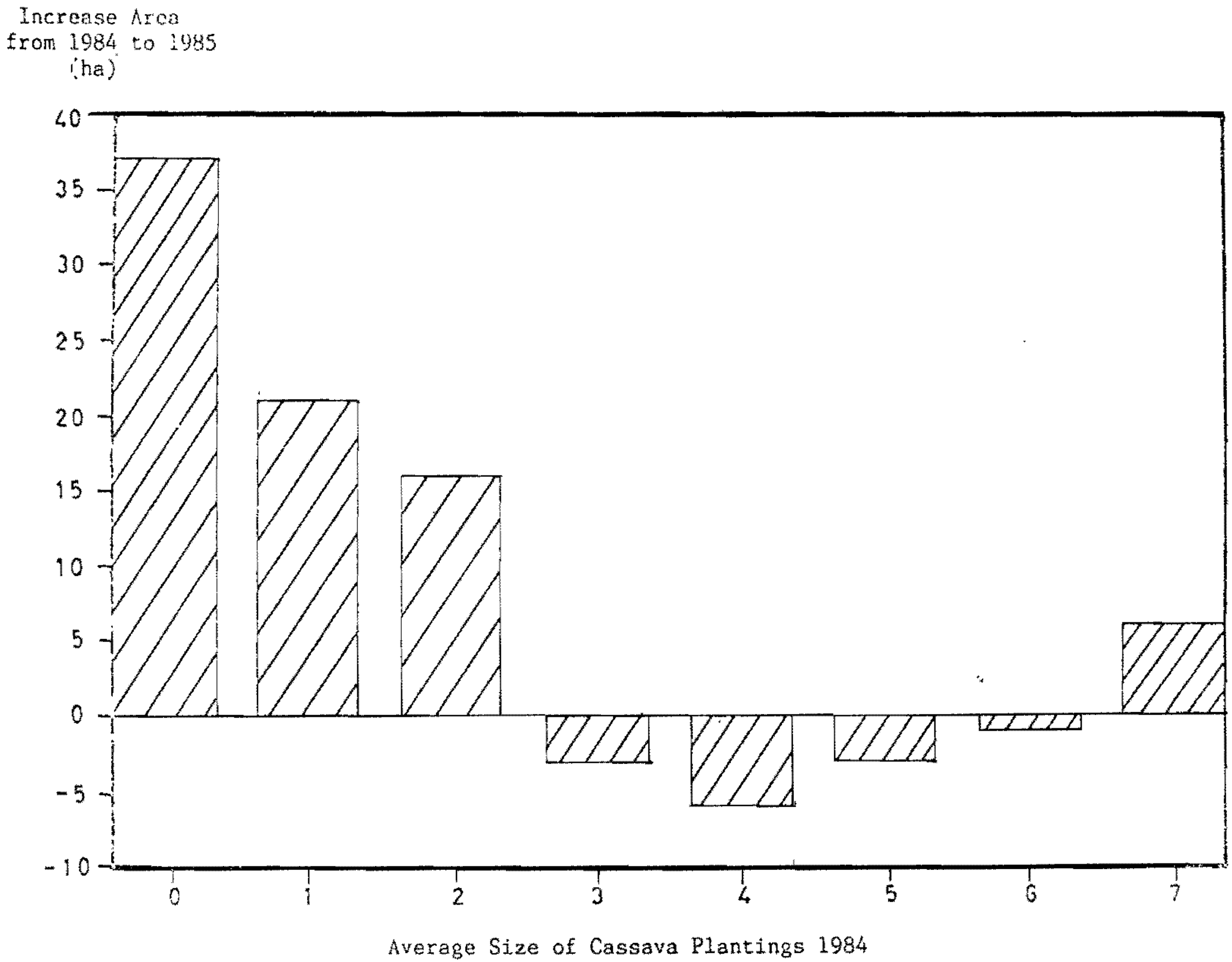
The hypothesis has been that market development will create a signficant demand for improved production technology, which in turn will fuel the rate of development of alternative markets. Market development is thus a precondition to the field level definition and testing of new technology and the monitoring of farmer adoption and technology response. The cassava program has only new reached the point where it can launch a major effort in this area, so there is no actual impact to discuss as yet. However, as has been stressed throughout, the process starts before adoption is ever underway.

Impact assessment of improved production technology is at its most elementary level yield evaluation, especially identification of factors

Table 18. Atlantic Coast, Colombia: Actual increase in area planted to cassava by farmer association members, 1984-85.

Land Tenancy	Number of members	Cassava Planted in 1984 (ha)	Cassava Planted in 1985 (ha)
Land Reform	53	131	177
Land Owner	69	93	77
Communal Plot	20	32	31
Renter	58	48	71
Share Cropper	6	7	9
Pasture Improvement	11	23	26
Land Invasion	1	2	2
Kin's Plot	48	68	78
No Data	20	-	-
Total	286	404	471

Figure 1. Atlantic Coast, Colombia: Increase in cassava area planted in 1985 over 1984 according to average cassava area planted in 1984.



that are influencing yields. In his respect cassava and cassava production systems are very different from the cereal and legume grains or even potatoes. This difference arises from the fact that there is usually little, if any, input use in cassava in Latin America. Nevertheless, there is a very wide range in cassava yields at the farm-level due, it is hypothesized, to differences in agro-climatic conditions, pests and diseases, and management practices. Labor input itself is, on the one hand, a very poor proxy for these management practices and, on the other hand, largely determined by yield, since there is a direct correlation between yield and harvest labor per hectare. This leads to the very difficult question of how the impact of improved technology, which itself consists principally of improved varieties and management practices and not inputs, is to be evaluated; that is, in any cross-sectional analysis many of the factors now influencing yields will have to be identified and controlled for in order to measure the yield benefit of the technology itself.

The one previous attempt to identify limiting factors and evaluate their influence on yield (Pinstrup-Andersen and Diaz, 1977) failed. This was relatively early in the research program and yield-limiting factors were not well defined. The exercise was repeated in 1983-84 on the Atlantic Coast of Colombia. Production systems and their variation in the region were already fairly well described. Also climatic conditions were relatively homogenous. To ensure a signficiant yield variance production zones of known high and low productivity were chosen -- the survey was not random -- and 104 farmers in 12 municipios in 4 departments where selected and visited five to six times during the production year. To simplify an already complex process any plots with noticeable disease or pest problems were eliminated early on from the sample.

The sampling achieved its objective of getting a wide yield range (Figure 2), as yield varied from 3 to 22 t/ha with half the farmers producing yields over 9 t/ha. The major yield determining factors which were measured and included in the model (Table 19) were cropping system, method of soil preparation, number of and time of weeding, time of planting and time of harvest, soil fertility, rotation, and irrigation. No purchased inputs were applied in the sample. The soil fertility variables were based on critical response levels (CIAT, 1982); the time of planting and harvest were based on the known rainfall distribution and yield response from previous experimental trials in the area; and weeding was related to timing. The resulting equation (Table 20) largely failed to define yield-limiting factors. The only variables that were statistically signficant and of correct sign (in accordance with experimental data) were the yield depressing effect of yam in the cropping system and the yield augmenting influence of irrigation in the one region where it was used -- this area had an advantageous marketing position in Barranquilla, the largest urban market.

More refined specification and measurement of management practices and yields moves the process to some form of on-farm trial. The experience of the cassava economics section in such trials for any particular region has been that treatment response across farms is often variable, yield variation between farms is usually greater than that between treatments, and any attempts to begin to explain these differences is usually constrained by the limited degrees of freedom. The two methods taken

Table 19. Atlantic Coast, Colombia: Characterization of yield-limiting or yield augmenting factors in cassava production systems, 1983-84.

Yield-Limiting Factor	Variable Specification
Cropping System	
Monoculture	Dummy = 0
Cassava-Maize	Dummy = 1
Cassava-Yam-Other Crops	Dummy = 1
Land Preparation	
Manual	Dummy = 0
Mechanized	Dummy = 1
Weeding	
First Weeding	No. of months after planting.
Second Weeding	No. of months after first weeding.
Third Weeding	Dummy = 1 if done.
Irrigation	Number of irrigations.
Time of Planting and Harvest	
Plant Mar-Apr; Harvest 8 months (wet season)	Dummy = 1
Plant Mar-Apr; Harvest 8 months (dry season)	Dummy = 0
Plant May-June; Harvest 7 months (wet season)	Dummy = 1
Plant May-June; 7 months Harvest 12 months (dry season)	Dummy = 1
Plant May-June; Harvest 12 months (wet season)	Dummy = 1
Plant July-Oct.	Dummy = 1
Soil Factors	
Phosphorus 6.0 ppm., Bray II	Dummy = 1 if this level.
Potassium 0.15 meq.	Dummy = 1 if this level.
Interaction, P 6.0 ppm. and K 0.15 meq.	Dummy = 1 if this level.
Organic Matter, Percent	Level
Years plot planted continously in cassava	No. of years.

Table 20. Atlantic Coast, Colombia: Effect on cassava yields of management and soil factors, 1983-84.

Yield Limiting Factor	Estimated Yield Increment [2]
Intercept	4513 *
<u>Cropping System</u>	
Cassava-Maize over Monoculture	1010 ns
Cassava-Yam over Monoculture	- 2395 ***
<u>Land Preparation</u>	
Mechanized over Manual	- 172 ns
<u>Weeding</u>	
Loss per month delay in first weeding	- 16 ns
Loss per month delay in second weeding	411 ns
Effect of third weeding	- 986 ns
<u>Irrigation</u>	
Effect per irrigation	1992 ***
<u>Time of Planting and Harvest</u> [1]	
Plant Mar-Apr; early harvest	2877 *
Plant May-June; early harvest	1108 ns
Plant May-June; harvest in dry season	2089 ns
Plant May-June; late harvest	1253 ns
Late planting	2939 **
<u>Soil Factors</u>	
Insufficient phosphorus	1348 ns
Insufficient potassium	2301 **
P x K Interaction	- 270 ns
Response per % of organic matter	291 ns
Effect per year of previous cassava planting	275 ns

1/ Yield advantage over planting at beginning of the rains and harvest after eight months.

2/ R - square of the equation was 0.39; significance levels are as follows: ***P 0.01; ** P 0.05; * P 0.10.

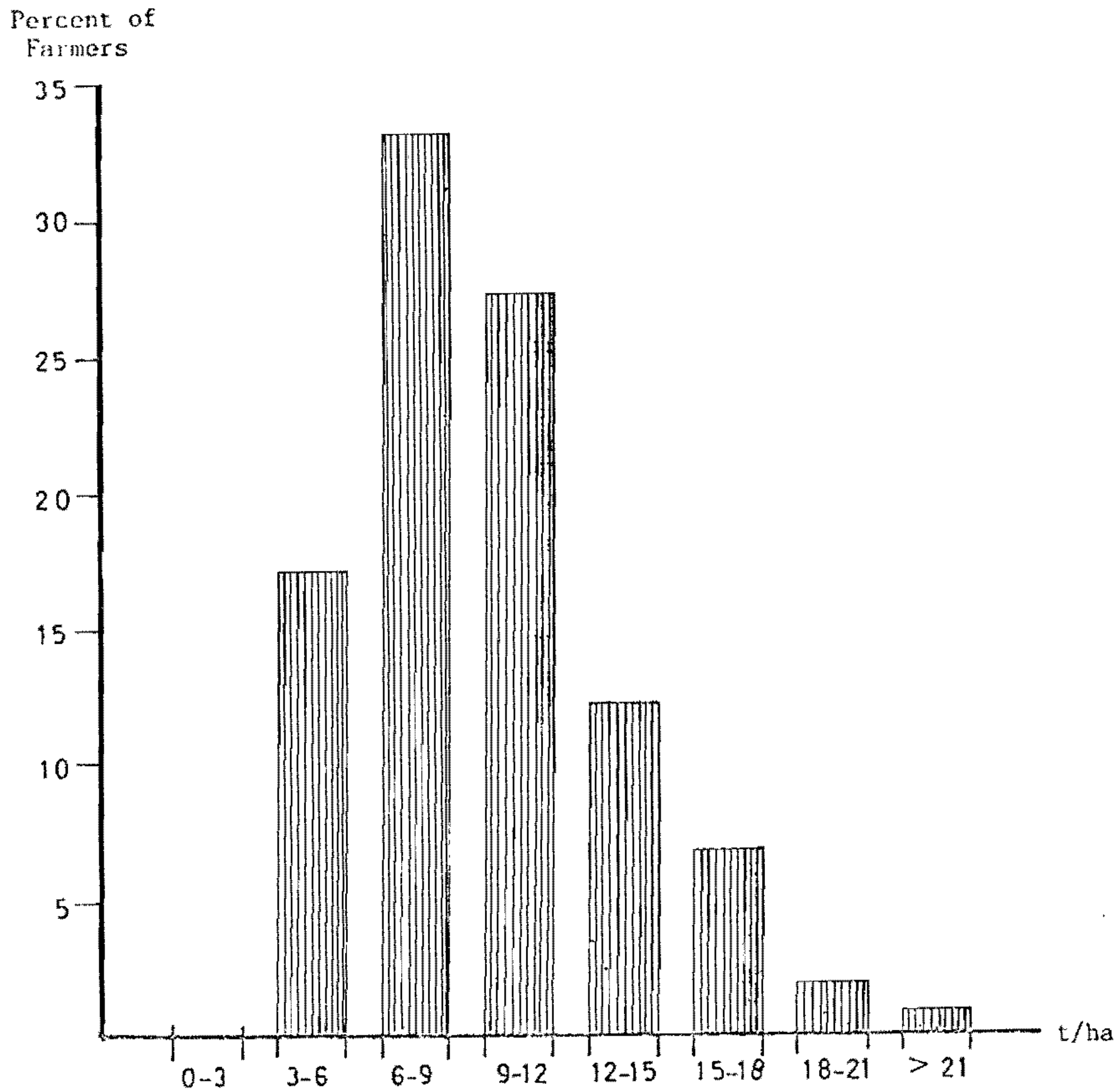


Figure 2. Atlantic Coast, Colombia: Yield Distribution of Cassava for Sample of Producers, 1983-84.

together would seem to imply that standardized on-farm trials be carried out across a large number of sites. These are costly, often limited by seed availability where a new variety is a component, and beset by problems of how much farmer participation to allow in relation to the ability to measure non-treatment variables and the degrees of freedom in the final analysis. However, future resolution of this issue will be critical to defining where and if new technology has had an impact.

Measurement of Benefits

Research output at the IARC's in general, and within the cassava program in particular, is measured by its eventual impact on production and income generation. Very few agricultural research programs are evaluated by such stringent criteria; in most, research productivity is measured by more intermediate outputs. That research should be so clearly focused on eventual impact builds in certain biases in how scarce resources are allocated: that applied research will be preferred over more basic research, that projects with shorter-term pay-off will be preferred over those with longer-term pay-off, and most importantly that research will attempt to integrate all upstream and downstream activities necessary for impact. Correctives can be built in through long-term planning, but the primary Gordian knot remains that, if the research program is to be held accountable for impact, agricultural research necessarily will take a more activist role in development.

Impact assessment in this context thus becomes a monitoring device to ensure that research is appropriately targeted on the development objectives that have been defined. The role of monitoring is particularly exigent where income distribution is built into program objectives. Figures 3 and 4 and summarize the impact of the drying plants on benefit distribution for members of the farmers associations in the 1984-85 drying season in the Atlantic Coast of Colombia. The major portion of the benefits were distributed to the population with few land resources, principally because of the make-up of the associations. On an individual basis benefits increased with farm size, as income sources shifted away from wages and distributed profits to cassava sales. Thus, the income generation potential of the project still depends critically on access to land resources. However, the significant innovation is that the farmer associations could be a vehicle for bringing the most marginal economic population into the growth process. The key organizational insight here is that these farmer organizations are closed, they generate multiple income sources within the plant operation, and each member maintains a significant economic stake in the shared equity capital.

The plants, however, did not depend on only members' cassava production but rather supplies from non-members. For every member there were five non-member vendors of cassava. Moreover, these sellers were as well concentrated in the more marginal economic population on the coast; for example, a third were renters (Table 21). The plants signficantly expanded the number of beneficiaries far beyond that originally conceived. Although the per capita benefits were not absolutely large, the benefits were not insignificant for this rather marginal population, since either the cassava was of low quality and therefore of low opportunity cost or the plants provided a sales outlet when capital was required. However, the principal finding was that this sales pattern was dependent on close

Figure 3. Atlantic Coast Colombia: Total Benefits Recieved by Members of Farmer Associations by Farm Size, 1984-85.

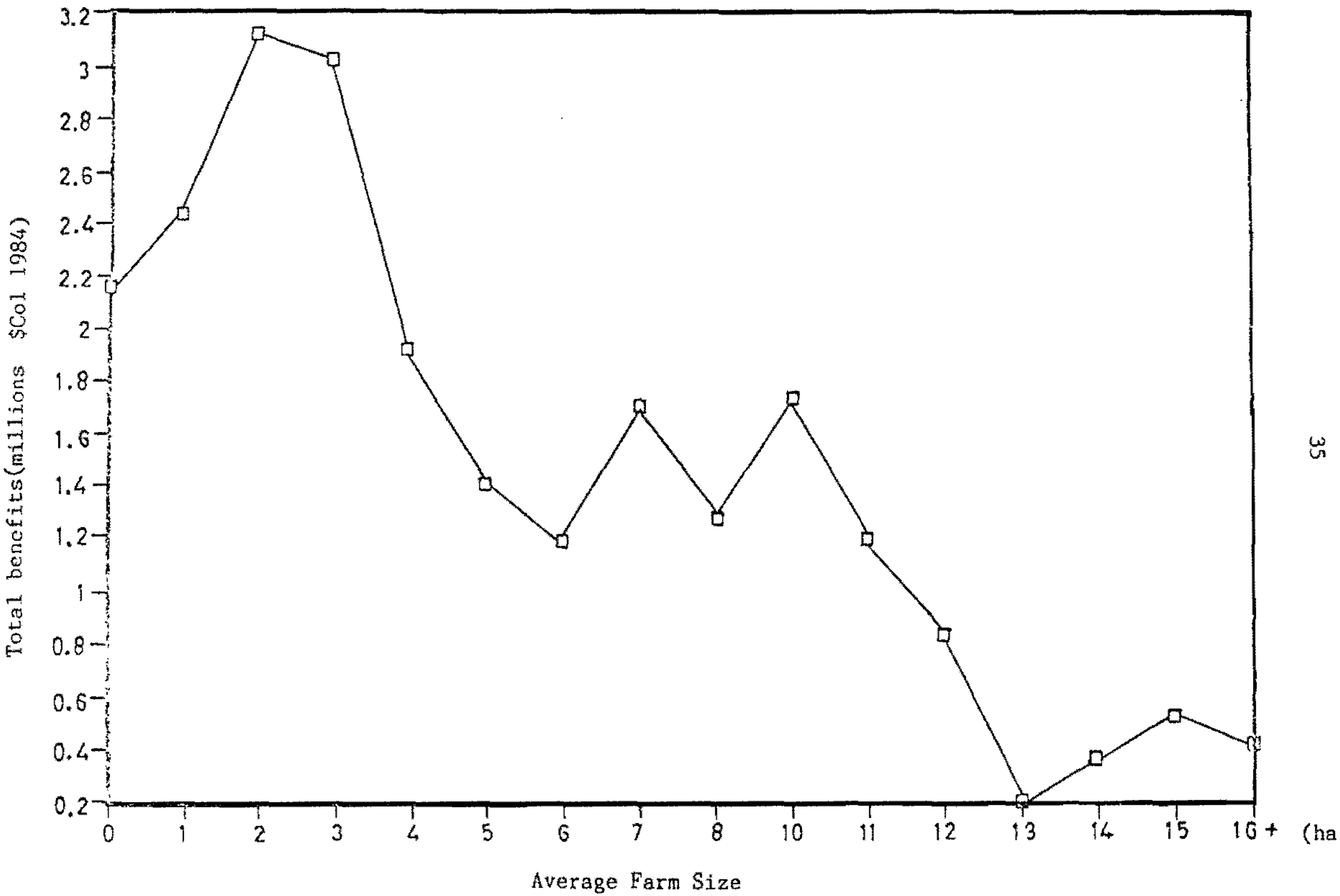


Figure 4. Atlantic Coast, Colombia: Benefits Received per Member of Farmer Associations by Farm Size, 1984-85.

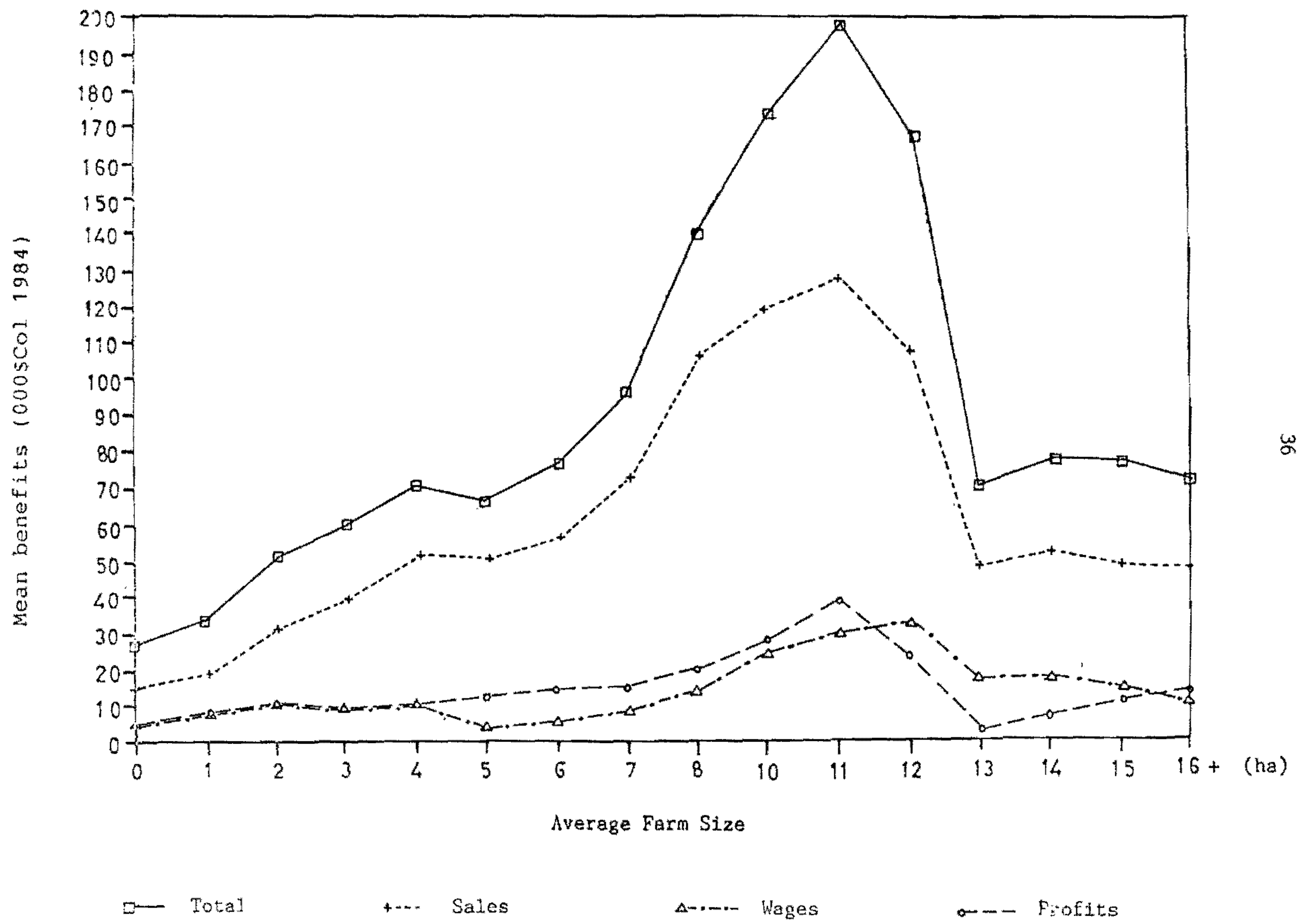


Table 21. Atlantic Coast, Colombia: Number of Vendors and Quantity Sold by Non-members of Farmers Associations by Tenancy, 1984-85.

Tenancy	Number of Vendors	Percent of all Vendors (%)	Cassava Sold (tons)	Percent of all Cassava (%)	Average sold (kg/capita)
Land Reform	93	6	223.3	7	2411
Land Reform-Small Plot	86	5	378.5	11	4401
Land Owner-Small Scale	303	19	783.6	23	2590
Communal Plot	128	8	405.4	12	3162
Renter	546	35	887.1	26	1625
Share Cropper	151	9	80.1	2	533
Land invasion	3	0.2	2.3	0.1	682
Kin's Plot	214	13	223.0	7	1044
Landowner-Large Scale	34	2	157.3	5	4639
Intermediary	25	2	233.4	7	9190
Total	1582		3374.0		2132

physical (Figure 5) and social (Table 22) distance to the plant. Those few plants where large landowners or intermediaries were important were those relatively distant or isolated from cassava production zones. Plant location thus became a primary determinant of benefit distribution. Plant location in the beginning phases of the project was determined by the criteria of institutions within the project, but in the future the plant location effect on income distribution could be maintained though screening of credit applications for plant investment, especially where, as in this case, credit is already rationed.

The conclusion here is worth emphasizing: that the impact achieved in this case was dependent as much on institutional or organizational innovations as it was on new utilization or production techniques. More to the point, impact depended on the integration of both types of innovations, with each influencing the other. Nor can it be clearly demarcated where research ended and development began, since certainly in the case of organization innovations, the laboratory is provided by actual field-level projects.

Development of an alternative market can introduce quite radical changes in the local agricultural economy. What these changes will be can only be forseen by modelling of the commodity system. As a further tool for directing impact, a simulation model of the cassava economy on the Colombian Atlantic coast was constructed. The model incorporates significant detail on cassava production, marketing and consumption and estimates equilibrium, market-clearing prices in a significant number of inter-dependent markets. The model has a stochastic element to simulate weather and can incorporate various assumptions concerning yield response, sorghum prices, and the rate of investment in drying plants. The model runs for a ten-year period and can estimate the discounted economic benefits of the development of a cassava drying industry for different types of beneficiaries.

The first outcome of the model is that the cassava economy without the development of a dry cassava industry essentially stagnates at current production and consumption levels over the next ten years, since rural-urban migration and the "convenience" factor counter the effect of increasing population (Tables 23 and 24). Such an effect describes what has already happened in a country such as Venezuela. However, the development of a drying industry significantly changes that prognosis. In this case cassava production increases at the very respectable rate of 3.7% per annum, primarily on farms of less than 20 hectares.

The development of a dried cassava industry has the expected effect on reducing variation in producer prices and in consumer prices. Both area planted and yields increase, due essentially to improved price stability. The differential yield response by farm size due to reduced market risk comes out of the quadratic programming model and reflects the stronger shift to monoculture systems on the part of large farmers. The difference in area response reflects the degree of land constraint faced by the different sized farmers. What was not included in the model was non-producing farmers coming into production, especially renters. This requires modelling of the land market and remains a future research activity.

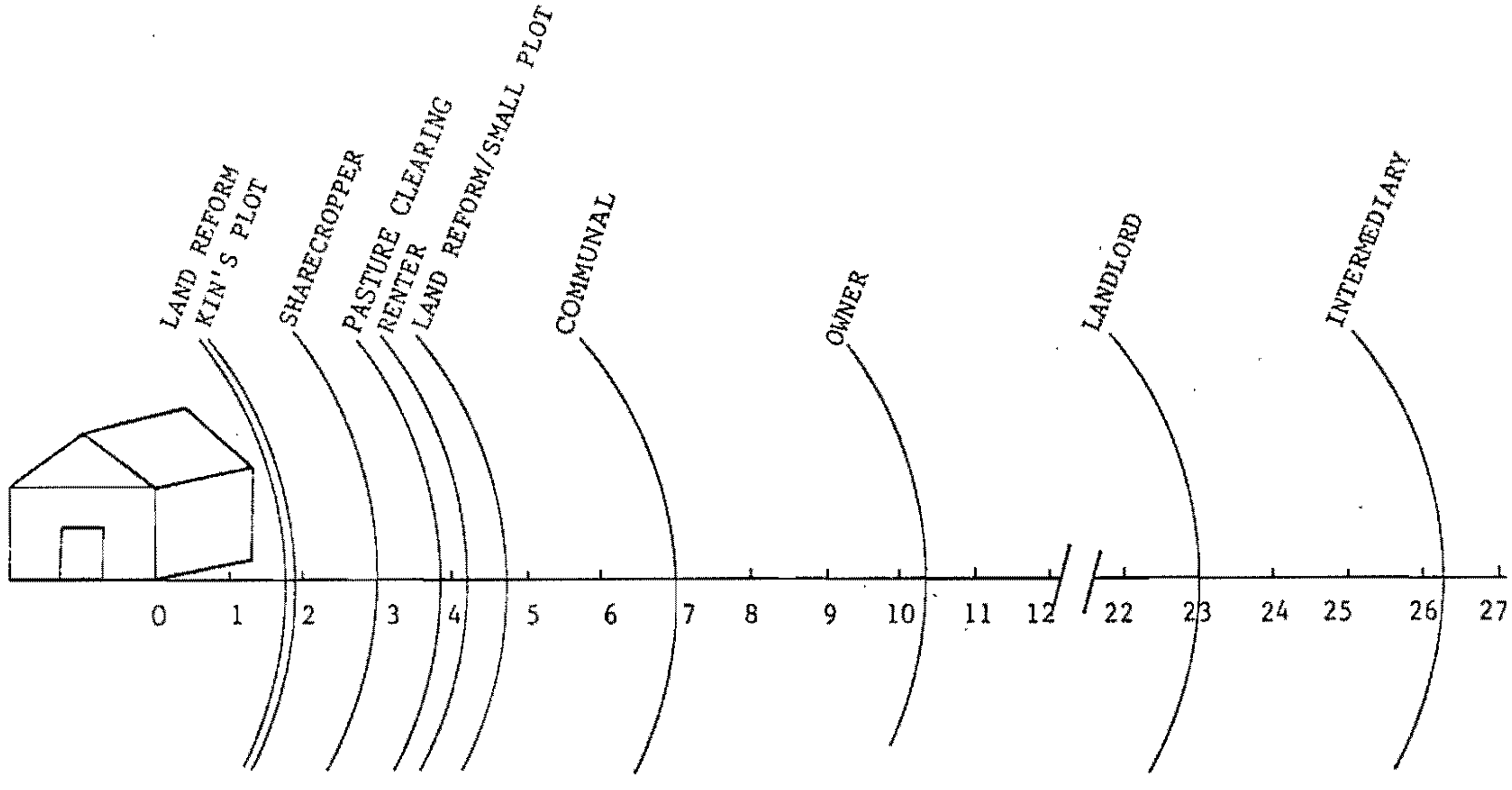


FIGURE 5. FARM-TO-PROCESSING PLANT DISTANCE FOR NON-MEMBER SELLERS

Table 22. Atlantic Coast, Colombia: Cassava Sold by Non-Members of the Farmer Associations by Social Relation.

Social Relationship	Number of Vendors	Percent of all Vendors (%)	Cassava Sold (tons)	Percent of all Cassava Sold (%)	Average Sold (kg/capita)
Kin	439	24	589.9	17	1344
Friend (amigo, compañero)	710	38	1322.1	38	1863
Known Acquaintance (conocido)	415	22	1048.5	30	2528
Unknown Person	275	15	494.8	14	1797
No data	12	1	1.2	1	101
Total	1851		3456.5		1868

```
 CCCCCCC      AAA      SSSSSSS    SSSSSSS      AAA     VV     VV     AAA   
CCCCCCCCC    AAAAA    SSSSSSSSS  SSSSSSSSS    AAAAA    VV     VV    AAAAA  
CC     CC   AA   AA   SS     SS  SS     SS   AA   AA   VV     VV   AA   AA 
CC         AA     AA  SS         SS         AA     AA  VV     VV  AA     AA
CC         AA     AA  SSSSSSSS   SSSSSSSS   AA     AA  VV     VV  AA     AA
CC         AAAAAAAAA   SSSSSSSS   SSSSSSSS  AAAAAAAAA  VV     VV  AAAAAAAAA
CC         AAAAAAAAA         SS         SS  AAAAAAAAA   VV   VV   AAAAAAAAA
CC     CC  AA     AA  SS     SS  SS     SS  AA     AA    VV VV    AA     AA
CCCCCCCCC  AA     AA  SSSSSSSSS  SSSSSSSSS  AA     AA     VVV     AA     AA
 CCCCCCC   AA     AA   SSSSSSS    SSSSSSS   AA     AA      V      AA     AA
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Table 9. Growth Rates in Bean Production, Area and Yields in Selected African Countries, 1962-1973 and 1973-84.

	1962-73			1973-84		
	Production	Area	Yield	Production	Area	Yield
Eastern Africa						
Ethiopia	2.81	2.21	0.60	-6.83	-7.47	0.65
Kenya	n.a	n.a	n.a	n.a	n.a	n.a
Somalia	10.87	8.47	12.89	9.40	10.72	-1.33
Tanzania	4.89	2.80	2.10	4.49	5.56	-1.06
Uganda	10.90	11.73	-0.83	n.a	n.a	n.a
Great Lakes Region						
Burundi	7.05	6.73	0.32	3.60	-0.70	5.26
Rwanda	5.11	3.33	1.78	3.69	3.63	0.06
Zaire	n.a	n.a	n.a	n.a	n.a	n.a
Southern Africa						
Angola	1.96	5.48	-3.51	-7.08	-1.06	-6.00
Lesotho	7.55	8.69	-1.13	10.40	-0.65	11.11
Madagascar	1.97	0.96	1.01	-3.29	-2.95	-0.34
Malawi	2.79	2.15	0.49	24.36	25.37	1.92
Mozambique	n.a	n.a	n.a	n.a	n.a	n.a
Rep. South Africa	1.45	-1.89	3.34	-2.22	-5.42	3.20
Swaziland	0	0	2.53	1.65	-0.72	-1.52
Zambia	n.a	n.a	n.a	n.a	n.a	n.a
Zimbabwe	1.93	-0.54	2.49	5.10	1.08	4.02
West Africa						
Cameroon	2.44	5.27	-2.82	6.83	4.45	2.38

n.a Data not available

Source: FAO

Table 8. Yields of Beans in Africa (kg/ha).

	1962-1964	1972-1974	1982-1984
Eastern Africa			
Ethiopia	705	715	780
Kenya	623	623	596
Somalia	187	479	339
Tanzania	427	524	472
Uganda	651	550	948
Great Lakes Region			
Burundi	686	659	951
Rwanda	738	763	753
Zaire	n.a	n.a	500
Southern Africa			
Angola	895	594	364
Lesotho	283	241	833
Madagascar	782	857	833
Malawi	560	618	534
Mozambique	n.a	n.a	n.a
Rep. South Africa	521	844	1128
Swaziland	349	476	398
Zambia	n.a	n.a	n.a
Zimbabwe	405	500	752
West Africa			
Cameroon	696	504	659
Total	625	626	643

n.a Data not available

Source: FAO; CIAT estimates

Table 7. Area Cultivated with Beans in Africa (000 ha).

	1962-1964	1972-1974	1982-1984
Eastern Africa			
Ethiopia	88	101	42
Kenya	443	763	1038
Somalia	2	10	46
Tanzania	214	267	487
Uganda	143	391	326
Great Lakes Region			
Burundi	174	313	297
Rwanda	116	167	256
Zaire	n.a	n.a	192
Southern Africa			
Angola	67	120	110
Lesotho	6	11	12
Madagascar	62	68	52
Malawi	13	17	125
Mozambique	n.a	n.a	n.a
Rep. South Africa	87	73	43
Swaziland	2	2	2
Zambia	n.a	n.a	n.a
Zimbabwe	53	50	62
West Africa			
Cameroon	64	95	159
Total	1534	2448	3249

n.a Data not available

Source: FAO; CIAT estimates

Table 6. Production of Beans in Africa (1000 tons).

	1962-1964	1972-1974	1982-1984
Eastern Africa			
Ethiopia	62	72	33
Kenya	276	476	619
Somalia	0.3	4	16
Tanzania	92	140	230
Uganda	93	211	259
Great Lakes Region			
Burundi	119	226	282
Rwanda	86	126	193
Zaire	n.a	n.a	96
Southern Africa			
Angola	60	71	40
Lesotho	2	3	10
Madagascar	48	58	43
Malawi	7	11	67
Mozambique	n.a	n.a	n.a
Rep. South Africa	45	61	49
Swaziland	0.3	1	0.7
Zambia	n.a	n.a	n.a
Zimbabwe	21	25	46
West Africa			
Cameroon	48	48	105
Total	959	1533	2089

n.a Data not available.

Source: FAO; CIAT estimates

Table 5. Growth Rates in Bean Production, Area and Yields in Latin America. 1962-73 and 1973-84.

	1962-73			1973-1984		
	Production	Area	Yield	Production	Area	Yield
Brazil	2.16	2.50	-0.33	0.39	2.50	-2.10
Mexico	1.91	-0.83	2.74	3.26	3.09	0.17
Tropical South America						
Bolivia	4.27	1.55	1.02	1.93	-6.85	9.97
Colombia	3.07	1.95	0.48	1.76	2.29	0.73
Ecuador	2.97	3.39	-0.45	-0.95	-3.29	2.34
Paraguay	5.61	6.74	-1.05	5.01	5.79	-0.73
Peru	1.51	4.16	-2.72	-0.93	-2.35	1.52
Venezuela	-2.58	0.48	-3.08	-1.12	-3.40	2.13
Central America						
Costa Rica	-7.06	-10.37	3.46	0.30	3.94	-3.48
El Salvador	6.00	3.36	2.74	2.12	0.93	1.20
Guatemala	3.65	3.18	0.41	1.40	-0.89	2.33
Honduras	-0.43	-0.39	-0.01	-0.81	-2.39	1.63
Nicaragua	1.88	1.86	0.04	2.46	4.02	-1.54
Panama	-7.19	-6.34	-0.24	-1.00	-4.31	3.39
Caribbean						
Cuba	-2.79	-1.26	-1.54	1.22	0	1.41
Dominican Republic	1.24	-1.92	3.05	7.24	7.08	0.19
Haiti	0.69	0.54	0.12	2.18	9.08	-6.92
Temperate South America						
Argentina	7.89	10.00	-2.12	8.92	7.66	1.24
Chile	0.28	-0.34	0.60	4.59	3.53	1.06
Uruguay	-7.75	-3.91	-3.58	3.82	2.80	1.77

Source: FAO

Table 4. Yields of Beans in Latin America (kg/ha).

	1962-1964	1972-1974	1982-1984
Brazil	635	594	458
Mexico	405	576	623
Tropical South America			
Bolivia	363	399	1060
Colombia	561	643	701
Ecuador	475	441	563
Paraguay	770	763	750
Peru	958	725	827
Venezuela	470	380	472
Central America			
Costa Rica	364	687	437
El Salvador	615	726	759
Guatemala	650	714	904
Honduras	647	551	609
Nicaragua	801	783	668
Panama	265	289	357
Caribbean			
Cuba	758	666	766
Dominican Republic	697	911	913
Haiti	1012	1057	553
Temperate South America			
Argentina	1060	975	1103
Chile	966	1006	1142
Uruguay	653	504	604
Total	556	604	564

Source: FAO

Table 3. Area Cultivated with Beans, Latin America (000 ha).

	1962-1964	1972-1974	1982-1984
Brazil	2237	2923	3876
Mexico	1825	1592	1955
Tropical South America			
Bolivia	8	9	4
Colombia	79	101	133
Ecuador	49	65	49
Paraguay	26	45	80
Peru	46	63	51
Venezuela	79	77	59
Central America			
Costa Rica	45	21	39
El Salvador	31	45	57
Guatemala	77	101	97
Honduras	78	69	62
Nicaragua	50	56	82
Panama	24	11	9
Caribbean			
Cuba	40	35	35
Dominican Republic	32	32	59
Haiti	39	41	92
Temperate South America			
Argentina	27	83	213
Chile	70	74	98
Uruguay	6	4	5
Total	4868	5447	7055

Source: FAO

Table 2. Production of Beans in Latin America (1000 tons).

	1962-1964	1972-1974	1982-1984
Brazil	1420	1726	1801
Mexico	742	905	1215
Tropical South America			
Bolivia	3	4	4
Colombia	45	65	79
Ecuador	23	29	28
Paraguay	20	34	60
Peru	44	46	42
Venezuela	37	29	28
Central America			
Costa Rica	16	14	17
El Salvador	19	33	43
Guatemala	50	72	88
Honduras	51	38	38
Nicaragua	40	43	55
Panama	6	3	3
Caribbean			
Cuba	30	24	27
Dominican Republic	22	29	53
Haiti	39	43	51
Temperate South America			
Argentina	29	82	235
Chile	67	74	113
Uruguay	4	2	3
Total	2707	3295	3983

Source: FAO

Table 1. Black Bean Yields and Adoption of Improved Varieties, Argentina, 1981-85.

Year	Black Bean Yields (kg/ha)	Farmers Using Improved Varieties (%)
1985	1224	85.5
1984	1389	66.7
1983	1022	41.3
1982	800	16.3
1981	864	0

Source: Yield data 1981, 82, 84 Michigan Bean Digest; 1985 USDA Bean Market News; 1983 EEAOC. Adoption data from EEAOC survey.

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region to losses in production of beans as well as other crops.

Argentina: A bumper crop of black beans was achieved in 1985 with yields attaining an average of 1633 kg/ha and the rapid adoption of improved black bean varieties (DOR 41, BAT 448, BAT 304) appears to be closely associated with rising black bean yields (Table 1). Adoption of the new varieties introduced originally through CIAT international trials conducted by EEAOC (Estación Experimental Agro-Industrial Obispo Colombres) and INTA, has rocketed from no commercial use in 1981 to an adoption of 85% in 1985 (Gargiulo). Farmers reported an average yield advantage of 292 kg/ha with the improved varieties in a EEAOC survey of a 15% sample of bean farmers. Net benefits to farmers from the new black bean varieties are estimated at US$2.5 million for 1985.

Increases in black bean productivity have enabled Argentina to play a role as a residual supplier to partially cover production shortfalls in Mexico and Brazil. For the first time in 1985 a major export contract with Mexico was negotiated whereby 30,000 tons were sold in a government to government deal, and private Argentinean traders made separate deliveries. While there is little official bean trade with Brazil, informed sources report that substantial bean shipments enter Brazil from Argentina via unauthorized channels.

Central America: Record bean harvests were obtained in 1984/85 in Costa Rica and Guatemala (FAO; USDA). While favorable weather conditions are reported to have been a factor (USDA), the spread of improved bean varieties has contributed to rising production in Guatemala and Costa Rica (see separate article in this volume for details).

1985, while prices for the 1985-86 winter season irrigated crop in Sinaloa and Nayarit may reach as high as 187,000 pesos/ton.

Mexican imports in 1984/85 were an estimated 120,000, of which 40,000 tons were Chilean blacks purchased at 520 $U.S./ton, while over 30,000 tons of blacks were imported from Argentina. Sharply rising imports are expected for 1986, reaching as high as 200,000 tons. Conasupo, the Mexican grain marketing agency, has reportedly already contracted for the 1986 delivery of 25,000 tons of black beans from Argentina, and 120,000 tons (pintos, pinks and blacks) from the United States.

African Great Lakes: A severe drought in early 1984 had a major impact on the production of beans as well as on other food staples in Burundi and Rwanda. Losses ranged from roughly a quarter of production in the Central Plateau of Rwanda to virtually the entire crop in the Ruhengeri and Kisenyi regions. Bean prices skyrocketed to 100 Fr/kg in August-September 1984, up from 20 Fr/kg in mid-1983. Although beans came into Rwanda, principally from Kivu, Zaire, first portered by small scale market women, then later trucked in by big merchants, many people experienced real hunger in fall 1984.

Because the sorghum and maize crop failed along with that for beans, many people were forced to manage on a diet of sweet potatoes and cassava. Bean leaves from the fall planting of 1984 were eaten in large quantities as they provided the first available protein source with which to supplement a practically all starch diet. Fortunately production recovered in the fall 1984 season, and was normal in the spring 1985 season. Nevertheless, the drought of early 1984 indicates the vulnerability of the Great Lakes

Trends in Beans - 1985*

Douglas Pachico

While the world's two largest bean producers - Brazil and Mexico - are facing potentially significant production shortfalls, 1985 saw a much improved crop in the African Great Lakes (Burundi, Rwanda and Kivu, Zaire), Central America and Argentina.

Brazil: A major drought in southern Brazil has reduced both acreage planted and yields of beans. It has been rumored that in December the agriculture minister advised President Sarney that up to 200,000 tons of imports may be needed to meet domestic requirements. Although official imports may fall far short of such a record breaking figure, both Chile and the United States have reportedly been negotiating to sell beans to Brazil. The U.S. has offered $30,000,000 in credits to finance bean imports.

Mexico: Mexico had a sub-par output in the 1984-85 season estimated at less than a million tons (BMN, March 27, 85). Strong competition with maize and sorghum is said to have limited area planted to beans. In an emergency production program to stimulate bean output, guaranteed prices were set at 105,000 pesos/ton for the 1984-85 irrigated winter planting, while a 25% discount was given on fertilizers and pesticides. However, prices for the main spring planting remained at 52,850 pesos/ton, so that the 1985-86 crop is estimated at a disappointing 1.0 million tons. This is expected to occur despite having raised guaranteed prices from 52,850 pesos/ton to 155,000 in October

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* Information on the African Great Lakes was kindly provided by Joachim Voss.

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a larger extent on resources controlled by the farmer, such as water and fertility in irrigated rice.

Livestock production systems are highly complex; attractiveness of new pasture cultivars is not determined exclusively by one simple trait such as total dry matter production but an array of characteristics including seasonal forage production, quality, palatability, aggressiveness to control weeds, seed production, resistance to pests and diseases. The relative weight assigned to individual traits varies across ecosystems and farming systems. This complexity makes researchers poor forecasters of acceptability of new materials. It is therefore concluded that early exposure of materials to farmers in different settings is important. This is easily done by farmers on their own in the case of grasses due to their inherent interest in new grasses and what is needed is only a survey mechanism to feed results back to researchers. It is expected that a more active role of researchers is needed in the form of on-farm trials for the case of legumes and legume-grass associations.

The studies of the early adoption and impact of A. gayanus are showing that valuable additional forage grass germplasm resources can be generated through a systematic decentralized screening approach. The challenge now is to prove that the same basic approach will generate forage legume cultivars that will be adopted by the farming community.

Andropogon adoption seems to be gaining momentum in Central America and Panama, with more than 1,000 ha in the latter country and initial areas in Nicaragua, Mexico, Honduras and Costa Rica. Virtually all areas established have been planted as pure grass pastures.

Planting intentions for 1986 indicate an expansion of about 31% over existing areas at a regional level. This figure nevertheless masks the marked differences in adoption stage and growth rates between Brazil and Colombia, where the material was released first with growth rates of 25% and 45% respectively, and the rest of the countries, with growth rates above 100%. Planting intentions clearly indicate the overwhelming tendency to establish A. gayanus as a pure-grass pasture.

Conclusions and Future Plans

The limited experience in adoption and impact studies within the Tropical Pastures Program is all related to grasses, mainly A. gayanus. This implies that conclusions drawn necessarily only apply to grasses. Tropical forage legumes constitute a totally new "product" in these farming systems. No previous experience is available to rely on. Use of tropical forage legumes will imply important adjustments to the farming systems and to the methodologies to monitor diffusion, adoption and impact.

The aggregate consumer producer surplus study conducted for CIAT's long term plan documented the basic procedure followed. More detailed work will be needed to better depict the shifts in supply curves. The importance of this was shown by LINDNER and JARRET, 1978; LYNAM and JONES, 1984.

To better assess the distributional impact among rural and urban consumers as well as consumers of different income levels further work is needed on demand parameters at a disaggregate level (e.g. elasticities for individual beef cuts by income strata).

Most of the benefits have up to now been linked to shifts in the supply function for beef. Several studies (VERA and SERE, 1985; SERE and VACCARO, 1984; SCHELLENBERG, 1984) have documented the importance of beef and milk (dual purpose) systems and the increased potential for adoption of pasture technology in these systems. Consumption parameters for milk will be necessary to assess the benefits related to supply shifts in the milk sector.

Farmers are willing to test new grass cultivars. Small test plots are grown at a low investment cost. Given he low-input nature of the pasture technology, adoption is very dependent on the specific resource endowment of individual farms. Many farmers test a new material but a lower number really expand to commercial use. The extent to which farmers use a new cultivar seems to be more related to the fit of the material to the specific resource endowment of the farms particularly soils and rainfall pattern than to socioeconomic variables. Thus adoption of a low input technology will be less homogeneous within a geographic region than adoption of cultivars of materials which rely to it were asked the same set of questions on characteristics of the farm and specific questions on reasons for not using the material. The survey has been completed and presently (December 1985) data are being tabulated and analyzed. Results of the survey will be used for the assessment of the economic impact of the technology.

E. Status of A. gayanus adoption throughout tropical Latin America (October 1985)

During the recent RIEPT meeting a rapid survey of diffusion and use of *A. gayanus* in tropical Latin America was undertaken.

Participants were asked to estimate the present area of *A. gayanus* in commercial use in their state or department and a figure for their whole country, disaggregated according to whether it was grown as a pure grass pasture or in association with a legume. They were also asked to forecast the areas to be sown in 1986, again in terms of pure stands and in association.

Table 13 shows that almost 300,000 ha are estimated to have been established up to 1985. The picture is clearly dominated by the extent of adoption in Brazil which contributes 93% of the total existing area. Nevertheless, important areas are also found in Colombia and Venezuela, countries with substantial areas of acid infertile savannas.

Table 13. Use of *A. gayanus* in Latin America, 1985[1] (hectares)

	1985 Existence		1986 Planting Intentions	
	In pure stands	In legume-grass mixtures	In pure stands	In legume-grass mixtures
Bolivia	100	0	450	0
Brazil	268000	0	66000	0
Colombia	7600	300	3400	300
Costa Rica	1	1	8	5
Guatemala	0	0	1	0
Guyana	2	0	0	0
Honduras	15	0	8	0
Mexico	22	0	75	0
Nicaragua	245	0	150	0
Panama	1032	50	1085	0
Paraguay	1000	0	1500	0
Peru	120	5	220	0
Venezuela	11100	200	17900	500
Total	289237	556	90797	805

1/ Based on a survey of researchers of the RIEPT, October 1985

D. Andropogon gayanus in Central Brazil

Survey of the tropical pasture seed industry

In cooperation with CPAC/EMBRAPA and the Seed Section of the Tropical Pastures Program a survey of the main tropical pasture seed producers and dealers was undertaken to assess the extent of diffusion of *A. gayanus* in Brazil. Major findings of economic relevance were:

- The total volume of *A. gayanus* seed handled by the large-scale pasture seed sector was 175 tons in 1982, 422 tons in 1983 and 496 tons in 1984.

- Price of *A. gayanus* seed dropped rapidly in real terms, moving from US$13.63 in 1982 to US$1.58 in 1984.

- Estimates of the importance of farmer-to-farmer trade in *A. gayanus* seed varied widely. The median estimate by seed producers was that they provided 65% of the total volume sown.

- Using this information and the reported median seeding rate the present area of *A. gayanus* existing in Brazil was estimated to be about 170,000 ha.

- Main areas of adoption are Mato Grosso, Goias, and Minas Gerais, with minor areas in the Pantanal and the Northeast.

Early adoption and impact of A.gayanus in the Cerrados

In 1984 EMBRAPA's Cerrados Center CPAC commissioned a study on the adoption of agricultural technology generated by the EMBRAPA system for the Cerrados region. This study was undertaken by the University of Brasilia. Based on CPAC's agroecological studies the Geoeconomic Region of Brasilia (approximately 20 million ha) was stratified into homogeneous regions, and 11 "municipios" considered representative of the main agroecological regions were sampled. Within these "municipios" 450 farmers were sampled randomly. This survey included two questions on *A. gayanus*: whether the farmer knew it and whether he was using it on his farm. Usage was defined as having any area of his farm planted to it, including very small "test" plots.

Preliminary manual tabulations showed that 85% of the respondents knew the plant and 25% claimed to "use" it. Given this indication of relatively wide adoption, a more detailed study of the adoption process and present use of the material was planned jointly by CPAC and CIAT.

Using the sampling frame of the farms surveyed by the University of Brasilia, a random sample of 60 "users" stratified according to occurrence in the 11 "municipios" was drawn, as well as of 40 farmers knowing the cultivar and 20 not knowing it. A survey was designed covering general characteristics of the farms, detailed information on the adoption and use of *A. gayanus* as well as its impact on the farming system, and intentions of expanding *A. gayanus* areas. Farmers not using

Table 12. Adoption impact of *A. gayanus* on the North Coast, Colombia

	Cesar	North Coast	Llanos Orientales	
	A.gayanus	A.gayanus	Grass	Legume grass association
Adoption ceiling (No. of farms)	66	121	66	66
Incremental beef production (tons liveweight)				
Year 5	336	381	408	557
Year 10	2814	4438	3410	4651
Year 15	3186	5878	3861	5267
Average	1707	2945	2068	2821
Cash flow ('000 US$)				
Year 5	-81	-106	-318	-362
Year 10	1250	1625	812	1312
Year 15	2125	3875	2125	3000
Net present value (10%)	6250	11250	5062	7500
IRR (%)	78	78	33	39

the same area adopted as in Cesar, and the use of either a pure grass technology or a legume grass association. The same adoption level as in the Cesar would require a substantially higher number of steers to be fattened. Expressed in terms of percentage of steers existing in 1981 in each region, values of 5% for the Cesar, 1% for the North Coast, 16% for a grass technology in the Llanos and 20% for a legume-grass association technology in the Llanos are reached. This clearly indicates that while adoption will be feasible and will not affect market prices significantly on the North Coast, the converse applies to the Llanos.

Table 12 presents the evolution overtime of the aggregate impact of the four strategies in terms of incremental beef production and cash flow in US$ assuming constant 1985 prices. Given the fact that zero research costs are imputed to the North Coast as a spill-over of Llanos research and no extension efforts were involved beyond those of private seed producers, and that these costs are internalized in the seed price paid by farmers, project level returns correspond to the aggregate of the farm level parameters. Net present values at a 10% discount rate were highest for the whole North Coast alternative, followed by the Llanos association alternative, the Cesar alternative and finally the Llanos grass alternative. Nevertheless, due to the different investment levels required, the order changes when the alternatives are ranked by marginal internal rates of return, with the Cesar and North Coast alternatives achieving 78% p.a. versus 39% for the association and 33% for the grass alternative in the Llanos.

It can be concluded that:

1. In spite of having been developed as a technology for very acid infertile soils, A. gayanus can make an impact in very specific farming system niches such as the acid soils with aluminium in the North Coast.

2. As can be expected from a low external input technology, its performance depends markedly on the resource endowment (particularly soils and climate) existing on the farm. Where this is very variable across farms as in Cesar, adoption will not be uniform but very selective.

3. Rapid initial adoption in Cesar is explained by the low opportunity cost of the land involved, the substantial production impact achieved, the low establishment costs, ample supply of cattle on the farms, and complementarity of the A. gayanus pasture with other pastures grown on more fertile soils on the same farms.

4. The high marginal rates of return achieved (78% p.a.) have been a strong incentive for adoption, which has occurred without any official sector intervention, in years where cattle prices were on a downward trend and the general socioeconomic environment was not conducive to pastoral investments.

Table 11. Adoption impact of *A. gayanus* on the North Coast, Colombia

	Cesar	North Coast	Llanos Orientales	
	A.gayanus	A.gayanus	Grass	Legume grass association
Adoption ceiling (No. of farms)	66	121	66	66
Cummulative *A. gayanus* areas (ha):				
Year 5	1982	2244	1982	1982
Year 10	16554	26106	16554	16554
Year 15	18744	34578	18744	18744
Incremental steers needed (No):				
Year 5	991	1122	2576	3171
Year 10	8277	13053	21520	26486
Year 15	9372	17289	24367	29990

Table 10. Cash flow of pasture investments on the North Coast and in the Llanos Orientales, Colombia (US$/ha)

	Cesar	Llanos Orientales	
	A.gayanus	Grass	Legume grass association
Investment:			
Pastures	31.12	92.51	98.71
Marginal investment in steers	106.95	241.80	297.60
Others	7.75	6.45	7.94
Total	145.82	340.76	404.25
Net income:			
Year 1	113.46	121.27	166.28
Year 3	113.46	98.33	143.34
Year 15	220.41	363.07	463.88
IRR (%)	77.79	33.25	39.22

Table 9. Establishment and maintenance costs of *A. gayanus* in Cesar and the Llanos Orientales, Colombia. 1985

	Cesar		Llanos Orientales			
	A.gayanus		Grass		Legume grass association	
	US$/ha	%	US$/ha	%	US$/ha	%
Establishment						
Land preparation	9.44	30	10.45	11	10.45	11
Sowing	21.74	70	36.27	39	42.48	43
Fertilization	0	0	45.96	50	45.96	46
Total	31.18	100	92.68	100	98.89	100
Maintenance						
Fertilization (every three years)	0	0	22.98	100	22.98	100
Weed control (every year)	6.21	100	0	0	0	0
Total	6.21	100	22.98	100	22.98	100

Table 8. Physical impact of _A. gayanus_ in Cesar and the Llanos Orientales, Colombia.

	Cesar		Llanos Orientales			
	A.gayanus		Grass		Legume grass association	
	Wet	Dry	Wet	Dry	Wet	Dry
Native pasture						
Stocking rate (UA/ha)	1	0	0.2	0.2	0.2	0.2
Production p.a. (kg/UA)	100	0	75	0	75	0
Established pasture						
Stocking rate (UA/ha)	1.5	1	1.5	1.1	1.8	1
Production p.a. (kg/UA)	150	45	130	25	150	25
Marginal stocking rate (UA/ha)	0.5		1.3		1.6	
Marginal production p.a (kg/ha)	170		206		281	
Persistance (years)	15		15		15	

Potential area for which

. *A. gayanus* is suitable........................	109,000 ha
. Average farm size.............................	1,158 ha
. Number of farms with potential	95
. Average area of suitable soils per farm........	407 ha

Adoption ceilings:

. % of farms.....................................	70% (66 farms)
. % of suitable area per farm...................	70% (284 ha)

The major impact is the increase in stocking rate both in the wet and dry seasons and the increased weight gain per animal (Table 8). For comparative purposes corresponding values for straight grass and legume-grass associations in the Llanos are presented. These assumptions consider only the impact on farms similar to those with more than 50 ha of *A. gayanus*, thus ignoring the benefits achieved on all other farms using the material, farms on which the advantage of *A. gayanus* may be smaller. Establishment costs are limited to seed and minimal seed bed preparation, resulting in markedly lower investments per hectare than in the Llanos. Given the fact that machinery is available on most farms, only the variable costs of its use are imputed. Similarly, pasture maintenance represents only about one fourth of its cost in the Llanos (Table 9). Per hectare investment costs amount to US$145 in Cesar of which US$31 correspond to the pasture compared with between US$340 (US$93 for the pasture) and US$404 (US$99 for the pasture) in the Llanos. Cash flows in years 1 to 15 are higher for the Llanos alternatives (Table 10), but marginal internal rates of return are substantially higher in Cesar (78% p.a.) than for both alternatives in the Llanos (33% and 39% p.a.).

In order to asses the level of impact, farms were assumed to adopt the technology in the following sequence:

1.5% in year 1	22.0% in year 6
3.0% in year 2	16.0% in year 7
7.5% in year 3	7.5% in year 8
16.0% in year 4	3.0% in year 9
22.0% in year 5	1.5% in year 10

Within farms areas sown were assumed to evolve as follows:

4 ha in year 1
50 ha in year 2
80 ha in year 3
80 ha in year 4
70 ha in year 5

At the aggregate level four alternatives were compared (Table 11): the impact in Cesar, the impact on the North Coast based on the same parameters and areas of appropriate soils as reported by the IGAC/ICA map, the impact in the Llanos assuming the same number of adopters and

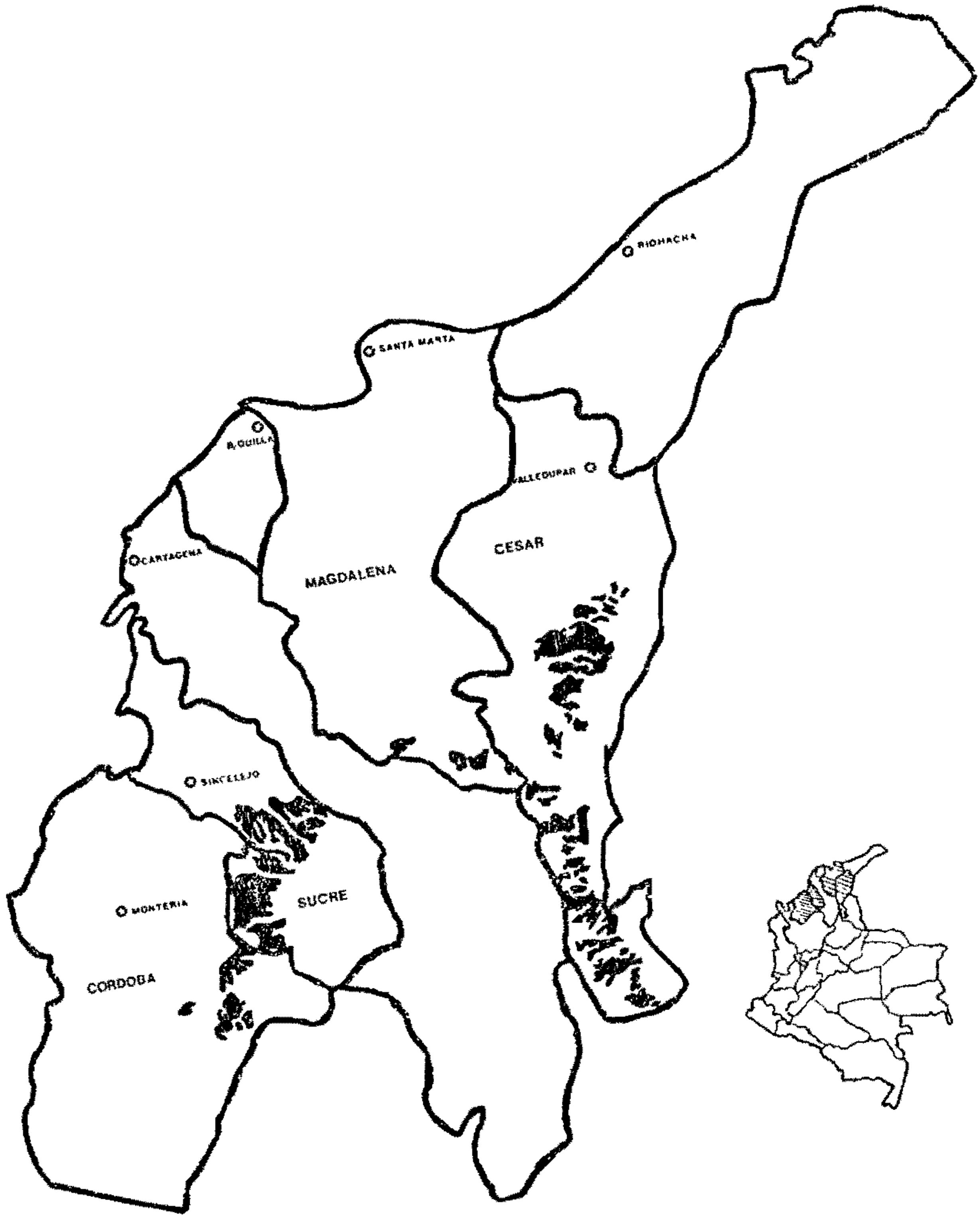


Figure 3. Areas suitable for Andropogon gayanus on the North Coast of Colombia

Table 6. Explanatory model of the *A. gayanus* area per farm, Department of Cesar, Colombia. 1985.

Dependent variable:	Andropogon area per farm (ha)		
Variable		**Regression coefficient**	**Significance**
1.	Constant	- 0.397	-
2.	Aluminium (meq/100 grs soil)	137.077	0.025
3.	Savanna areas (ha)	- 0.134	0.086
4.	Number of years planting *A. gayanus* squared	14.608	0.001
5.	Savanna area squared (ha)	8.655	0.101

Number of observations.. 66
Multiple coefficient of determination (R^2)................... 0.596

Table 7. Soils of farms using *A. gayanus* in the Department of Cesar, Colombia

	C e s a r				
	Suitable	Inter-mediate	Not suitable	Fertile	Llanos Orientales
Number of samples	9	39	47	32	*
pH	5.08	5.77	6.86	6.29	4.50
P (ppm)	11.07	35.68	103.00	74.10	1.60
K (meq/100 grs)	0.16	0.29	0.53	0.43	0.08
Ca (meq/100 grs)	1.51	5.60	15.22	9.47	0.10
Mg (meq/100 grs)	0.32	1.19	2.69	2.19	0.02
Al saturation (%)	24.90	0.00	0.00	0.00	93.30

* 18 representative soil profiles 0-20 cm (ETES Study)

The above information was used to develop a regression model explaining the area of Andropogon per farm (Table 6). Aluminium was again shown to influence the extent of adoption as well as the area of savanna on the farm. This reflects the existence of infertile sandy areas without tree vegetation, sometimes with the presence of aluminium, which are particularly suitable for A. gayanus. Finally, the number of years in which the farmer planted Andropogon contributed significantly to the regression.

This reflects the fact that seed was limiting in the first years and that most farmers harvested seed to expand areas of Andropogon. The above mentioned factors explained 60% of the total variability observed in A. gayanus areas between farms.

The strong association of soil characteristics with A. gayanus performance and extent of adoption on farms led to a classification of soils sampled into "suitable" for A. gayanus (whenever aluminium was present), "not suitable" (when salinity was detected), and "intermediate" (when neither aluminium nor salinity were encountered). For comparative purposes soil samples were drawn from "fertile" plots where pastures with higher requirements such as P. maximum and D. aristatum were grown. Even "suitable" soils with aluminium are substantially richer in phosphorous, potassium, calcium and magnesium than typical Llanos Orientales soils, and aluminium saturation is only about one fourth of its level in the Llanos (Table 7).

This contributes to an explanation of the fact that A. gayanus is never fertilized on the North Coast. This reduction in costs compared with the Llanos is one of the key elements in explaining its substantially higher rate of adoption on the North Coast than in the Llanos.

ICA supplied a map produced by the IGAC (Instituto Geográfico Agustín Codazzi) which included a mapping unit of soils with aluminium. It showed approximately 200,000 ha of these soils in Cesar and 400,000 ha on the whole North Coast (see Figure 3). The overlap with the existence of large areas of A. gayanus (more than 50 ha) was very marked in the central part of the department. Analysis of the rainfall patterns, particularly the length and severity of the dry season, leads to the hypothesis that A. gayanus' competitive advantage over other grasses, particularly B. decumbens, is associated with the existence of a dry season of 5 months, with frequent months of zero rainfall. This does not occur in Southern Cesar.

In terms of research effort, the impact of A. gayanus in the North Coast has to be considered a spill-over of the programs' main research effort geared at developing forage germplasm for the acid infertile lands of tropical America. To quantify its potential magnitude the following set of assumptions was used for Cesar:

Table 5. Explanatory model for *A. gayanus* coverage: farms with areas of *A. gayanus* of more than 10 ha, Department of Cesar, Colombia, 1985[1]

Dependent variable: Andropogon coverage index (cm/5m transect)

Variable	Mean	Range	Regression coefficient	Significance
1. Constant			-96.047	-
2. Dummy: poorly drained soil			-163.608	0.001
3. Seeding rate (kg/ha)	10.75	4 -25	2.433	0.238
4. Dummy: previous land use - crops			193.048	0.001
5. Square root of soil depth (cms)	3.89	1 - 8.36	65.364	0.001
6. Salinity (mmhos/cm)	0.24	0 - 2.35	-252.572	0.001
7. Salinity squared	0.23	0 - 5.52	184.173	0.004
8. Aluminium (meq/100 grs soil)	0.07	0 - 1.30	396.995	0.001
9. Sodium (meq/100 grs soil)	0.11	0 - 5.90	-247.831	0.001
10. Rest period (days)	32.96	0 - 180	2.573	0.001

Number of observations.. 585
Multiple coefficient of determination (R^2).................... 0.543

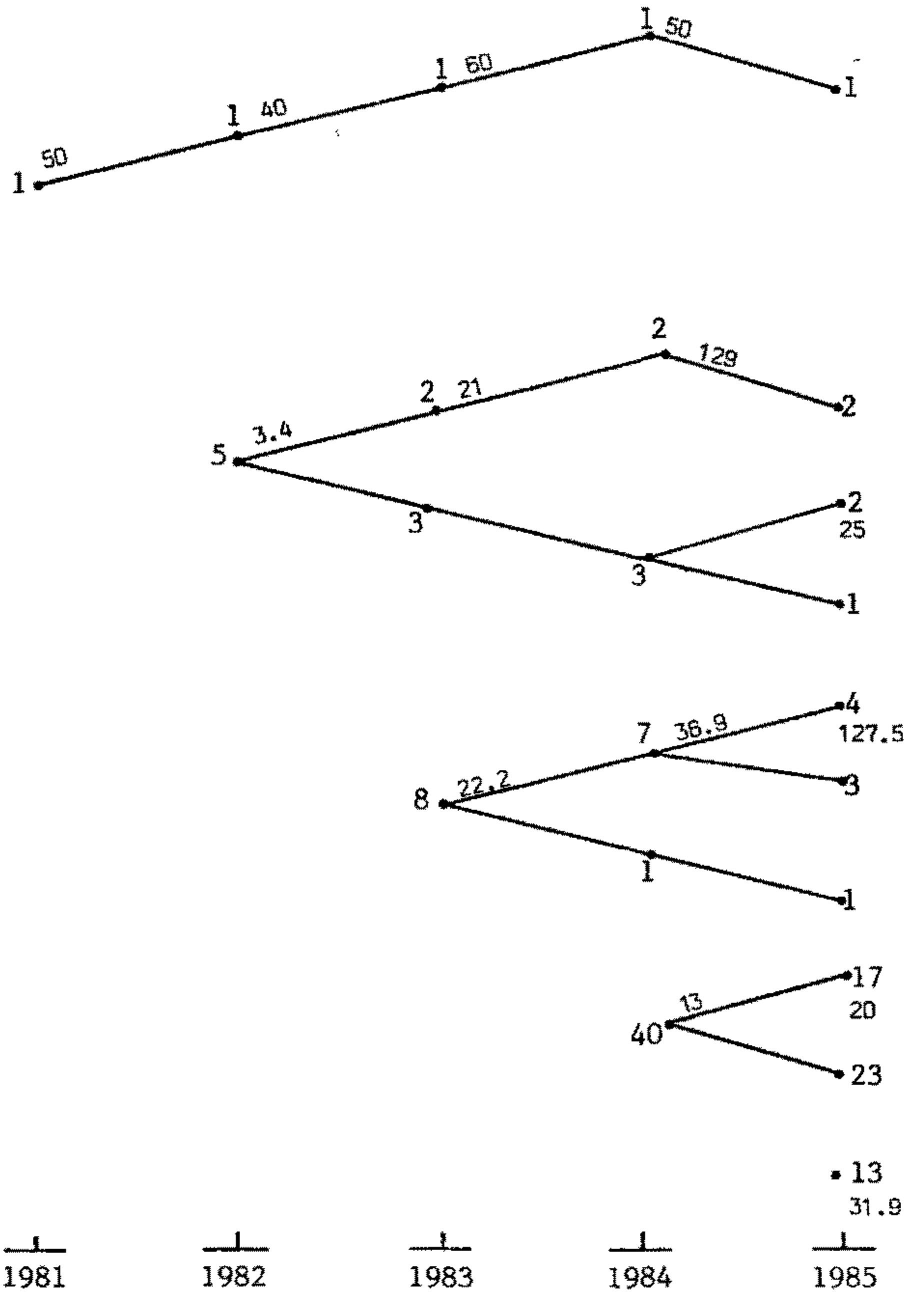
1/ Excludes 1985 plantings

Table 4. Explanatory model for *A. gayanus* coverage: all farms surveyed except 1985 plantings, Department of Cesar, Colombia, 1985

Dependent variable: Andropogon coverage index (cm/5m transect)

Variable	Mean	Range	Regression coefficient	Significance
1. Constant			-101.786	-
2. Dummy: poorly drained soil			-159.811	0.001
3. Seeding rate (kg/ha)	10.72	4.0-25	6.131	0.001
4. Dummy: previous land use - crops			97.952	0.001
5. Sand, %	43.39	4.3-78	2.261	0.001
6. Square root of soil depth (cms)	3.75	1 - 8.36	46.309	0.001
7. Salinity (mmhos/cm)	0.47	0 - 3.75	-72.620	0.003
8. Salinity squared	0.72	0 -14.06	6.622	0.390
9. Aluminium (meq/100 grs soil)	0.04	0 - 1.30	385.861	0.001
10. Dummy: planting after October			-105.284	0.001

Number of observations.. 982
Multiple coefficient of determination (R^2).................... 0.431



1/ Number of users, mean area planted (ha)

Figure 2. Adoption over time: number of adopters continuing to grow Andropogon gayanus[1] in the Department of Cesar, Colombia

To depict the dynamics of the early adoption process, decision trees were constructed indicating the number of farmers continuing to plant A. gayanus once they had tested it and the average areas planted by those who continue to expand areas in subsequent years (Figure 2). This analysis was done separately for each year since the release of the material. The figures for 1985 are not included because the survey was done before the end of the planting season. Year 1 is atypical because one farmer introduced the material in the region, saw a market for its seed and continued to expand, mainly in order to increase his seed volume. In subsequent years an increasing number of farmers tested the material, and did so with relatively important areas. These initial areas tended to increase in size over time, reflecting increasing confidence in the technology, decreasing seed prices, and ample seed supply.

At the same time an important number of farmers discontinued testing, while continuing adopters rapidly increased areas planted. This seems to indicate that large numbers of farmers were willing to test a new grass cultivar promoted as being adapted to poor soils. Many found it unsuited for their conditions. It must be kept in mind also that these pastures are perennial crops. Thus after a few years some farms had already planted all the land appropriate for it and therefore stopped. Regression analysis was used in an attempt to explain the wide variability of the stands of Andropogon observed in the region. Table 4 presents the analysis undertaken for all plots surveyed except those established in 1985, where the coverage index would have been misleading. The analysis shows that:

- poor drainage has a very negative effect;
- plots planted after crops have significantly higher coverage indices;
- sandy soil texture is associated with significantly higher coverage index values;
- soil depth has a highly significant effect which is not linear; very shallow soils have a particularly negative effect on A. gayanus stands;
- Andropogon is very sensitive to low levels of salinity;
- there is a significant association between increasing aluminium levels and higher Andropogon coverage indices, thus confirming its adaptation to acid soils;
- Andropogon reacts negatively to late planting.

In spite of not including any management variable such as grazing regime, stocking rate or weed control, this model explains 43% of the total variability observed, thus highlighting the importance of the characteristics of the land resources allocated to the grass.

A second model was estimated for farms with more than 10 ha of A. gayanus which basically confirmed the previous model's results but increased the multiple coefficient of determination to 54% (Table 5).

Table 2. Land use on farms adopting *A. gayanus* in the Department of Cesar, Colombia (average)

	A. gayanus area (ha)		
	1-20	21-50	+50
Number of farms	37	18	11
Hectares of:			
. A.gayanus	8	35	182
. P.maximum + H.rufa + D.aristatum	126	438	570
. Savannas	98	30	225
. Other pastures and fállow	112	66	114
. Crops	23	105	67
Total farm area	367	674	1158

Table 3. Stock numbers on farms adopting *A. gayanus* in the Department of Cesar, Colombia (average)

	A.gayanus area (ha)					
	1-20		21-50		+50	
	Dry	Wet	Dry	Wet.	Dry	Wet
. Dual-purpose cows	107	112	117	127	402	409
. Steers	56	83	178	199	506	528
Total herd	348	381	607	654	1306	1423

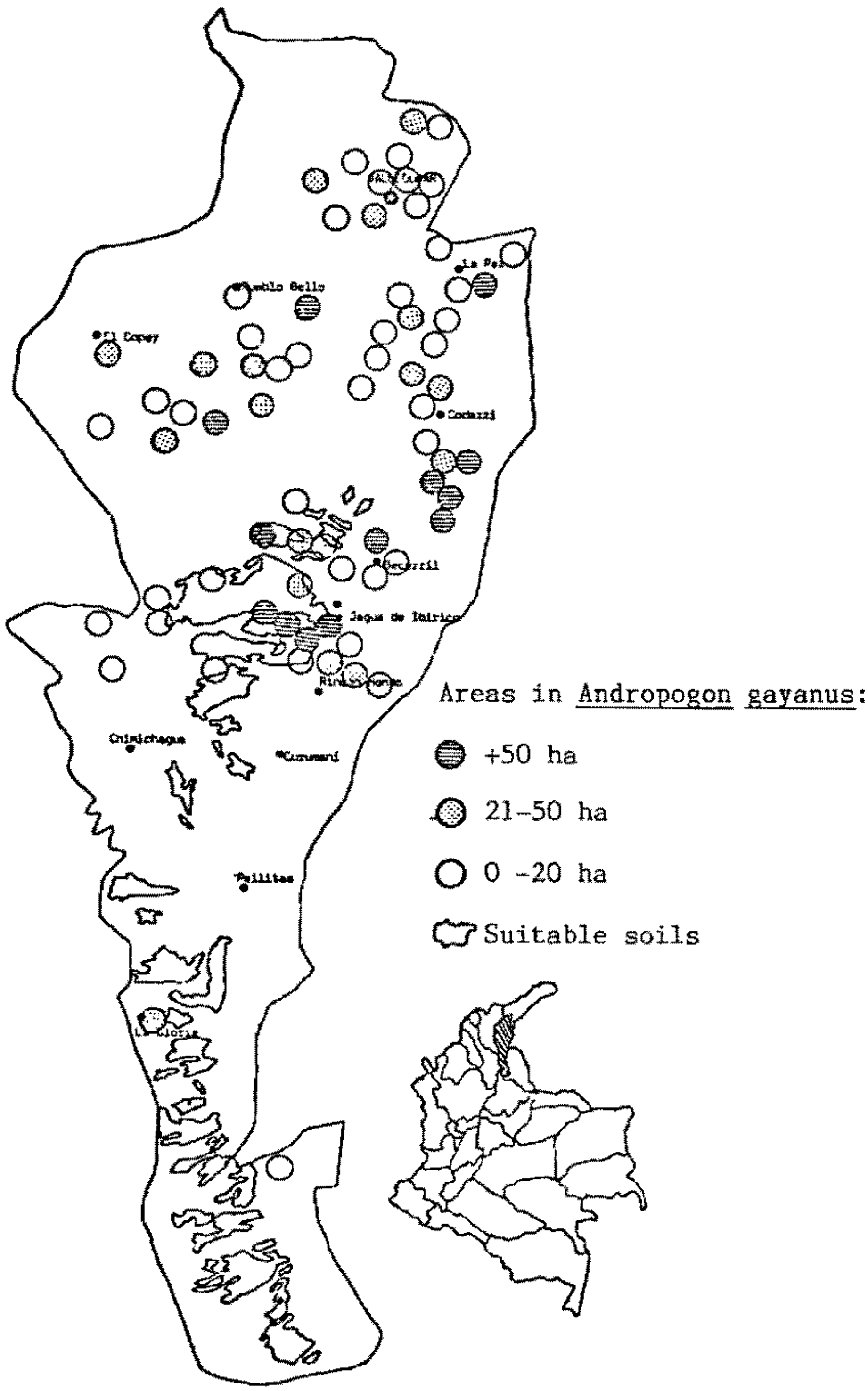


Figure 1. Location of farms surveyed in the Department of Cesar, Colombia

c) Adoption and impact of *A. gayanus* in the Cesar Department, Colombia, 1985

The previous survey had drawn the program's attention to the apparent fit of *A. gayanus* into some North Coast farming systems. Adoption particularly seemed to concentrate in the Cesar department in the North Eastern corner of Colombia.

A visit to the region revealed that about 60-70 tons of seed were being produced annually, that this was concentrated in very few individual enterprises and larger farmers, that some of it was sold to seed dealers in the Llanos and some sold to Venezuela, but that the largest quantity was being used on the North Coast, particularly in Cesar.

This led to the implementation of a survey of early adopters during 1985. Customer lists were obtained from the main *A. gayanus* seed producers. A random sample of customers having bought less than 200 kg each was drawn and all customers having bought 200 kg or more were included. The survey questionaire included questions on general characteristics of the farming operation, management of different types of pastures and particularly *A. gayanus*, and future plans related to the cultivar. In addition *A. gayanus* plots were visited, soil samples drawn and measurements taken of profile depth as well as plant size (diameter of tussocks) and plant density (number of plants in a 5 m transect) as well as presence of legumes and weeds. A total of 66 farms were surveyed and 1,103 individual 5 m transects were evaluated. Figure 1 shows the distribution of the farms surveyed in Cesar classified by the size of the *A. gayanus* paddocks established. Adoption clearly concentrated in the northern half of the department.

As stated above truly random surveys of early adoption need very large sample sizes in order to include enough adopters to allow inferences to be drawn about factors determining adoption. Studies which consider only adopters thus focus on explaining the extent of use of the technology being monitored as the central variable.

Farms were therefore classified in three categories according to the area of *A. gayanus* existing on the farm at the time of the survey. Farm size and land use differ markedly between adoption categories (Table 2). Mean Andropogon areas increase from 8 ha in the lowest category up to 182 ha in the 50 ha + category. While *A. gayanus* comprises only 2% of the total farm area in the lowest category, it increases to 5% in the intermediate category and 16% in the highest one. This clearly indicates a better fit of the technology on the latter farms due to the larger share of savanna type soils on these farm. Farms tend to grow crops in all three categories.

Animal production in Cesar comprises an important dual-purpose beef and milk production system and the fattening of steers. The relative importance of dual-purpose milk production is larger in the smaller farms (Table 3) which have less *A. gayanus* in relation to other pastures (Table 2). Nevertheless the absolute number of dual-purpose cows increases substantially in the 50 ha + category.

This role of early adoption studies is seen as particularly critical for the research process in tropical pastures given the complexity of farming systems involving large ruminants, the lengthiness of on-farm trials and the related high cost of trials. All these factors lead to a different optimal mix of systematic on-farm trials and monitoring of the performance of new technology under the condition of early-adopting farms.

The lengthiness of the process implies the urgent need to find shortcut methods. Random surveys of farms to describe and analyze early adoption are not a cost effective proposition due to the low frequency of adopters at this stage. Alternatively this has led the pasture team to follow a methodology of purposive sampling of early adopters. Studies are initiated by obtaining lists as complete as possible of all purchasers of seed of the new cultivar from commercial seed dealers. In the course of the actual survey, early adopters, extensionists, and other informants report on further adopters.

Table 1 presents the evolution of the area of A. gayanus on 57 early adopting farms in Colombia during the period 1979-1983. The most striking result of this study was the good performance of A. gayanus in some regions outside the Llanos, particularly, in the Colombian North Coast and its performance below expectations in the Colombian Llanos. This was also reflected by substantially higher planting intentions in the North Coast, and an increased interest in A. gayanus seed production for sale in this region. This is also reflected by the farmer's expectations which led them to test the material. These expectations were clearly related to problems of the regions: forage for the dry season in the North Coast, pasture for infertile soils in the Middle Magdalena (where the dry season is not severe) while in the Llanos the pattern of expected advantages was not so well defined.

It is interesting to note that the capability of A. gayanus to associate with legumes, one of its main merits from a researcher's perspective, was only mentioned once. This documents the lack of credibility of the role of legumes with ranchers.

Table 1. Evolution of the area of Andropogon gayanus on farms of 57 early adopters in Colombia, 1979-1983

Región	1979	1980	1981	1982	1983
Eastern Plains	5	191	560	1682	2087
Middle Magdalena	8	36	205	705	1013
North Coast	29	129	624	1208	1902
Total	42	356	1389	3595	5002

Beef is not a homogeneous product but a complementary production system with several cuts of different quality produced in a fixed proportion. Income elasticities of different cuts across income strata differ. With increasing per-capita beef availability (through lower prices or increased income) higher income people tend to increase expenditure for beef by purchasing higher quality, higher-priced cuts. This leads to an increasing spread between the prices of best and cheapest cuts, which causes an overproportional price reduction for low quality cuts.

Examples of Adoption and Impact Studies within the Tropical Pastures Program

Adoption and impact studies can fulfill two types of purposes: (a) document impact or potential impact to support the decision of investing in the given type of research, or (b) be used as a decision tool within the Program's activities to assign resources to different projects, ecosystems, etc. While the first target is fulfilled with studies at a rather aggregate level, the latter requires substantially more detailed analyses. Some examples of both types of studies produced in the Tropical Pastures Program will be briefly described.

a) Ex-ante impact of CIAT's pasture research 1980

This analysis was produced for the "CIAT in the 1980s document". Its perspective was continent-wide and analyzed the impact of an abstract improved pasture technology at a very aggregate level using a consumer-producer surplus framework.

Herd development was simulated with and without improved pasture technology based on initial cattle inventory by ecosystem by country. Sigmoid adoption patterns starting at different points in time were defined according to the status of pasture research for each condition (ecological zone and country).

Twenty percent of the impact were considered to be caused by CIAT's research investment. This led to benefit cost ratios of 31:1 at a 5% discount rate and 15:1 at a 10% discount rate (CIAT, 1981). These results documented the high pay-off of pasture research due to the magnitude of the potential impact and the sensitivity of this result to interest rates, a fact reflecting the long gestation period of benefits stream.

b) Survey of A. gayanus adoption in Colombia, 1983

With the commercial release of *A. gayanus* (the first cultivar developed through colaborative activities of CIAT and national pasture research programs) by several national agricultural research programs from 1980 onwards, performance of this cultivar in farmers' fields became of interest to the program. While the first study reported was more geared to documenting an impact, surveys related to early adoption were clearly more geared at generating feedback for the researchers of national programs and CIAT on the merits and limitations of the new cultivar in order to generate new hypotheses to direct research.

sector is acknowledged. This will require a particular effort to document the attractiveness of legumes to farmers and the profitability of producing seed of these cultivars.

c) Nature and distribution of the benefits

Forages being an intermediate product for ruminant animal production, the expected benefits are related mainly to beef and milk production (in Africa also small ruminant production). Presently in tropical Latin American beef is clearly the more important commodity but an increased impact on milk production can be expected if necessary complementary investments, particularly in road infrastructure, are undertaken.

Both these markets (but particularly beef) are characterized by a supply elasticity which is very low in the short run (even negative in the case of beef) while quite high in the long run. Price elasticities of demand for beef and milk are of intermediate magnitude (0.5 to 0.8) and expenditures shares are high (between 20 and 37% of total food expenditure for beef, milk and dairy products for the lowest income qualite of the population, RUBINSTEIN and NORES, 1980).

This has led to very unstable beef markets with typically 6-7 year cycles. Adjustment is achieved by changes in both prices and quantities. In milk, short to medium term supply response is higher, therefore dampening price movements. Government intervention is important in both markets due to the wage good character of both products. It usually operates through controlled milk prices and variable amounts of imported dry milk. In the beef market direct interventions are difficult and expensive due to the value of the product, the high cost of conservation and the length of the cycles leading to more emphasis on indirect measures such as credit rationing, interest rates, exchange rates and changing taxation for beef trade.

Another important characteristic is that important alternative sources of animal protein exist. The Economics Section has undertaken joint studies with FAO's Regional Office for Latin America and the Caribean to better understand the demand relationships between different meat sources leading to the estimation of income, price, and cross price elasticities for beef, pork, and poultry.

Preliminary results clearly show that the main two competitors as sources of animal protein in tropical America are beef and poultry, while the pork sector is rather stagnant. Both industries have very different input structures; their competitiveness varies between countries and regions due to their resource base and specific policies.

Given the nature of the production systems most of any potential benefits are achieved through the markets. Increased subsistence consumption plays only a very minor role. Among consumers, lower income strata tend to show higher income elasticities than higher income groups.

b) Characteristics of the improved pasture technology

The objective of the technology being developed by the Tropical Pastures Program is to improve animal productivity through the introduction of improved grass and legume cultivars into the system. These new cultivars are the result of a germplasm collection and screening effort which seeks materials with adaptation to soils, climates, and biotic factors which require low levels of external inputs.

While most agricultural research has been aimed at increasing land and/or labour productivity through the introduction of additional capital this technology aims principally at increasing capital (particularly cattle) productivity through the introduction of new forage cultivars and some complementary inputs (particularly P fertilizers).

Both existing and improved pastures are perennial, a fact which reduces the incidence of land preparation and seed costs in relation to annual forages, but a fact which complicates adoption, impact, and studies of these issues.

Straight grass pastures have been introduced to the more intensively managed regions of the savannas, typically closer to the markets or on somewhat more fertile soils. These are also the areas with the highest potential for adoption of improved legume-grass associations. But given the perennial character of straight grass pastures, the nature of the investment in them, which requires a relatively high initial outlay and very low maintenance costs, makes it difficult to economically replace them, thus leaving only the natural savannas in less favourable locations main as candidates for adopting legume-grass associations. This does not consider some options presently being studied to introduce improved legumes into existing grass swards with very low inputs.

Nevertheless in general terms adoption of new perennial pasture technology is an investment decision much more complex than shifting from traditional to improved varieties in annual crops. The perennial character of these materials imposes an additional complexity for impact assessment: the need to quantify the rate of degradation in order to assess stocks of improved pastures at any point in time.

While the role of the commercial seed production sector has been very clear-cut in fostering the adoption of improved varieties of annual crops such as rice or wheat and much more so in hybrid corn or sorghum, it is much less so in tropical grass cultivars. Given the usual cash limitations ranchers tend to prefer to multiply their own pasture seed, frequently using permanent labour at slack periods. In addition to producing their own seed, an important trade "over the fence" could be observed for the case of *A. gayanus*. This characteristic of forage materials of being easy to multiply can contribute to adoption but definitely makes estimation of seed volumes and areas established particularly difficult. For the case of tropical forage legumes a greater need for an active involvement of the commercial seed producer

ADOPTION AND IMPACT STUDIES: STATUS AND CURRENT THINKING WITHIN THE TROPICAL PASTURES PROGRAM

Carlos Seré

Introduction

Impact and adoption of agricultural research results have become a widespread concern within the CGIAR and within the broader international agricultural research community. This is reflected by a rapidly increasing number of articles and review papers (See among others DE JANVRY and DETHIER, 1985, SCHUH and TOLLINI, 1978).

This interest reflects the increasing concern about the efficiency of investing in agricultural research in a period where the rapid impact of Green Revolution varieties of rice and wheat is losing its power as a argument for expanded investments and there is concern about the shape of the production function for agricultural research. Are we already operating at a level with rapidly decreasing marginal returns?

Most of the research investment by the CGAIR has gone into annual foodcrops for direct human consumption. Tropical pastures are a quite peculiar commodity within the CGAIR portfolio. They are perennial and additionally they are intermediate products for animal production. This paper will attempt to elaborate (a) the peculiarities of this commodity, (b) their implications for adoption and impact, (c) the research strategy being developed taking account of these realities, (d) some initial results and their implications, and (e) a summary of future plans.

a) Nature of the production systems

Extensive livestock production is the most feasible land use of 300 million ha of acid infertile savanna soils of tropical America. These frontier production systems make use of the ample land availability (which produces large volumes of forage of such a low quality, that the largest proportion has to be burnt to let animals graze the young regrowth, which is of slightly better quality), require very low labour inputs but have substantial capital requirements, mainly for cattle. The performance per animal is very poor leading to a low capital productivity, which frequently implies that it is not economic to stock the ranches to carrying capacity. Cash is very scarce in these farms in relation to the capital available and very variable over the years due to the cattle cycles, observable in most countries of the region (see RIVAS and CORDEU, 1983).

ADOPTION AND IMPACT STUDIES:

STATUS AND CURRENT THINKING WITHIN THE TROPICAL PASTURES PROGRAM

CARLOS SERE

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Table 6. The distribution of Benefits from Improved Black Bean varieties. Rio General, Costa Rica, 1984.

Farm Size	Farms (%)	Adoption in Planted System (% Area)	Adoption in Broadcast System (% Area)	Benefits Share (%)
0-10 ha.	43.2	83.1	39.5	26.2
10.1 - 50 ha.	40.5	81.3	40.2	37.6
50.1 - ha	16.2	84.4	77.6	36.2
Total	100.0	82.8	53.7	100.0

Source: Survey data.

Conclusion: Future Research

A critical part of the success achieved in the generation and transfer of improved black bean varieties in Costa Rica has been the existence of an integrated multi-institutional effort. Without basic breeding and selection research, the new varieties would not have been developed. Without on-farm evaluation, the best varieties for farmers conditions would not have been readily identified. Without an effective extension and seed multiplication effort, the spread of the new varieties would not have been so widespread or rapid. Costa Rica has had a particularly effective seed program, and this appears to be a critical factor in why improved bean varieties have moved more quickly there than else where in Central America.

Though repeated surveys have consistently shown a pattern of significant adoption of improved varieties in Southern Costa Rica, even among small farmers, relatively little is known about their spread else where in the country. Additional research is in process on this question, with a survey of Upala, Costa Rica's second most important bean region, having been completed in 1985. Nonetheless no data on adoption is available from regions which account for two-fifths of national production. Such information could clarify further the nation wide dimensions of the impact of the new varieties.

Yet the impact of the new bean varieties can not be fully understood solely by analyzing the behavior of producers. The effect of the increased supply on prices must also be considered. In Costa Rica, though, bean prices are administered by the CNP, not determined in the market. Therefore, to estimate the distribution of benefits from the new technology between consumers and producers, it is necessary to analyze in more detail bean pricing policy and its relation to new cost reducing technology.

Lastly, this study should have made clear that crop improvement programs must be dynamic. For example, from the survey field work it became clear that anthracnose was on incipient problem with Talamanca. This information was taken up by bean researchers, who are now addressing this problem. Likewise this study indicates that contrary to prior expectations the traditional system (broadcast) is relatively less used by small farmers than large. The relative potential for improvement of these two systems needs to be better understood since it may have an important bearing, for example, on optimal plant architecture. Thus, commodity programs can derive substantial benefit from feedback on farmers' often dynamic conditions.

Table 5. Bean Production, Marketing, Imports and Prices, Costa Rica, 1981 - 85.

Year ending	Production (Tons)	Imports (Tons)	Official Bean Purchases (Tons)	Price (1980 c/kg)
1985	23,002	-0-	14,178	7.66
1984	20,780	13,612	17,184	8.70
1983	14,362	15,218	9,447	8.99
1982	16,312	10,772	3,419	8.24
1981	12,289	12,604	8,900	7.99

Source: CNP.

Producers clearly benefit from the new varieties, and small farmers share in these benefits. A high proportion of small farmers have adopted the new varieties, and a high proportion of their area, especially of planted beans, is now in new varieties (Table 6). Clearly small farmers have had access to the new technology, and it appears to be scale neutral.

Nevertheless, small farmers receive about one-quarter of the benfits of new technology even though they comprise two-fifths of bean farmers. This occurs due to two factors. First, the large farmers simply cultivate greater extensions of beans. The average large farm plants 2.8 hectares of improved varieties, four times the area planted on average by small farmers (0.7 ha). Second, not only do large farmers cultivate much greater areas in the broadcast system, but also they devote a much higher proportion of their broadcast area to improved varieties.

Consequently, medium and large farmers receive a greater share of total benefits from the new varieties, as well as greater benefits per farm. This does not result due to any bias counter to small producers in the new technology, but rather it is a direct outcome of the distribution of resources. While small farmers obtain less absolute benefits from the new technology, the relative importance of these benefits as a proportion of farm income may well be higher on small farms.

Although small farmers have been clear gainers from the new varieties, and though these gains may be important relative to their total farm income, in this case scale neutral technology has not been an efficient means of redressing income iniquities. Alleviating income disparities is probably not a realistic objective to expect of improved agricultural technolgy even when it can make a real contribution to incomes and welfare of the poor (Pachico).

Table 4. Costs and returns to Bean production systems and varieties. Rio General, Costa Rica ($U.S. 1985/ha).

	Broadcast System		Planted System	
	Local Variety	Improved Variety	Local Variety	Improved Variety
Labor	36.76	36.76	71.62	71.62
Seed	25.26	54.06	12.96	27.36
Fertilizers	0	0	31.50	31.50
Protection Chemicals	0	0	28.98	28.98
Capital Costs	5.58	8.18	13.06	13.76
Harvest	43.44	44.86	51.38	69.26
Land	112.00	112.00	112.00	112.00
Total costs	223.04	255.86	321.50	355.48
Gross value of output	294.66	368.48	452.02	609.40
Net Income	71.62	112.62	130.52	253.92
Return on costs (%)	32.1	44.0	40.6	71.4
Cost/kg	0.49	0.45	0.46	0.38
Returns to family labor (kg/day)	14.1	17.7	12.4	15.3

Source: van Platen et al; Ballestero; Survey data.

varieties is \$123/ha in the planted system, and \$41/ha in the broadcast system, while the marginal return on capital is over 400% in the planted system, and over 200% in the broadcast system. These high returns have induced farmers to allocate over 80% of their area of planted black beans to new varieties, and over 50% of the area broadcast.

<u>Impact of the New Varieties</u>

Bean production in Costa Rica reached an all time peak in 1984, and this record was surpassed by an even greater harvest in 1985 (Table 5). Similarly, the quantities of beans purchased by CNP also reached record high levels in 1984-85, while imports dropped to nil in 1985. Comparing 1984-85 with 1981-83, annual average production rose 7570 tons, while official purchases increased 8426 tons and imports fell 6055 tons. The period 1981-83 corresponds to the original release of the new bean varieties, and is a period in which they would have had very little impact, while by the 1984-85 period use of the new varieties was widespread.

Doubtless the new varieties have contributed to the climb in bean production, though it cannot be said for certain that their use is the sole cause of the observed production surge.

Projecting the adoption rates observed in the Rio General to a national basis, and assuming that in adopting the new varieties farmers did not change their production system or their area cultivated, it is estimated that the improved varieties would have increased production some 3900 tons in 1985 while farmers would have enjoyed an increase of U.S. \$1,800,000 in private profits. This estimate does not take into account any bean price reduction that may have occurred due to increased supply, which would decrease farmer benefits.

The evidence from the Rio General region suggests that the new varieties could have contributed more than half of the increase in bean production observed nationally, and this figure could be greater if the improved profitability of the new varieties induced farmers to expand area planted or switch from the broadcast to the planted system. On the other hand, adoption levels may have been different in other production zones. Moreover, other factors, such as weather, may have also played a role in buoyant 1984-85 bean production. The bean price, though, seems unlikely to have motivated a major output expansion in 1984-85 since the real price peaked in September 1983 and fell steadily throughout the entire period.

Varieties and Systems

Data from several different surveys across years and regions indicate that in the planted system the improved varieties express a greater yield superiority over the local varieties in the planted system than in the broadcast system (Table 3). In the planted system the improved varieties outyield the locals by an average of 46.1% or 307 kg/ha, while in the broadcast system they outyield the local varieties 23.1% or 108 kg/ha. Consequently it is hardly surprising that farmers are far more likely to cultivate the improved varieties when they use the planted system than they are when they use the broadcast system. This, for example, largely explains why the percent of farmers using the improved varieties was higher in the first season 1984 which is 100% planted, that in the second season 1984 when broadcast is the more common system (Figure 1). Among those black bean growers who do use the planted system in the second season, 80.0% sow improved varieties, compared to 40.1% of those in the broadcast system.

Analysis of costs and returns of alternative combinations of varieties and production systems illustrates how farmers of different resource endowments select their production practices. In a full opportunity cost framework, cultivating the improved varieties in the planted system leads to the highest return per hectare, more than double that obtained in broadcast beans (Table 4). Returns to capital are also highest with improved varieties in the planted system even though this system has the highest total costs. Thus, in the absence of a capital constraint, it pays to invest the additional capital required for the planted system.

The broadcast system never generates returns to land competitive with those of the planted system, and this is doubtless a principle reason why small farmers make greater use of the planted system. However, as the opportunity cost of land declines, as it does with a shift to more marginal land or with increasing farm size, the broadcast system can obtain a return on capital that is competitive with the planted system.

The chief attraction of the broadcast system is its low labor input and low capital requirement. For farmers facing stringent constraints in labor and cash availability, the broadcast system remains the lowest cost method of being able to produce beans. The broadcast system also results in higher net output of beans per day of family labor, though its advantage is slight.

Nonetheless, the planted system has the lowest average with cost for bean production, holding the opportunity cost of land constant. Thus, unless the opportunity cost of land is very low, or when labor or capital are limiting at quite a low level, the returns to both land and capital are higher in the planted system.

Within either system it clearly pays to produce with the new varieties rather than the local. Even with the cost of purchasing official seed which for most farmers would be a one time rather than an annual cost, the net marginal return of shifting from local to improved

Table 3. Farmer yields with improved and local black bean varieties, by system and season, Costa Rica.

System	Region	Cycle	Yield Improved (Kg/ha)	Yield Local (Kg/ha)
Planted	South	1982B	662	575
	South	1983A	977	616
	South	1984B	1129	848
	North	1984/85	1124	625
	Average		973	666
Broadcast	South	1981B	435	319
	South	1982B	543	403
	South	1984B	584	589
	North	1984/85	738	555
	Average		575	467

Source: Chapman et al; Ballestero; CIAT survey data.

Farmers' appreciation of the characteristics of the new varieties were also crucial to their quick diffusion. Among farmers who know Talamanca, 81% considered that it outyields local varieties and 92% preferred Talamanca for its upright architecture, which both makes cultural practices more manageable and also makes the plant more tolerant of humid conditions in particular leading to better grain quality at harvest.

Lack of resistence to anthracnose is the only problem so far observed with Talamanca in farmers' fields. Although this has not yet significantly impeded farmers' use of Talamanca, a breeding effort is now underway to incorporate anthracnose resistence into Talamanca.

Brunca has achieved a much lower level of adoption than Talamanca in part due to its later release. In 1984 it was cultivated by only 7% of farmers in the wet season (compared to 55% for Talamanca), and 15% of farmers in the dry season (compared to 44% for Talamnaca). Among the few farmers who have experience with Brunca, 88% consider it high yielding, but 57% faulted its prostrate architecture which makes management more difficult in the planted system and leads to more disease and poorer grain quality in high humidity conditions. This view, though, seems to be that of farmers using the planted system which prevails in the wet season and which generally entails the need to enter the field to undertake cultural practices. The prostrate architecture of Brunca may be an advantage for competition with weeds in the dry season broadcast system, where farmers realize no cultural practices between sowing and harvest.

This is supported by the fact that there is more frequent use of Brunca in the dry season than the wet (7% vs. 15%), while the reverse is true for Talamanca (55% vs. 44%). Moreover, of dry season sowings of Brunca only 20% are in the planted system, but 37% of Talamanca is planted. Thus, Brunca seems better adapted to the broadcast system while Talamanca is preferred for the planted systems. Indeed, the objective of Costa Rican bean scientists in releasing the two varieties was that Brunca would be more suited to the broadcast system.

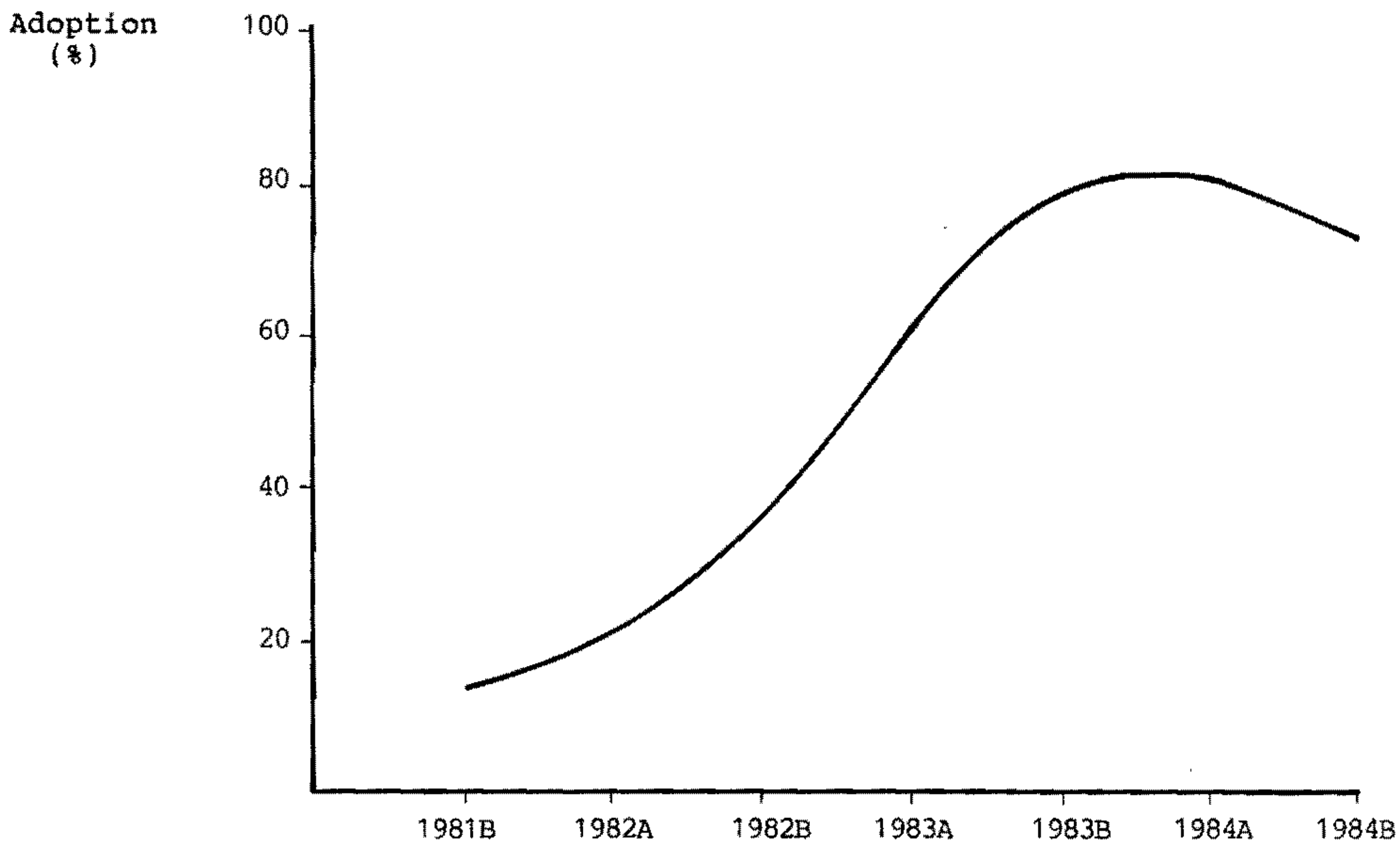
Although Talamanca and Brunca account for 88% of the black bean area to improved varieties, farmers also make some use of other improved varieties such as Porillo Sintetico and Jamapa.

Table 2. Bean Production System by land tenency for farms of different sizes. Rio Rio General, Costa Rica, 1984

	Planted System		Broadcast System	
Farm Size	Own Land (%)	Rented[a] Land (%)	Own Land (%)	Rented[a] Land (%)
0-10 ha	70.5	29.5	35.5	64.5
10.1-50.0 ha	92.7	7.3	88.4	11.6
50.1 + ha	100.0	0	49.2	50.8

[a] Principally share cropped

Figure 1. Percentage of Farmers Adopting Improved Bean Varieties, Perez Zeledon, Costa Rica, 1981 - 84.



Source: Chapman et al 1981B, 1982B; Ballestero 1982B, 1983A; CIAT survey 1984A, 1984B.

Another advantage of the broadcast system is its low cash investment. In the planted system higher yields are achieved in part through the use of chemical fertilizers, fungicides, herbicides or manual weed control which often necessitates the hiring of labor. Hence for farmers facing a very severe capital constraint, or producing beans for subsistence and not for market, the broadcast system may be preferred for its low cost.

In sum, the broadcast system is more appropriate for large farmers with ample land and relatively scarce labor. It is also used by small farmers who sharecrop, who face severe capital constraints, or whose labor is absorbed by the coffee harvest. The planted system appeals primarily to small farmers who lack land to leave in fallow and who wish to maximize returns to their scarce resource-land.

Adoption of these varieties can be followed through a number of studies. A 1982 survey of small farm technology was carried out by IICA (Chapman et al). In this study a sample of 98 farmers was randomly drawn from ministry of health lists of residents of Pejibaye. In 1983 the University of Costa Rica drew a random sample of 195 farmers from ministry of health lists in Perez Zeledon (Ballestero). In 1985 CIAT interviewed a random sample of 159 farmers in Perez Zeledon and Buenos Aires, thus obtaining broad coverage of the Rio General. In each successive study the geographical coverage of the sample was expanded. All data reported in this paper, is from the 1985 survey except where otherwise indicated.

The data from the three studies show a rapid spread of the new varieties in Perez Zeledon from 14% of farmers in 1981 (Chapman et al) up to 81% in the 1984 May wet season and 73% in the 1984 September dry season sowing (Figure 1). While these data from Perez Zeledon portray the pattern of the diffusion of the new varieties, the 1985 survey indicates that the level of adoption is somewhat higher in the more accessible Perez Zeledon region and that the level of adoption over the Rio General region as a whole was 60% in the 1984 wet season, and 52% in the dry season sowing. It is expected that the more outlying regions should catch up and eventually attain the same levels of acceptance as in Perez Zeledon where adoption appears to have peaked in the range of 75-80% of farmers. The new varieties covered 71% of the area cultivated to black beans in the Rio General during the 1984 wet season and 53% of the area in the 1984 dry season.

The wide availability of Talamanca and Brunca seed, principally through the CNP, has greatly facilitated their rapid diffusion, with 37.8% of adopting farmers first having obtained seed from official sources (Ballestero). Although most farmers normally save their own seed, the easy access to official seed supplies quickly built up a large critical mass of farmers with seed of the new varieties. Most (53.5%) farmers using new varieties first obtained seed from other farmers, but this was possible in large part because there existed a substantial pool of local farmers who had obtained the new seed from the CNP.

Table 1. Land use intensity with Two Bean Production Systems, Rio General, Costa Rica, 1984.

Rotation[a]	Broadcast Beans (%)	Planted Beans (%)
One crop then fallow	32	7
Two crops/year, then fallow	32	22
Three crops in 2 years, then fallow	36	16
Four crops in 2 years, then fallow	0	27
Continuous cropping, 2 crops/year	0	29

[a]Crops in rotations include beans, maize, and rice in various combinations.
Source: CIAT Survey, 1985.

The planted system also has the advantage of permitting more intense crop rotations, with planted beans being used in rotations that involve two crops annually for at least two years in the case of nearly three-fifths of the farmers using the system (Table 1). In contrast, three-fifths of the farmers using broadcast beans do so in rotations that consist of one or two crops followed by a fallow. Moreover, fallow periods between the two systems differ, with the farmers reporting an optimal fallow of two years or more with broadcast, while with planted beans one year is the most common fallow period.

Although the land extensive broadcast system is traditional, the newer planted system which leads to higher land productivity is preferred by small farmers. On farms of less than 10 ha. 59% of the area sown to beans in 1984 was in the planted system compared to only 41% on farms over 10 ha. Small farmers are increasingly less able to sustain the fallow periods necessary to maintain soil fertility and build up the weed cover needed for the broadcast system. Only 16% of farms less than 10 ha. reported having enough land to leave in fallow, while among farms 10-50 ha. 50% have sufficient land for fallow, and on farms greater than 50 ha. 88% had enough land.

While the ground cover provided by the cutting of the weeds in the broadcast system does serve as a barrier to erosion as well as provide a multch that reduces incidence of web blight (Galindo et al), a low labor requirement is the advantage most often cited by farmers (Ballestero). During the second season (October sowing) when labor is scarce due to the coffee harvest, 86% of bean area is in the low labor broadcast system, and only 14% in the planted system. However, in the first season "wet" sowing (May), when labor is not so limiting, 100% of bean area is in the more labor intensive planted system.

The lower labor requirement of the broadcast system is both more compatible with seasonal whole farm labor demand, and also more suitable for larger scale production where land is in relatively ample supply compared to labor. For example, in the second season when labor is more limiting, 58% of farmers cultivating planted beans sow less than 0.75 ha. compared to only 10% of farmers using the broadcast system. Likewise small farms (less than 10 ha.) devote 24% of their second season bean area to the planted system compared to 12% for medium sized farms (10-50 ha.) and 10% for large farms (over 50 ha.).

Small farmers are able to make use of the broadcast system largely through renting or sharecropping land (Table 2). Most (65%) of the area cultivated by small farmers that is in the broadcast system is rented or sharecropped, while 71% of their area in the planted system is owned land. Similarly large farmers cultivate about half their broadcast area with sharecroppers while all their land in the planted system is owned. Thus, to a considerable extent small farmers continue to use the broadcast system only because they are able to obtain low opportunity cost land to rent or sharecrop.

inputs difficult to obtain on the frontier. A sufficiency of beans for own consumption can ordinarily be easily obtained, and before the road was built into the Rio General in the 1950's, there was little vent for surplus production. Thus, most production was for own consumption and beans were an important dietary staple.

Despite the onset of rapid urbanization in the 1960's, beans have remained a staple food in Costa Rica, continuing to provide nearly a tenth of national protein consumption (FAO 1979-81). With few exceptions, however, traditional production systems have not been able to meet demand, and Costa Rica has been a consistent bean importer to make up this shortfall. Bean production has also been depressed by a policy of maintaining domestic bean prices well below world market prices (Stewart).

As Costa Rican society became more differentiated and modernized, a program of formal scientific research to increase the productivity of beans was initiated. This institutional innovation began in the University of Costa Rica (UCR) in 1958, and by 1978 bean research was an integrated effort of the Ministry of Agriculture (MAG), the National Production Council (CNP), the National Seed Office (ONS) and the UCR, while the International Center for Tropical Agriculture developed close ties with Costa Rican bean research (Chapman et al).

The activities of these new institutions in agriculture provided a flow of new services to agriculture: research (UCR, MAG), extension (MAG), on-farm trials (CNP, MAG), seed production and distribution (CNP, ONS), and marketing (CNP). Simultaneously, transport improved and other services (eg agrochemical input supply, credit) became increasingly available in Rio General.

In summary, though the upper Rio General valley retains many vestiges of its frontier character, increased population pressure and the penetration of services from a modernizing urban sector have created a radically new environment for agriculture. Changes in bean production technology associated with these processes will now be discussed.

Bean Production Systems

Farmers can choose between two alternative production systems, either the traditional shifting cultivation broadcast system, or a newer intensive system based on planting with the digging stick.

The planted system was first used by a few farmers from about 1978, but it began to spread rapidly since 1981-82, both in The Rio General and also in other major bean producing regions in Costa Rica (Borbon).

This system is associated with more intense management as most farmers apply chemical fertilizer (82%), spray to control insects and diseases (71%) and control weeds either manually or with herbicides (71%). In contrast, only 2% of the farmers utilize agrochemicals in the broadcast system. The more intense management of planted beans leads to higher yields (1055 kg/ha) than are obtained with the broadcast system (583 kg/ha).

Opportunities presented by new production technologies as well as emerging resources scarcities that undermine the viability of traditional production practices are leading to the adoption of new production technologies, even in traditional food staples produced by small farmers in Latin America. The conventional view has been that technical change in Latin America has been concentrated in export or commercial crops that are produced primarily in the large farm sector, while small farmer food crops have been bypassed by technical change (Piñiero et al; Crouch and de Janvry; de Janvry and Dethier).

Such has certainly been the case until recently in Costa Rica. Here technical change doubled the productivity of export crops such as coffee and sugar cane, from the 1950's to the 1970's, but bean yields remained stagnant at 400 kg/ha. in the same period (Hall). Though improved varieties and the use of agrochemicals became widespread in Costa Rican export crops, bean production remained rooted in low productivity shifting cultivation systems, an almost direct inheritance from pre-Colombian practices (Chapman et al; Platen et al).

Recent studies, however, have begun to observe signs of technical dynamism in Costa Rican bean production, as new varieties are being adopted and production systems intensified (Ballestero; Borbon and Pachico). This paper examines the extent, nature, and causes of recent changes in bean production in the upper Rio General valley of southern Costa Rica in order to assess the potential for technical change in small farmer food staple crops in Latin America.

Costa Rican Context

Expansion at the agricultural frontier has been a critical part of Costa Rica's accommodation to an explosive population growth that peaked at near 4%/yr in the late 1950's. Settlement of the previously sparsely populated Rio General valley took place from the 1920's to the early 1960's when this population growth was at its height. By the 1970's population pressure was being felt in the upper Rio General which was already converted to an area of net emigration to new frontiers yet further south (Hall).

The Rio General watershed is now the leading bean producing region in Costa Rica, accounting for 32.6% of national production (CNP). Traditional bean production practices in Rio General reflect the characteristics of this transitional period of frontier settlement. Traditionally bean seed is first broadcast into fallow or uncultivated land, then the weeds are chopped down by machete to cover the bean seed. The crop is then left untended until harvested. Land thus cleared for bean production may be left again in fallow or pasture, or another crop (maize, upland rice or beans) can be taken before leaving the plot to fallow.

Though land productivity is low in this broadcast (tapado) system of shifting cultivation, typically no more than 100-200 kg/year through a normal four-year cycle, the system is viable on the frontier where land is in relatively ample supply. The broadcast system has the advantages of a minimal investment in labor and capital and requires no

The Adoption of Improved Bean Varieties: A Case Study in Costa Rica

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The case of cassava exemplifies a commodity approach to income generation and development. The role of commodity "booms" in agricultural development is often underplayed but such examples as coffee and later soybeans in Brazil or rubber and later oil palm in Malaysia highlight the commodity as a growth source. A commodity approach to research is a logical solution to the difficulties in focus and problem identification in applied research. However, a commodity focus also has a potential role in development and it can be easily linked to agricultural research, on the one hand, and to agricultural policy on the other. A commodity approach to identifying the key interventions that lead to income growth and equitable distribution thus has certain merits. Such an approach slices the world in a different way than, say, farming systems research. Whereas the latter adopts a regional, production, and often farm strata focus in order to delimit the system universe, a commodity system is defined across a variety of system levels, including farm, marketing and consumption systems. The recent search for holism in agricultural research thus need not in all cases sacrifice a commodity focus.

Nevertheless, cassava is not necessarily a paradigm for the organization of research in all other commodity programs, just as wheat and rice are relatively unique cases as well. What is apparent, however, is that the focus and structure of the research program and in turn its effectiveness follows from a clear specification of potential impact. That IARC's should be measured by their impact thus has obvious benefits, but in many cases this moves commodity research programs away from a singular focus on breeding and forces links with more development-oriented activities. This has implications for the type of institutions with which IARC's work. That IARC's serve only national research organizations thus becomes too limiting and instead there is a natural tendency to collaborate with that institution or complex of institutions which best assures impact. Impact, however, creates its own dynamic, and since crop expansion creates demand for improved production technology, this process in the end strengthens national commodity research programs. Insuring impact from improved technologies is a complex enterprise and making research institutions responsible for such impact forges organizational linkages that assure this end. Research thus moves from being a passive to a very much activist enterprise; programs like cassava cannot wait for impact but rather must create the conditions that insure it. Impact assessment directs that effort rather than providing the epitaph.

and CIMMYT. Impact assessment can play a more active role in a research program but that role must begin before actual impact is even detectable.

Such a role for impact assessment, however, presupposes that there are alternatives in research design and in their consequent impact. The focus of the CGIAR system's objectives on increased food production by the small farmer and increased food consumption by the poor consumer suggests that there are such alternatives. The argument, however, has been made that these objectives are obtainable through appropriate commodity choice and country priorities. That is, focusing research on crops grown principally by small farmers and/or those which form a large portion of the diet of the poor can be expected to benefit the poor. Some of those who take this position go further to claim that actual decisions within the commodity research program can be isolated from concerns about impact, and the recent bandwagon among social scientists for the scale neutrality of improved varieties represents an apparent acceptance of this point of view. Research in this conception is defined by purely technical criteria and the priorities set within the particular disciplines and the respective literature.

However, cassava is a case in point that, while income distributional goals are first set by defining the research center's crop portfolio -- eg. the principal objective in cassava is to increase small farmer income while in tropical pastures and rice it is to improve the nutrition of the poor --, decisions made within the particular research program determine whether these income distributional goals are met. On the one hand, developing a dried cassava industry in Latin America based on large-scale production units and production technology could have been an option in the program's research strategy. On the other hand, hammering the point once again, an investment in research on cassava production technology by no means insures a positive impact on small farmer incomes. A cassava equivalent of IR-22 or CICA 8, in and of itself, has little chance of impact in Latin America. If crop research is to have an impact on socio-economic objectives, then that research needs to be defined in terms of the socio-economic environment in which that technology is to be released. If taken seriously, such a focus fundamentally affects how the research program is organized and how closely it is linked to what are seemingly development activities. In particular, if the program's objectives include income distributional goals, then research activities almost certainly must be integrated with field-level, development-oriented research.

The success of the dwarf rice and wheat varieties in Asia has tended to narrow the conception of the types of innovations that IARC's produce to essentially varieties, with the attendant misconception that improved varieties alone are in all cases sufficient for impact. This conclusion does not characterise the cassava program which has searched for innovations not only in production techniques but also in post-harvest and utilization technology and even organizational and institutional innovations -- Ruttan (1984) has recently argued that the latter is a primary output of social science research. In the case of cassava it is difficult to divine which type of innovation will have the greater impact and therefore which should be the principal concern of the research program. The innovations reinforce one another. Thus, restricting an IARC's mandate to just germplasm can in some cases be unproductive.

Table 27. Atlantic Costa, Colombia: Simulation of Social Benefits of Dried Cassava and Fresh Root Storage Technologies, 1994.

	Situation in 1985	A*	B*	C*	D*
Employment in 1994: (mon-years)					
Rural employment	21608	21541	27422	23740	28448
Urban employment	4404	4365	4363	6278	6306
Foreign Exchange Served in 1994:					
Million US-$	0.56	0.65	11.05	0.48	8.27
Increase Improducer Surplüs: (million US-$)					
Small farms	n.a.	-	8.4	8.3	14.1
Medium farms	n.a.	-	11.8	8.1	17.7
Large farms	n.a.	-	17.1	10.3	24.6
Increase in Consumer Surplus: (million US-$)					
Metropolitan consumer	n.a.	-	-1.1	24.3	23.6
Intermediate urban consumer	n.a.	-	-0.9	2.4	2.0
Rural consumer	n.a.	-	-3.5	13.4	11.7
Animal feed industry	n.a.	-	8.6	-0.4	5.2
Increase in total benefits: (million US-$)					
Producers	n.a.	-	33.3	20.6	48.5
Consumers	n.a.	-	-5.7	40.0	37.2
Industry	n.a.	-	7.2	-1.9	2.8
Total	n.a.	-	34.8	58.7	88.5

* For explanatory notes on the different simulations reported, see Table 26.

Table 26. Atlantic Coast, Colombia: Simulation of Consumption Impact of Dried Cassava and Fresh Root Storage Technologies, 1984.

	Situation in 1985	A*	B*	C*	D*
Fresh Cassava Consumption: (kg/head)					
Metropolitan area	29.9	21.6	21.1	39.4	39.6
Intermediate urban area	53.5	46.5	45.0	57.7	58.2
Rural area	80.6	63.7	62.2	83.3	83.8
Producers	164.0	158.5	152.4	146.5	148.1
Fresch Cassava Prices: (US-$/ton)					
Metropolitan area	404	387	399	349	346
C.V. Cassava price in metropolitan area	0.11	0.11	0.07	0.11	0.06
Intermediate urban area	252	236	247	264	260
Rural area	243	228	239	256	253
Dried Cassava:					
Total Consumption (tons)	4089	4681	80108	3494	59923
Price (US-$/ton)	221	199	215	230	226
C.V. of total consumption	0.46	0.25	0.29	0.65	0.38
% utilization of drying capacity	0.82	0.94	0.74	0.70	0.66

* A: Present situation develops as expected without growing drying industry or fresh cassava storage

* B: Drying industry develops

* C: Fresh cassava storage is introduced

* D: Fresh cassava storage and dried cassava develop together

Table 25. Atlantic Coast, Colombia: Simulation of Social Benefits of Dried Cassava and Fresh Root Storage Technologies, 1984

	Situation in 1985	A*	B*	C*	D*
Employment in 1994:					
(man-years)					
Rural employment	21608	21541	27422	23740	28448
Urban employment	4404	4365	4363	6278	6306
Foreign exchange saved in 1994:					
Millions US-$	0.56	0.65	11.05	0.48	8.27
Increase in producers surplus:					
(million US-$)					
Small farms	n.a.	-	8.4	8.3	14.1
Medium farms	n.a.	-	11.8	8.1	17.7
Large farms	n.a.	-	17.1	10.3	24.6
Increase in consumers surplus:					
(million US-$)					
Metropolitan consumers	n.a.	-	-1.1	24.3	23.6
Intermediate urban consumers	n.a.	-	-0.9	2.4	2.0
Rural consumers	n.a.	-	-3.5	13.4	11.7
Animal feed industry	n.a.	-	8.6	-0.4	5.2
Increase in total benefits:					
(million US-$)					
Producers	n.a.	-	33.3	20.6	48.5
Consumers	n.a.	-	-5.7	40.0	37.2
Industry	n.a.	-	7.2	40.0	37.2
Total	n.a.	-	34.8	58.7	88.5

* For explanatory notes on the different simulations reported, see Table 17.

Varying yield and investment response assumptions provide useful insights into the development of the cassava economy. An important conclusion is that the development of the cassava industry and overall production response is quite sensitive to cassava yields. Improved production technology can provide an important stimulus to the growth in the dried cassava industry. On the other hand, increasing the rate of investment in drying plants is also a stimulus to increased cassava production, partially through the further reduction in price variation.

The expected benefits in the development of a dried cassava industry over the ten-year period are significant (Table 25). Benefits are captured by producers but with the important consideration that there is little negative impact on consumer welfare. Producer benefits are expected to be distributed more or less proportionally according to farm size, Employment in the cassava sector is expected to increase at about 2.7% per annum, due in part to increased labor utilization in the drying plants but principally to intensification of farm production. This is about the rate of population growth and although significant is not expected to put pressure on wages in the region. Finally, the production of dried cassava will be replacing imported sorghum, resulting in a reduction in foreign exchange outflows.

The impact of the fresh root storage technology can also be simulated within the model (Tables 26 and 27). Introduction of the fresh root storage technology reverses the downward trend in cassava consumption and increases consumption levels in metropolitan areas well over present levels. Consumer prices in urban areas are lowered significantly while farm prices actually rise slightly. Fresh storage technology in fact has the potential to generate higher benefits than in the development of a dried cassava industry, although in this case benefits go primarily to consumers. Development of both markets results in a very high level of benefits, biased only somewhat more to producers than consumers. Development of the dried cassava industry, however, is not as rapid.

Models reflect the current understanding of the cassava commodity system and the expected adjustments in the development of an alternative market. In one respect they represent a standard against which progress within the project can be measured. On the other hand, when the model results are compared to actual adjustment patterns and benefit streams, the interplay provides a basis for improving understanding of that process. Understanding change in a rural economy thus becomes an interactive process between model formulation and verification. It is this understanding which provides the means, particularly through organizational and institutional adjustments, of directing the impact of new technology toward the defined objectives.

Conclusions

Impact assessment can play a valuable role within the international centers, but it is most effective if it is an integral part of an on-going research program. Ex-post impact evaluation, in and of itself, makes interesting history but is of little use to decision-making within a research program unless it is closely linked to questions about technology design. An interesting question is the effect that the innumerable impact studies of improved rice and wheat varieties has had on research at IRRI

Table 24. Atlantic Coast, Colombia: Simulation of Consumption Characteristics of Cassava Economy, 1994.

	Situation in 1985	A^*	B^*	$B1^*$	$B2^*$	$B3^*$
Fresh cassava consumption: (kg/head)						
Metropolitan area	29.9	21.6	21.1	21.2	20.7	21.0
Intermediate urban area	53.5	46.5	45.0	45.4	43.9	44.5
Rural area	80.6	63.7	62.2	62.6	61.0	61.7
Producers	164.0	158.5	152.4	153.9	152.5	150.2
Fresh cassava prices: (US-$/ton)						
Metropolitan area	404	387	399	396	409	404
C.V. Cassava price in metropolitan area	0.11	0.11	0.07	0.07	0.05	0.04
Intermediate urban area	252	236	247	244	256	251
Rural area	243	228	239	236	248	243
Dried cassava:						
Total consumption (tons)	4089	4681	80108	84880	62667	95797
Price (US-$/ton)	221	199	215	211	228	220
C.V. of total consumption	0.46	0.25	0.29	0.29	0.33	0.26
% utilization of drying capacity	0.82	0.94	0.74	0.75	0.67	0.64

* For explanatory notes on the different simulations reported, see Table 17.

Table 23. Atlantic Coast, Colombia: Simulation of Production Characteristics of the Cassava Economy, 1994.

	Situation in 1985	A*	B*	B1*	B2*	B3*
Yields (ton/ha):						
Small farms	6.81	6.98	7.73	8.50	7.40	7.89
Medium farms	6.83	7.10	8.29	8.51	7.34	8.49
Large farms	6.83	7.23	8.52	8.50	7.18	8.69
Area (ha):						
Small farms	22502	22344	23699	23583	24059	23983
Medium farms	21142	20916	24708	24472	25426	25433
Large farms	26801	26398	32496	32078	33768	33710
Production:						
Total(tons)	480878	496001	666137	682471	607713	698738
C.V.	0.13	0.13	0.13	0.14	0.12	0.12
Producers' price:						
US-$/t	84.7	75.9	82.3	80.7	87.4	84.5
C.V.	0.27	0.29	0.17	0.19	0.12	0.10

* A = Present situation develops as expected without growing drying industry or fresh cassava storage.
B = Drying industry develops.

1 = Establishment of drying industry increases yields uniformly over the farm types by 25%.
2 = Establishment of drying industry does not increase yield levels at all.
3 = Drying industry grows at double the estimated rate.

Trends in Cassava - 1985

John K. Lynam

The interpretation of trends in cassava is limited by uncertainty about the quality of the data. The problems with collecting accurate production and area data on cassava are legion, and trends analysis is further complicated by often unreported procedural changes in the development of the statistical series. Nor, in aggregate trends does the law of averages allow much hope that errors between countries will cancel each other out, since for most continents there are one or two major countries which account for the bulk of the production. The data tables provide little more than a reference point for understanding the relative importance of cassava between countries.

Nor do market prices give a clear picture of overall trends in aggregate supplies. Cassava prices in wholesale markets generally reflect the overall supply position of carbohydrate sources. Thus, shortfalls in potatoes, as often happens in Andean countries, often lead to large increases in cassava prices. The same applies to the case of platano and cassava in the Dominican Republic. The latter, together with the fact that marketing of cassava supplies is buffered by storage of roots in the ground, implies that market prices by themselves do not give a clear indication of production trends. Finally, since cassava is, except in the case of Thailand, a non-tradeable good, the trade balance is non-existent as an indicator of the overall supply and demand situation. Thus, little can be said with certainty about overall trends from inspection of cassava production and area data and there are few means of corroborating trends with other types of data. Thus, only some discussion of the recent cassava situation in the two largest producers, Thailand and Brazil, will be presented here.

Thailand

During the period of the "voluntary" export quota to the EEC, cassava production in Thailand has gone up every year, reaching almost 20 million tons in the 1984/85 season. For the first time in many years production is expected to come down in the 1985/86 crop season. Plantings were reduced due to very low root prices during the principal planting season and the relatively high prices of maize. Since then prices have recovered significantly.

Thailand has succeeded in moderating the impact of the 4.5 million ton quota on domestic farm prices. This has been achieved through the system of export allocation permits to the EC, whereby any exports to third countries results in an assured export allocation to the EC in the next period. Export allocations are based on stock levels held by shippers and these have been as low as 13% of total stock holdings in a period. To reduce costs of holding stocks and to secure higher export allocations, shippers are exporting to third countries, an estimated 1.7 million tons in 1985. These new markets include Taiwan, Japan, South Korea, the U.S.S.R., and significantly Portugal and Spain. However, to be competitive with international feedgrain prices in these markets, exporters have had to cut their prices, often below cost. Recent fob prices to third countries were $55, while those to Europe were $110. Thus, exporters cover losses through high prices to the EC, thereby maintaining domestic prices.

Since the old quota agreement expires on Dec. 31, 1986, Thailand now is in the process of negotiating a new agreement. A memorandum of understanding has been initialled by the commerce minister in which exports to the EC from Thailand will be restricted to 5.25 million tons per year for the period 1987 to 1990. Since Portugal and Spain will have joined the EC in the period, this agreement will also cover exports to those two countries. This level has generated significant criticism within Thailand and it remains to be seen whether this agreement will be ratified in its current form.

Brazil

Production of cassava roots in Brazil is principally transformed into farinha de mandicoa. The latter is the principal caloric staple in the Northeast. Cassava production over the last decade has declined in Brazil, both as a function of declining yield and area planted. Yield decline is due principally to a relative shift in production out of the South and Southeast and more to the lower yielding areas of the North and Northeast. Overall area decline has coincided with the very massive subsidization of wheat flour in Brazil, to the extent that wheat flour was significantly cheaper than farinha for a decade or so. Over the last two years there has been some progress in reducing the level of wheat subsidies, leading to improved stability in cassava production. Whether all subsidies will be eliminated remains to be seen with the recent economic policy changes directed at moderating inflation. Current farm level prices of cassava are at a very low level in many parts of the Northeast, while they are quite high in the South as cassava has resisted the ravages of the recent drought and is being heavily utilized in swine and dairy feeding because of the lack of feed grains.

CASSAVA PRODUCTION.RELATIVE IMPORTANCE IN THE REGION AND PER CAPITA PRODUCTION LEVELS

COUNTRY	PRODUCTION 1000 MT 1962/64	PRODUCTION 1000 MT 1972/74	PRODUCTION 1000 MT 1982/84	PERCENTAGE OF TOTAL % 1982/84	PER CAPITA PRODUCTION KG 1982/84
BRAZIL	22149	27051	22305	78.043	171
MEXICO	0	52	43	0.150	1
	22149	27103	22348	78.193	109
BOLIVIA	138	252	217	0.758	36
COLOMBIA	760	2045	2000	6.998	73
CUBA	167	229	335	1.172	34
DOMINICAN RP	149	195	96	0.336	16
ECUADOR	203	400	207	0.725	24
PARAGUAY	1149	1237	2137	7.477	615
PERU	442	458	349	1.222	19
VENEZUELA	326	294	319	1.116	18
TROPICAL SOUTH AMERICA	3334	5111	5660	19.805	58
COSTA RICA	10	10	22	0.076	9
EL SALVADOR	9	15	23	0.080	4
GUATEMALA	5	7	9	0.031	1
HONDURAS	23	17	9	0.033	2
NICARAGUA	12	20	27	0.096	9
PANAMA	18	39	35	0.122	17
CENTRAL AMERICA,PANAMA	77	107	125	0.439	5
BARBADOS	1	1	1	0.003	4
GUYANA	10	0	0	0.000	0
HAITI	110	223	263	0.921	42
JAMAICA	9	17	15	0.051	6
TRINIDAD TOB	4	4	3	0.010	3
CARIBBEAN	134	246	282	0.987	26
TROPICAL LATIN AMERICA	25694	32568	28416	99.423	84
ARGENTINA	238	240	165	0.577	6
TEMPERATE SOUTH AMERICA	238	240	165	0.577	4
LATIN AMERICA	25932	32807	28581	100.000	75

COLUMNS MAY NOT ADD EXACTLY DUE TO ROUNDING

CASSAVA ANNUAL GROWTH RATES

COUNTRY	PRODUCTION 1965/74	PRODUCTION 1975/84	PRODUCTION 1965/84	AREA 1965/74	AREA 1975/84	AREA 1965/84	YIELD 1965/74	YIELD 1975/84	YIELD 1965/84
BRASIL	0.6	-2.2***	-1.2***	1.7***	-1.0*	0.4*	-1.1	-1.2***	-1.6***
MEXICO	6.4***	-5.4	-2.1	6.4***	-7.6***	-1.1	0.0	0.0	-1.1
	0.6	-2.2***	-1.2***	1.7***	-1.0*	0.4*	-1.1	-1.2***	-1.6***
BOLIVIA	6.2***	-4.6**	1.0	4.8***	-3.1*	0.9	1.4***	-1.4	0.1
COLOMBIA	13.2***	0.5	5.2***	8.0***	-1.9***	2.1***	5.2***	2.4**	3.1***
CUBA	1.7***	-3.8***	3.2***	2.4***	4.2***	3.4***	-0.7*	-0.5***	-0.1
DOMINICAN RP	3.4***	-9.3**	-3.1***	3.2***	-0.5	0.8	0.2	-8.8***	-4.0**
ECUADOR	5.7***	-4.3	-2.7**	8.3***	-4.5**	-1.8*	-2.6*	0.2	-0.9*
PARAGUAY	-2.5*	4.4***	2.5***	-2.3***	4.6***	2.3***	-0.2	-0.2	0.2
PERU	0.0	-2.1**	-1.8***	-1.3**	-1.6***	-1.3***	1.3*	-0.5	-0.5**
VENEZUELA	-0.9	0.2	0.2	4.1**	1.2**	1.4***	-5.0***	-1.0	-1.2**
TROPICAL SOUTH AMERICA	4.1***	1.1***	2.2***	4.1***	0.2	1.6***	-0.1	0.8**	0.7***
COSTA RICA	-0.7	7.4***	4.0***	-2.7*	13.0***	1.8	2.1*	-5.6**	2.2**
SALVADOR	5.1***	7.0***	4.7***	0.0	4.5**	3.0***	5.1**	2.5***	1.8***
GUATEMALA	3.4***	2.4***	2.7***	3.0***	1.5***	2.9***	0.4	0.9	-0.1
HONDURAS	-7.3**	-0.2	-8.4***	-2.5**	-6.6***	-4.6***	-4.8*	6.4***	-3.9***
NICARAGUA	4.4***	2.3***	3.8***	5.5***	2.9***	4.4***	-1.1**	-0.6	-0.6***
PANAMA	9.2***	-2.1***	2.8***	11.3***	1.5***	4.8***	-2.1**	-3.6***	-2.0***
CENTRAL AMERICA,PANAMA	2.9***	2.2***	1.7***	2.8***	3.0***	2.3***	0.1	-0.8**	-0.6***
BARBADOS	1.2	1.4***	1.5***	2.5*	2.2***	2.6***	-1.4***	-0.8***	-1.1***
HAITI	5.1**	1.1***	2.8***	3.4*	2.0***	2.4***	1.7***	-0.9**	0.4**
JAMAICA	6.2*	-6.1*	3.2**	-0.7	-3.3	0.9	6.9	-2.8	2.3*
TRINIDAD ETC	4.1***	-6.5***	0.4	0.6	-6.5***	-1.9***	3.4***	-0.0	2.3***
CARIBBEAN	4.7***	0.5	2.7***	2.8**	1.8***	2.2***	1.9***	-1.3**	0.5*
TROPICAL LATIN AMERICA	1.1	-1.5***	-0.6**	2.2***	-0.6	0.7***	-1.1*	-0.9***	-1.3***
ARGENTINA	-1.1	-5.4**	-3.1***	-0.1	-2.1	-1.4***	-1.0	-3.3*	-1.8***
TEMPERATE SOUTH AMERICA	-1.1	-5.4**	-3.1***	-0.1	-2.1	-1.4***	-1.0	-3.3*	-1.8***
LATIN AMERICA	1.1	-1.5***	-0.6**	2.2***	-0.6*	0.7***	-1.1*	-0.9***	-1.3***

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

CASSAVA TRENDS IN AREA LEVEL BY COUNTRY 1962/84

COUNTRY	ANNUAL GROWTH RATE IN AREA 1962/84 %	AVERAGE AREA 1962/64	AVERAGE AREA 1972/74	AVERAGE AREA 1982/84
		-----	1000 HA	-----
BRASIL	0.979***	1603.3	2054.2	1987.3
MEXICO	-1.061	0.0	2.6	2.0
	0.986***	1603.3	2056.8	1989.3
BOLIVIA	1.462***	13.0	19.3	17.3
COLOMBIA	2.542***	135.0	250.4	208.0
CUBA	3.444***	24.7	33.8	50.0
DOMINICAN RP	0.730	15.0	18.0	16.7
ECUADOR	-0.609	24.7	47.9	22.3
PARAGUAY	2.472***	81.7	87.7	145.3
PERU	-1.402***	44.3	36.9	32.0
VENEZUELA	2.026***	25.3	38.0	40.3
TROPICAL SOUTH AMERICA	1.938***	363.7	532.0	532.0
COSTA RICA	1.503	2.7	2.4	5.3
EL SALVADOR	3.102***	1.0	1.2	2.0
GUATEMALA	2.522***	2.0	2.4	3.0
HONDURAS	-3.752***	4.0	3.5	2.0
NICARAGUA	4.485***	3.0	5.0	7.0
PANAMA	5.093***	2.0	4.5	5.0
CENTRAL AMERICA,PANAMA	2.339***	14.7	18.9	24.3
BARBADOS	1.860***	0.0	0.0	0.0
GUYANA	-0.000	1.0	0.0	0.0
HAITI	3.324***	30.0	52.0	64.7
JAMAICA	-0.822	3.3	2.0	2.0
TRINIDAD ETC	-1.952***	0.4	0.4	0.2
CARIBBEAN	2.906***	34.8	54.4	66.9
TROPICAL LATIN AMERICA	1.218***	2016.5	2662.1	2612.6
ARGENTINA	-0.596	20.0	22.6	18.7
TEMPERATE SOUTH AMERICA	-0.596	20.0	22.6	18.7
LATIN AMERICA	1.203***	2036.5	2684.7	2631.3

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

CASSAVA TRENDS IN YIELD LEVEL BY COUNTRY 1962/84

COUNTRY	ANNUAL GROWTH RATE IN YIELD 1962/84 %	AVERAGE YIELD 1962/64	AVERAGE YIELD 1972/74	AVERAGE YIELD 1982/84
		KG/HA		
BRASIL	-1.265***	13796.1	13167.2	11238.3
MEXICO	-1.071	0.0	20000.0	21500.0
	-1.262***	13796.1	13175.9	11248.6
BOLIVIA	0.583**	10589.7	13085.7	12446.0
COLOMBIA	3.070***	5628.7	8166.7	9615.8
CUBA	-0.050	6783.3	6776.6	6700.5
DOMINICAN RP	-2.880***	9955.6	10840.5	5710.3
ECUADOR	-0.263	8277.7	8443.6	9316.7
PARAGUAY	0.257	14064.9	14117.4	14707.0
PERU	0.114	9964.8	12424.5	10913.1
VENEZUELA	-1.968***	12861.0	7758.8	7906.0
TROPICAL SOUTH AMERICA	0.729***	9159.5	9604.7	10641.1
COSTA RICA	2.101***	3722.2	4247.4	4022.2
SALVADOR	1.524***	9000.0	12222.1	11500.0
GUATEMALA	0.296	2500.0	2876.0	3000.0
HONDURAS	-3.194***	5666.7	4796.6	4666.7
NICARAGUA	-0.441***	4111.1	4000.9	3904.8
PANAMA	-1.550***	9166.7	8770.9	7000.0
CENTRAL AMERICA,PANAMA	-0.243	5250.8	5692.3	5148.9
BARBADOS	-1.239***	31270.4	26465.6	24003.1
GUYANA	=0.000	10000.0	0.0	0.0
HAITI	0.579***	3677.8	4294.9	4072.1
JAMAICA	4.817***	2750.0	8392.1	7333.3
TRINIDAD ETC	2.116***	8968.6	11549.5	12431.7
CARIBBEAN	0.639***	3859.7	4512.1	4212.0
TROPICAL LATIN AMERICA	-0.990***	12725.4	12233.9	10882.5
ARGENTINA	-1.610***	11912.2	10535.6	8812.5
TEMPERATE SOUTH AMERICA	-1.610***	11912.2	10535.6	8812.5
LATIN AMERICA	-0.993***	12717.5	12220.1	10867.9

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 *P<0.05

CASSAVA — PRODUCTION, RELATIVE IMPORTANCE IN THE REGION AND PER CAPITA PRODUCTION LEVELS

COUNTRY	PRODUCTION 1000 MT 1962/64	1972/74	1982/84	PERCENTAGE OF TOTAL % 1982/84	PER CAPITA PRODUCTION KG 1982/84
BRUNEI	1	2	4	0.008	14
BURMA	4	23	63	0.133	2
CHINA	228	2310	3888	8.215	4
INDIA	2157	6273	5478	11.573	8
INDONESIA	11776	11534	13072	27.618	83
KAMPUCHEA DM	14	24	82	0.173	12
LAO	10	22	74	0.156	18
MALAYSIA	0	324	351	0.742	23
PHILIPPINES	567	511	1996	4.216	38
EAST TIMOR	13	14	0	0.000	0
SINGAPORE	3	3	1	0.002	0
SRI LANKA	321	547	648	1.370	41
THAILAND	1915	5294	18921	39.974	380
VIET NAM	1199	1076	2755	5.821	48
ASIA	18208	27956	47333	100.000	22

CASSAVA ANNUAL GROWTH RATES

COUNTRY	PRODUCTION 1965/74	PRODUCTION 1975/84	PRODUCTION 1965/84	AREA 1965/74	AREA 1975/84	AREA 1965/84	YIELD 1965/74	YIELD 1975/84	YIELD 1965/84
BRUNEI	2.7	5.0***	3.8***	1.6	17.9***	7.3***	1.0	-12.9**	-3.5**
BURMA	8.7*	18.3***	10.1***	9.0*	14.3***	9.8***	-0.3	4.0***	0.2
CHINA	15.8**	7.1***	8.1***	16.8**	3.2***	7.0***	-1.0	3.9***	1.1***
INDIA	8.3***	-1.9***	2.5***	4.2***	-3.3***	0.6	4.2***	1.4**	1.9***
INDONESIA	-0.1	0.8	1.2***	-1.3*	-0.4	-0.9***	1.2**	1.3***	2.1***
KAMPUCHEA DM	-1.7	1.7	10.6***	3.8	3.6	14.9***	-5.5***	-1.8	-4.3***
LAO	10.8***	12.6***	12.6***	7.3***	13.3***	11.5***	3.6***	-0.7	1.1***
MALAYSIA	4.2***	-0.1	2.4***	-2.5	-1.1	1.2*	6.7**	1.0	1.2*
PHILIPPINES	-0.9	9.1**	10.4***	0.5	6.6***	6.7***	-1.4	2.5	3.7***
EAST TIMOR	4.0	0.0	4.0	7.7***	0.0	7.7***	-3.7	0.0	-3.7
SINGAPORE	-4.3*	-1.8	-10.6***	0.2	1.1	-6.1**	-4.4**	-2.9	-4.4
SRI LANKA	6.5**	-1.3	3.8***	9.6**	-12.3***	-0.3	-3.1**	11.0***	4.1***
THAILAND	14.9***	8.7***	14.6***	16.7***	6.0**	14.3***	-1.8*	2.7**	0.3
VIET NAM	0.7	6.3*	8.1***	0.7	10.5***	8.9***	0.0	-4.2***	-0.9**
ASIA	4.6***	4.0***	5.6***	2.3***	2.2**	3.3***	2.3***	1.8***	2.3***

CASSAVA TRENDS IN YIELD LEVEL BY COUNTRY 1962/84

COUNTRY	ANNUAL GROWTH RATE IN YIELD 1962/84 %	AVERAGE YIELD 1962/64	AVERAGE YIELD 1972/74	AVERAGE YIELD 1982/84
		KG/HA		
BRUNEI	-1.976*	5567.0	7426.1	3666.7
BURMA	0.659	8684.2	10071.5	11900.0
CHINA	0.729**	13148.1	12264.0	15489.1
INDIA	3.168***	8607.6	17339.3	17924.3
INDONESIA	1.656***	7644.0	7845.9	9838.3
KAMPUCHEA DM	-4.051***	13666.7	9737.5	7469.2
LAO	3.070***	6666.7	15239.3	14800.0
MALAYSIA	1.204*	0.0	13998.0	12113.6
PHILIPPINES	2.845***	6337.2	5630.6	8798.1
EAST TIMOR	-2.079	2355.6	1808.4	0.0
SINGAPORE	-4.366	13852.8	8977.1	10989.0
SRI LANKA	2.332**	7620.5	4854.2	11552.4
THAILAND	-0.033	15680.1	12810.9	16662.5
VIET NAM	-0.634**	7208.9	7298.7	5639.7
ASIA	2.209***	8132.6	9875.4	12293.1

TRENDS IN PRODUCTION, CONSUMPTION AND TRADE OF BEEF AND MILK IN LATIN AMERICA

Carlos Seré

Meats, milk and dairy products are commodities which rank high in the preference of Latin American consumers, a fact reflected by the relatively high income elasticities of these products in most countries of the region (see NORES and RUBINSTEIN, 1980; ANDERSEN, LONDOÑO and HOOVER, 1976; SANINT, RIVAS, DUQUE and SERE, 1985; FAO, 1971; SARMA and YEUNG, 1985).

The marked economic recession of the eighties throughout the region caused an important drop in per capita incomes. During the period 1980-84 per capita income declined in all countries of Latin America except the Dominican Republic (0.3% p.a.) and Panama (0.2% p.a.). Extreme cases were Bolivia (-5.5%), El Salvador (-4.8%), Venezuela and Uruguay (-3.5%) (CEPAL, 1985).

Given the high income elasticities, this resulted in a recession in these markets. This was aggravated by the simultaneous expansion of surplus production in developed economies, reductions in access to developed country markets, and increased competition in third world markets.

Beef

In 1984, Latin America produced 8.2 million MT of beef (carcass weight) of which 62% was produced in the tropical region and 38% in the temperate region.

During the period 1977-84, production growth rates have tended to decline throughout the region, particularly in temperate Latin America, Brazil and Paraguay, i.e. net exporting countries. Production has grown at high rates in some Caribbean countries, Mexico and Peru, which are net importers. In Latin America as a whole production growth rates of 1.4% p.a. for the period 1969/76 dropped to -0.2% during the period 1977/84.

Productivity has basically remained constant since 1968 at a level of 29 kg beef c.w. per head in stock while production per capita has declined at a rate of -0.7% p.a. for Latin America as a whole during the period 1968/84. A particularly drastic case is the Cuban one: beef production per capita declined at an annual rate of -3.19% for the period 1968/84 while milk production expanded at a rate of 3.29% during the same period. A similar reduction in beef production per capita is observed in Paraguay, part of which may be explained by illegal trade with Brazil.

International beef prices have dropped markedly since 1980 and this is also reflected by domestic prices, particularly in countries like Argentina and Brazil where the drop in internal demand caused by decreasing per capita incomes coincided with weak international markets. Colombia's beef prices still are about two times the international price for beef from larger South American exporting countries. Nevertheless, Colombia had net exports of 7,000 MT in 1984, which were made possible through export incentives and barter trade.

Latin America still was a net beef exporter in 1984 but volumes dropped mainly due to the drastic reduction of beef production in Argentina. Tropical Latin America had a balanced situation during the period 1976/83 with average net imports of only 3,000 T. Due to the recession, in 1984 the region became a net exporter of 75,000 MT. This was mainly due to the increase of beef exports from Brazil, overriding the increase in net imports of Mexico.

The regional self-sufficiency index declined slightly from 113% to 110% between 1969/76 and 1977/84. Per capita consumption has remained constant during the period 1969/76 and 1977/84. This nevertheless masks the drop in consumption which occurred during the last few years.

This drop in demand is clearly shown by the reduction is growth rates of potential demand. While in the period 1970/80 potential beef demand of Latin America was growing at a rate of 4.95% percent p.a. as production was growing at 2.64% (see Trend Highlights 1982), during the period 1980/84 potential demand grew at a rate of only 1.2% and supply declined by -0.3%. This drastic change is clearly reflected in the evolution of domestic beef prices.

This picture of decreasing prices, stagnant consumption and increased exports has been shown to be directly linked to declining per capita incomes. Economic recovery and policies to support consumer incomes might very rapidly turn this scenario into the one prevailing in the seventies, where demand was rapidly outpacing supply.

Milk and Dairy Products

Milk production is stagnating in Latin America. In 1984, 34 million MT were produced (79% in tropical America, 21% in the temperate region). Growth rates of production dropped from 3.9% in the period 1969/76 to 1.6% p.a. in the period 1977/84, a rate below regional population growth (2.3% during the period 1977/84).

No major changes have occurred in terms of productivity, neither per capita nor per cow in stock.

Latin America as a whole is a traditional net importer of milk powder. This tendency has increased markedly in 1984. The largest importers of the region, Venezuela and Mexico, have expanded volumes imported over the levels of 1976/83. Central America's situation has also deteriorated markedly with net imports during 1984 of almost double the average over the period 1976/83.

Comparing the period 1969/76 and 1977/84 it can be observed that while temperate South America somewhat reduced its high consumption level, in the tropics per capita production rose from 86 to 94 kg. This increase was particularly high in Venezuela and in Cuba, the country with the highest per capita consumption level of tropical America.

Per capita consumption showed a substantial decline in Nicaragua (from 179.8 kg in 1969/76 to 97.7 kg in 1977/84); in spite of this the country changed from being a net exporter to a net importer.

Self sufficiency levels have tended to decrease throughout tropical America. They are particularly low in the Caribbean, Central America, Bolivia and Venezuela.

Cuba is an interesting case where the official policy has been to shift resources from beef to milk production. This has apparently been achieved as shown by very high milk consumption and increasing self sufficiency levels.

The dairy scenario of tropical America has been influenced by the oversupply on the world market and the consequent low international price of dairy products. Domestic prices have dropped, production has slowed down, while imports and per capita consumption have expanded. This situation cannot be expected to change in the short run.

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BBBBBBBB   EEEEEEEEE  EEEEEEEEE  FFFFFFFFF             VV      VV  EEEEEEEEE      AAA     LL
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BEEF AND VEAL : STOCKS AND PRODUCTION FOR SELECTED REGIONS
1984

Region and Country	Production		Stocks	
	Total 000mt	%	Total 000heads	%
WORLD	45751	100.0	1272541	100.0
UNITED STATES	10927	23.9	114040	9.0
EUROPE	11045	24.1	134235	10.5
LATIN AMERICA	8171	17.9	269918	21.2
TROPICAL L.A.	5046	11.0	202075	15.9
Brazil	2293	5.0	132801	10.4
Colombia	629	1.4	23960	1.9
Venezuela	330	0.7	12283	1.0
TEMPERATE L.A.	3125	6.8	67843	5.3
Argentina	2570	5.6	53500	4.2
ASIA	2730	6.0	373563	29.4
AFRICA	3028	6.6	175586	13.8
OCEANIA	1751	3.8	30534	2.4

BEEF AND VEAL PRODUCTION, RELATIVE IMPORTANCE IN THE REGION AND PER CAPITA PRODUCTION LEVELS

COUNTRY	PRODUCTION -----1000 MT----- 1968/75	1976/83	1984	PERCENTAGE OF TOTAL % 1984	PER CAPITA PRODUCTION KG 1984
BRAZIL	1967	2301	2293	28.18	17
MEXICO	465	614	780	9.58	10
	2432	2916	3073	37.76	15
BOLIVIA	56	83	93	1.14	15
COLOMBIA	422	586	629	7.73	22
CUBA	176	147	151	1.86	15
DOMINICAN RP	35	48	57	0.70	9
ECUADOR	58	86	110	1.35	12
PARAGUAY	118	108	85	1.04	24
PERU	91	91	104	1.28	5
VENEZUELA	217	319	330	4.06	19
TROPICAL SOUTH AMERICA	1172	1468	1559	19.16	16
COSTA RICA	49	75	62	0.76	24
EL SALVADOR	23	30	30	0.37	6
GUATEMALA	57	74	64	0.79	8
HONDURAS	35	56	65	0.80	15
NICARAGUA	59	66	60	0.74	19
PANAMA	38	46	50	0.61	23
CENTRAL AMERICA PANAMA	260	348	331	4.07	13
BARBADOS	0	0	0	0.00	0
GUYANA	4	4	4	0.05	4
HAITI	19	25	33	0.41	5
JAMAICA	11	12	12	0.15	5
TRINIDAD TOB	1	2	1	0.01	1
CARIBBEAN	36	43	50	0.61	5
TROPICAL LATIN AMERICA	3901	4775	5013	61.60	14
ARGENTINA	2376	2850	2570	31.58	85
CHILE	158	182	200	2.46	17
URUGUAY	326	367	355	4.36	119
TEMPERATE SOUTH AMERICA	2861	3399	3125	38.40	70
LATIN AMERICA	6762	8173	8138	100.00	21

COLUMNS MAY NOT ADD EXACTLY DUE TO ROUNDING

AREA IN ANNUAL AND PERMANET CROPS AND PERMANENT PASTURES

COUNTRY	PERMANENT PASTURES 1967/74	PERMANENT PASTURES 1975/82	PERMANENT PASTURES 1983	ANNUAL AND PERMANENT CROPS 1967/74	ANNUAL AND PERMANENT CROPS 1975/82	ANNUAL AND PERMANENT CROPS 1983
	000 HAS.					
BRAZIL	144192	158500	164000	54799	66003	74700
MEXICO	74499	74499	74499	23207	23288	23600
	218691	232999	238499	78006	89290	98300
BOLIVIA	27563	27081	26950	2403	3339	3375
COLOMBIA	30000	30000	30000	5097	5549	5690
CUBA	2542	2587	2490	2615	3169	3215
DOMINICAN RP	1369	1784	2092	1135	1319	1460
ECUADOR	2339	3204	4600	2564	2592	2482
PARAGUAY	14569	15419	15550	964	1666	1940
PERU	27120	27120	27120	2898	3385	3517
VENEZUELA	16468	17094	17350	3512	3686	3758
TROPICAL SOUTH AMERICA	121968	124289	126152	21187	24705	25437
COSTA RICA	1367	1805	2167	491	537	635
EL SALVADOR	610	610	610	639	700	725
GUATEMALA	934	1082	1334	1590	1757	1815
HONDURAS	3400	3400	3400	1555	1732	1720
NICARAGUA	3384	4147	5050	1445	1378	1267
PANAMA	1127	1161	1161	547	570	584
CENTRAL AMERICA PANAMA	10822	12205	13722	6266	6674	6796
BARBADOS	4	4	4	33	33	33
GUYANA	999	1110	1230	372	437	495
HAITI	625	519	502	812	882	899
JAMAICA	234	209	200	249	265	269
TRINIDAD TOB	10	11	11	142	158	158
CARIBBEAN	1872	1853	1947	1608	1774	1854
TROPICAL LATIN AMERICA	353353	371345	380320	107067	122443	132387
ARGENTINA	144480	143350	142900	33361	35121	35700
CHILE	11099	11809	11900	4926	5455	5528
URUGUAY	13632	13605	13632	1843	1674	1446
TEMPERATE SOUTH AMERICA	169210	168764	168432	40131	42250	42674
LATIN AMERICA	522563	540109	548752	147198	164693	175061

BEEF AND VEAL PRODUCTION PER CAPITA 1968/84

COUNTRY	ANNUAL GROWTH RATE 1968/84 %	AVERAGE 1968/75	AVERAGE 1976/83	1984
		---KG/YEAR---		
BRAZIL	-0.55	19.8	19.1	17.3
MEXICO	0.50	8.7	8.9	10.1
	-0.41	15.9	15.4	14.7
BOLIVIA	2.04***	12.5	15.0	15.0
COLOMBIA	1.27***	19.6	22.9	22.4
CUBA	-3.19***	20.2	15.1	15.2
DOMINICAN RP	1.68***	7.4	8.3	9.3
ECUADOR	1.80***	9.2	10.8	12.1
PARAGUAY	-4.85***	49.4	35.0	23.8
PERU	-2.15***	6.5	5.2	5.4
VENEZUELA	0.71**	18.7	20.8	18.5
TROPICAL SOUTH AMERICA	-0.11	15.9	16.3	15.6
COSTA RICA	1.14	26.9	34.3	24.5
SALVADOR	0.26	6.1	6.4	5.6
GUATEMALA	-0.89	10.3	10.4	7.8
HONDURAS	2.36***	12.5	15.3	15.4
NICARAGUA	-2.87***	28.3	24.8	19.0
PANAMA	0.13	24.0	24.1	23.4
CENTRAL AMERICA PANAMA	-0.14	14.8	15.6	12.9
BARBADOS	-6.44**	1.8	.	.
GUYANA	-2.54***	5.7	4.4	4.3
HAITI	1.37***	4.1	4.4	5.1
JAMAICA	-0.46	5.7	5.6	5.2
TRINIDAD ETC	-1.89*	1.4	1.3	0.9
CARIBBEAN	0.38*	4.2	4.2	4.5
TROPICAL LATIN AMERICA	-0.28*	15.4	15.3	14.5
ARGENTINA	-0.72	97.1	102.0	85.4
CHILE	0.06	16.5	16.5	16.8
URUGUAY	0.67	115.5	126.0	118.7
TEMPERATE SOUTH AMERICA	-0.57	77.5	81.2	69.5
LATIN AMERICA	-0.72**	23.4	23.1	20.8

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 *P<0.05

BEEF AND VEAL ANNUAL GROWTH RATES OF PRODUCTION ,POPULATION AND PRODUCTION PER CAPITA. 1969/84

	PRODUCTION		POPULATION		PRODUCTION PER CAPITA	
	1969/76	1977/84	1969/76	1977/84	1969/76	1977/84
BRAZIL	3.0***	0.2	2.6***	2.2***	0.5	-1.9
MEXICO	2.6***	4.1***	3.2***	2.6***	-0.6	1.5
	3.0***	1.1	2.8***	2.3***	0.2	-1.2
BOLIVIA	5.1***	3.1***	2.4***	2.6***	2.6**	0.5
COLOMBIA	3.1**	1.8***	2.2***	2.2***	0.9	-0.4
CUBA	-7.2***	1.1**	1.7***	0.6***	-8.8***	0.5
DOMINICAN RP	3.8***	5.2***	2.9***	1.2***	0.9	3.9***
ECUADOR	3.3**	4.1***	2.9***	3.1***	0.3	1.0
PARAGUAY	-3.3**	-4.8***	3.1***	3.1***	-6.5***	-7.9***
PERU	-1.8**	3.1**	2.7***	2.3***	-4.5***	0.8
VENEZUELA	4.2***	2.1*	3.6***	3.4***	0.6	-1.3
TROPICAL SOUTH AMERICA	1.1	1.7***	2.6***	2.3***	-1.5*	-0.6
COSTA RICA	8.4***	-4.6**	2.5***	3.1***	5.8***	-7.7***
SALVADOR	7.9***	0.0	2.9***	2.9***	5.0**	-2.8**
GUATEMALA	1.4	-1.1	3.1***	3.0***	-1.6	-4.0
HONDURAS	4.6**	4.9**	3.2***	3.5***	1.4	1.4
NICARAGUA	1.9	-5.0	3.3***	3.5***	-1.4	-8.6**
PANAMA	4.9***	3.0*	2.7***	2.4***	2.2***	0.6
CENTRAL AMERICA PANAMA	4.4***	-1.0*	3.0***	3.1***	1.4	-4.0***
BARBADOS	-17.8***	22.1*	0.5***	0.8**	-18.3***	20.3*
GUYANA	-0.9	3.2**	2.2***	1.7***	-3.2***	1.5
HAITI	2.6***	6.3***	2.3***	2.4***	0.3	3.9***
JAMAICA	1.5	0.0	1.7***	1.2***	-0.3	-1.2*
TRINIDAD ETC	-2.5*	-6.8	1.1***	-0.5	-3.6**	-6.4
CARIBBEAN	1.5***	3.9***	1.9***	1.8***	-0.5	2.1***
TROPICAL LATIN AMERICA	2.5***	1.2*	2.7***	2.4***	-0.2	-1.2*
ARGENTINA	-0.4	-3.3***	1.7***	1.6***	-2.1	-4.9***
CHILE	2.8	3.3***	1.7***	1.7***	1.1	1.6
URUGUAY	1.3	3.2	0.2***	0.6***	1.1	2.6
TEMPERATE SOUTH AMERICA	-0.0	-2.2**	1.6***	1.6***	-1.6	-3.8***
LATIN AMERICA	1.4	-0.2	2.6***	2.3***	-1.2	-2.5***

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

BEEF AND VEAL PRODUCTION PER HEAD IN STOCK 1968/84

COUNTRY	ANNUAL GROWTH RATE 1968/84 %	AVERAGE 1968/75	AVERAGE 1976/83	1984
		KG/HEAD		
BRAZIL	-1.33**	24.3	23.6	17.3
MEXICO	0.39	18.1	18.9	20.8
	-0.97**	22.8	22.4	18.0
BOLIVIA	-0.23	21.9	21.3	21.6
COLOMBIA	1.98***	20.0	24.2	26.4
CUBA	-1.98***	29.7	24.9	23.6
DOMINICAN RP	-0.19	25.5	23.9	28.6
ECUADOR	2.41***	24.1	29.3	33.3
PARAGUAY	-2.96***	25.8	20.1	16.7
PERU	1.11	22.4	22.5	36.8
VENEZUELA	1.54***	25.5	30.5	26.9
TROPICAL SOUTH AMERICA	0.73***	23.2	25.0	26.0
COSTA RICA	-0.03	30.3	35.7	24.3
SALVADOR	3.33***	21.4	24.9	32.0
GUATEMALA	-0.37	36.6	45.2	24.6
HONDURAS	2.05***	21.2	24.7	26.7
NICARAGUA	0.36	25.5	26.1	30.0
PANAMA	1.09**	30.1	32.7	34.0
CENTRAL AMERICA PANAMA	0.81*	27.4	31.0	27.6
BARBADOS	-6.04**	23.2	.	.
GUYANA	-1.49***	15.5	13.2	12.8
HAITI	0.42***	23.7	24.7	24.4
JAMAICA	-0.46	41.5	41.5	37.7
TRINIDAD ETC	-2.74**	22.3	19.9	13.2
CARIBBEAN	-0.18	25.3	25.3	24.1
TROPICAL LATIN AMERICA	-0.38	23.2	23.6	20.5
ARGENTINA	0.32	45.9	50.7	48.0
CHILE	-0.21	50.6	50.2	51.7
URUGUAY	-0.23	34.6	34.5	37.4
TEMPERATE SOUTH AMERICA	0.21	44.4	48.2	46.7
LATIN AMERICA	-0.47	29.1	29.9	26.1

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 *P<0.05

BEEF AND VEAL ANNUAL GROWTH RATES OF PRODUCTION ,STOCKS AN PRODUCTION/HEAD IN STOCK 1969/84

COUNTRY	PRODUCTION 1969/76	PRODUCTION 1977/84	STOCK 1969/76	STOCK 1977/84	PRODUCTION/HEAD IN STOCK 1969/76	PRODUCTION/HEAD IN STOCK 1977/84
BRAZIL	3.0***	0.2	3.7***	6.3*	-0.6	-6.1***
MEXICO	2.6***	4.1***	2.5***	4.4*	0.1	-0.3
	3.0***	1.1	3.4***	5.8*	-0.4	-4.7***
BOLIVIA	5.1***	3.1***	6.7***	2.3*	-1.6	0.8*
COLOMBIA	3.1**	1.8***	2.8***	-0.2	0.3	2.1***
CUBA	-7.2***	1.1**	-2.5**	1.9*	-4.7***	-0.8*
DOMINICAN RP	3.8***	5.2***	9.3***	-0.7	-5.5***	5.9***
ECUADOR	3.3**	4.1***	0.7*	3.1*	2.5**	1.0
PARAGUAY	-3.3**	-4.8***	3.0***	-2.0*	-6.3***	-2.7**
PERU	-1.8**	3.1**	0.9	-3.3*	-2.6***	6.4**
VENEZUELA	4.2***	2.1*	2.0***	3.4*	2.2**	-1.3
TROPICAL SOUTH AMERICA	1.1	1.7***	2.2***	0.6*	-1.1	1.1*
COSTA RICA	8.4***	-4.6**	3.7***	4.2*	4.7**	-8.9***
SALVADOR	7.9***	0.0	-1.9	-5.7*	9.8***	5.7**
GUATEMALA	1.4	-1.1	0.2	8.4*	1.2	-9.5**
HONDURAS	4.6**	4.9**	2.6***	3.7*	2.0	1.1
NICARAGUA	1.9	-5.0	2.2*	-4.9*	-0.3	-0.2
PANAMA	4.9***	3.0*	2.3***	0.9*	2.6***	2.1
CENTRAL AMERICA PANAMA	4.4***	-1.0*	1.8***	1.5*	2.7*	-2.4***
BARBADOS	-17.8***	22.1*	0.6	-0.3	-18.3***	20.0*
GUYANA	-0.9	3.2**	1.5***	2.5*	-2.5**	0.6
HAITI	2.6***	6.3***	1.3**	6.3*	1.3***	0.0
JAMAICA	1.5	0.0	1.1**	1.9*	0.3	-1.9**
TRINIDAD ETC	-2.5*	-6.8	2.8***	0.2	-5.3***	-7.1
CARIBBEAN	1.5***	3.9***	1.4***	4.6*	0.1	-0.8*
TROPICAL LATIN AMERICA	2.5***	1.2*	2.9***	4.1*	-0.5	-3.0***
ARGENTINA	-0.4	-3.3***	2.9***	-1.9*	-3.3	-1.4
CHILE	2.8	3.3***	3.0***	1.9*	-0.2	1.4
URUGUAY	1.3	3.2	3.9***	-0.1	-2.6	3.3
TEMPERATE SOUTH AMERICA	-0.0	-2.2**	3.1***	-1.4*	-3.1	-0.8
LATIN AMERICA	1.4	-0.2	3.0***	2.8*	-1.6	-3.0***

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

BEEF AND VEAL* SUMMARY OF LATIN AMERICA TRADE (THOUSAND TONS)

REGION	EXPORT			IMPORT			+IMPORT-EXPORT		
	1968/75	1976/83	1984	1968/75	1976/83	1984	1968/75	1976/83	1984
BRAZIL	73	41	116	11	127	35	-62	86	-81
MEXICO	29	16	2	1	6	53	-28	-10	51
	102	57	118	12	133	88	-90	76	-30
BOLIVIA	1	1	0	0	0	0	-1	-1	0
COLOMBIA	17	17	8	1	1	1	-16	-16	-7
CUBA	2	0	0	0	1	0	-2	1	0
DOMINICAN RP	6	3	1	1	1	1	-5	-2	0
ECUADOR	0	1	0	0	0	0	0	-1	0
PARAGUAY	10	3	7	0	0	0	-10	-3	-7
PERU	0	0	0	7	9	10	7	9	10
VENEZUELA	0	1	0	2	17	6	2	16	6
TROPICAL SOUTH AMERICA	36	26	16	11	29	18	-25	3	2
COSTA RICA	22	29	20	1	1	0	-21	-28	-20
SALVADOR	2	4	2	1	1	0	-1	-3	-2
GUATEMALA	14	14	9	1	1	0	-13	-13	-9
HONDURAS	15	22	14	0	1	0	-15	-21	-14
NICARAGUA	23	23	11	1	1	0	-22	-22	-11
PANAMA	2	2	3	1	1	0	-1	-1	-3
CENTRAL AMERICA PANAMA	78	94	59	5	6	0	-73	-88	-59
BARBADOS	1	1	0	2	3	3	1	2	3
GUYANA	1	1	0	1	0	0	0	-1	0
HAITI	1	1	1	1	1	1	0	0	0
JAMAICA	1	0	0	4	4	1	3	4	1
TRINIDAD	1	1	1	3	8	9	2	7	8
CARIBBEAN	5	4	2	11	16	14	6	12	12
TROPICAL LATIN AMERICA	221	181	195	39	184	120	-182	3	-75
ARGENTINA	262	245	134	0	0	0	-262	-245	-134
CHILE	1	2	0	21	5	5	20	3	5
URUGUAY	100	115	92	0	0	0	-100	-115	-92
TEMPERATE SOUTH AMERICA	363	362	226	21	5	5	-342	-357	-221
LATIN AMERICA	584	543	421	60	189	125	-524	-354	-296

*FRESH, CHILLED OR FROZEN

BEEF AND VEAL *   PRODUCTION,TRADE AND APPARENT CONSUMPTION

COUNTRY	1969/76 PRODUCTION	1969/76 +IMPORT -EXPORT	1969/76 APPARENT CONSUMPTION	1969/76 APPARENT PER CAPITA CONSUMPTION	1969/76 SELF SUFFICIENCY INDEX	1977/84 PRODUCTION	1977/84 +IMPORT -EXPORT	1977/84 APPARENT CONSUMPTION	1977/84 APPARENT PER CAPITA CONSUMPTION	1977/84 SELF SUFFICIENCY INDEX
	1000 MT			KG		1000 MT			KG	
BRAZIL	2027.0	-144.2	1882.8	18.5	107.7	2316.1	-156.8	2159.3	17.5	107.3
MEXICO	474.8	-23.4	451.4	8.1	105.2	645.9	2.0	647.9	9.2	99.7
	2501.8	-167.6	2334.2	14.83	107.18	2962	-154.8	2807.2	14.48	105.51
BOLIVIA	59.0	-0.7	58.4	12.7	101.2	85.8	0.3	86.1	15.2	99.6
COLOMBIA	442.5	-18.8	423.7	19.3	104.4	596.9	-14.5	582.3	22.2	102.5
CUBA	167.0	71.7	238.7	26.7	70.0	148.1	87.8	235.9	24.2	62.8
DOMINICAN RP	36.4	-4.4	32.0	6.6	113.7	49.7	-1.7	48.0	8.2	103.5
ECUADOR	60.0	0.1	60.1	9.4	99.8	91.2	0.2	91.4	11.2	99.8
PARAGUAY	116.3	-39.4	76.9	30.9	151.2	106.4	-10.3	96.1	29.8	110.7
PERU	90.9	7.6	98.5	6.8	92.3	92.8	9.7	102.5	5.8	90.5
VENEZUELA	228.6	2.4	231.0	19.2	99.0	326.1	19.1	345.2	21.7	94.5
TROPICAL SOUTH AMERICA	1200.7	18.51	1219.3	16.09	98.48	1497	90.65	1587.6	17.16	94.29
COSTA RICA	54.0	-23.2	30.8	16.7	175.5	72.8	-28.0	44.9	19.7	162.3
EL SALVADOR	24.6	-0.4	24.2	6.3	101.5	29.9	1.3	31.2	6.4	95.8
GUATEMALA	59.0	-16.3	42.6	7.4	138.3	73.8	-26.5	47.3	6.4	156.1
HONDURAS	37.0	-14.7	22.3	7.8	166.0	58.7	-18.5	40.3	10.7	145.8
NICARAGUA	61.7	-22.7	39.0	18.2	158.2	64.6	-19.1	45.5	16.2	142.0
PANAMA	39.8	4.7	44.5	27.6	89.3	46.5	4.7	51.1	26.1	90.9
CENTRAL AMERICA PANAMA	276.08	-72.58	203.50	12.50	135.67	346.41	-86.07	260.34	12.52	133.06
BARBADOS	0.4	6.5	7.0	28.8	6.0	0.3	5.6	5.8	22.7	4.9
GUYANA	4.1	0.8	4.9	6.6	83.9	3.8	0.0	3.8	4.3	99.1
HAITI	20.0	-0.3	19.7	4.0	101.6	26.9	0.0	26.9	4.6	99.9
JAMAICA	11.1	11.6	22.7	11.6	48.8	12.3	8.5	20.7	9.4	59.1
TRINIDAD TOB	1.5	6.3	7.8	7.4	18.7	1.5	14.4	15.9	14.1	9.2
CARIBBEAN	37.04	24.98	62.02	6.98	59.72	44.69	28.55	73.25	7.07	61.02
TROPICAL LATIN AMERICA	4015.7	-196.7	3819.0	14.8	105.1	4850.1	-121.7	4728.4	14.9	102.6
ARGENTINA	2407.6	-496.5	1911.1	76.4	126.0	2819.6	-498.6	2321.0	81.5	121.5
CHILE	161.3	20.1	181.5	18.5	88.9	182.0	6.1	188.0	16.8	96.8
URUGUAY	334.3	-109.0	225.3	79.5	148.4	361.2	-117.3	243.9	83.2	148.1
TEMPERATE SOUTH AMERIC	2903.2	-585.4	2317.8	61.6	125.3	3362.8	-609.9	2752.9	64.6	122.2
LATIN AMERICA	6918.9	-782.1	6136.8	20.6	112.7	8212.9	-731.5	7481.3	20.6	109.8

*FRESH,CHILLED OR FROZEN

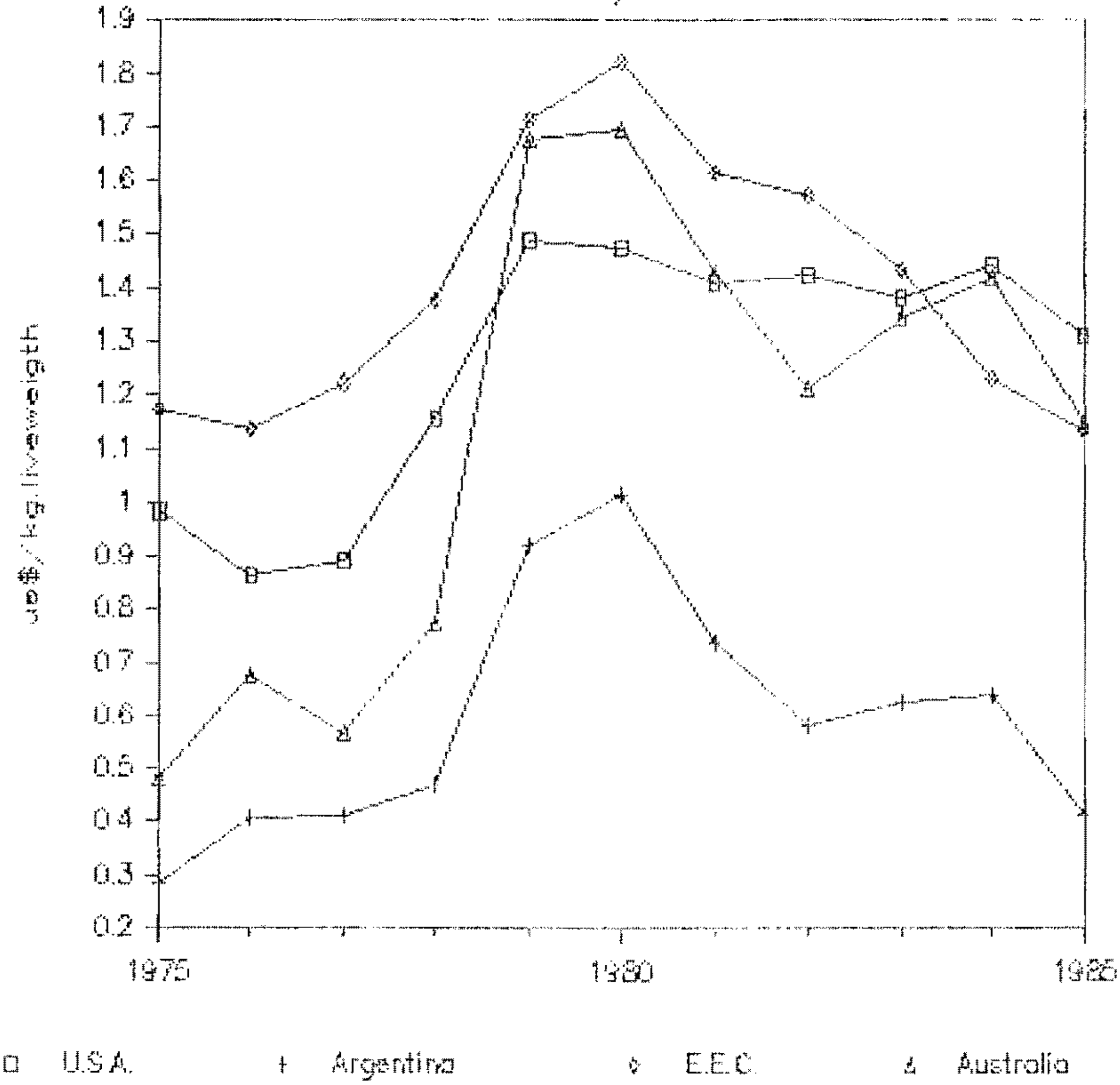
Beef and Veal:Annual Growth Rates of Potential Domestic Demand and Production by Country. Average 1980/84

Region and Country	Annual Growth Rate	
	Demand	Production
Tropical Latin America	1.2	1.6
Brazil	1.2	1.3
Mexico	1.8	6.5
Bolivia	-2.9	1.3
Colombia	2.0	1.0
Ecuador	1.7	3.3
Paraguay	2.9	-8.4
Peru	0.1	6.4
Venezuela	1.5	-1.2
Cuba	n.d.	-0.3
Dominican RP	2.6	3.8
Central America & Panama	0.7	-1.1
Costa Rica	0.5	-7.9
El Salvador	-1.0	1.4
Guatemala	0.3	-8.3
Honduras	1.4	5.2
Nicaragua	2.7	5.0
Panama	2.3	3.8
Caribbean	-0.3	3.4
Guyana	4.5	0.0
Haiti	-0.7	8.1
Jamaica	-2.9	-2.4
Trinidad & Tobago	2.2	-20.8
Temperate Latin America	1.0	-3.1
Argentina	1.3	-3.8
Chile	0.3	5.4
Uruguay	0.3	-2.6
Latin America	1.2	-0.3

Demand estimated using $d=p+ey+eyp$
where d=annual growth rate of domestic demand
p=annual growth rate of population
y=annual growthrate of real per capita income
e=income elasticity of demand

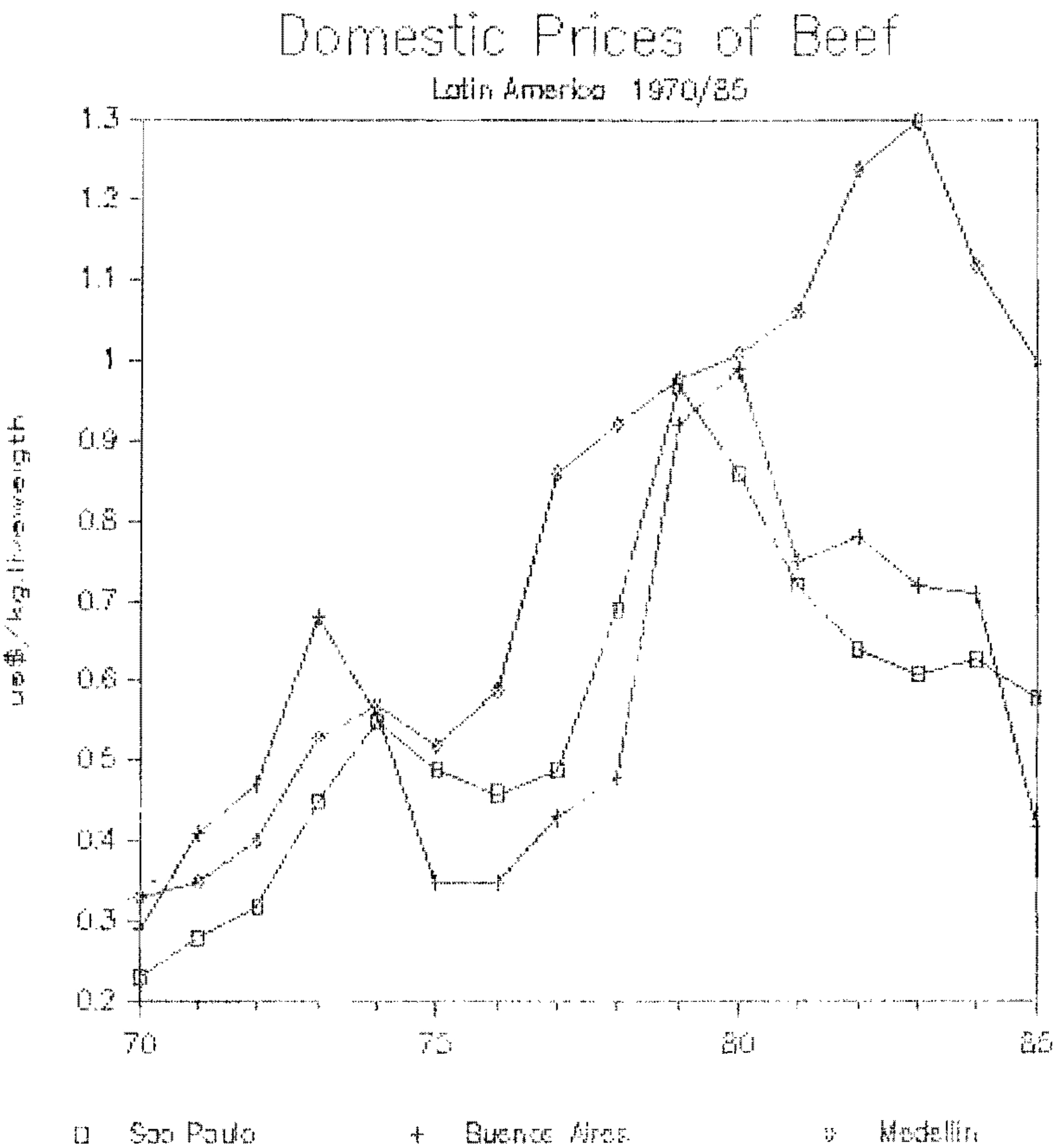
International Beef Prices

1975/1985



Australia: Wholesale, Brisbane, Oxen 301-320 kg, slaught. W.T.
Argentina: Buenos Aires, Wholesale Liniers, young bulls, liveweight.
E.E.C.: Wholesale, adult, weighted average liveweight.
U.S.A.: Wholesale Omaha. Steers 900-1100 lb liveweight.

SOURCE: FAO (several issues)



Sources: BRASIL: IBGE (several issues)
COLOMBIA: FADEGAN and public services company of Medellín
ARGENTINA: JUNTA NACIONAL DE CARNES (1986)

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 CCCCCCC    OOOOOOO   WW      WW          M       M   IIIIII    LL          KK      KK
CCCCCCCCC  OOOOOOOOO  WW      WW          MM     MM   IIIIII    LL          KK     KK
CC     CC  OO     OO  WW      WW          MMM   MMM     II      LL          KK    KK
CC         OO     OO  WW      WW          MMMM MMMM     II      LL          KK   KK
CC         OO     OO  WW      WW          MM MMM MM     II      LL          KKKK
CC         OO     OO  WW      WW          MM  M  MM     II      LL          KKKK
CC         OO     OO  WW   W  WW          MM     MM     II      LL          KK   KK
CC     CC  OO     OO  WW WWW WW           MM     MM     II      LL          KK    KK
CCCCCCCCC  OOOOOOOOO   WWW WWW            MM     MM   IIIIII    LLLLLLLLL   KK     KK
 CCCCCCC    OOOOOOO     W   W             MM     MM   IIIIII    LLLLLLLLL   KK      KK
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COW MILK

PRODUCTION,RELATIVE IMPORTANCE IN THE REGION
AND PER CAPITA PRODUCTION LEVELS

COUNTRY	PRODUCTION 1000 MT 1968/75	1976/83	1984	PERCENTAGE OF TOTAL % 1984	PER CAPITA PRODUCTION KG 1984
BRAZIL	7908	10690	10500	30.79	79
MEXICO	4154	6560	7227	21.19	94
	12063	17249	17727	51.98	85
BOLIVIA	42	65	80	0.23	13
COLOMBIA	2212	2421	2800	8.21	100
CUBA	727	1121	1100	3.23	110
DOMINICAN RP	299	403	460	1.35	75
ECUADOR	729	866	990	2.90	109
PARAGUAY	96	155	165	0.48	46
PERU	808	801	750	2.20	39
VENEZUELA	1013	1341	1487	4.36	83
TROPICAL SOUTH AMERICA	5926	7173	7832	22.96	78
COSTA RICA	212	307	340	1.00	134
EL SALVADOR	182	269	249	0.73	46
GUATEMALA	275	318	330	0.97	40
HONDURAS	172	229	280	0.82	66
NICARAGUA	379	289	125	0.37	40
PANAMA	72	91	92	0.27	43
CENTRAL AMERICA PANAMA	1293	1503	1416	4.15	55
BARBADOS	6	7	8	0.02	31
GUYANA	17	13	15	0.04	16
HAITI	20	21	22	0.06	3
JAMAICA	45	49	48	0.14	21
TRINIDAD TOB	9	7	8	0.02	7
CARIBBEAN	96	97	101	0.30	9
TROPICAL LATIN AMERICA	19377	26023	27076	79.39	78
ARGENTINA	4977	5417	5200	15.25	173
CHILE	967	1039	950	2.79	80
URUGUAY	721	803	880	2.58	294
TEMPERATE SOUTH AMERICA	6664	7259	7030	20.61	156
LATIN AMERICA	26042	33282	34106	100.00	87

COLUMNS MAY NOT ADD EXACTLY DUE TO ROUNDING

COW MILK: STOCKS AND PRODUCTION FOR SELECTED REGIONS
1984

Region and Country	Production		Stocks	
	Total 000mt	%	Total 000heads	%
WORLD	448587	100.0	221546	100.0
UNITED STATES	61436	13.7	11200	5.1
EUROPE	185399	41.3	50817	22.9
LATIN AMERICA	34578	7.7	36462	16.5
TROPICAL L.A.	27546	6.1	32313	14.6
Brazil	10500	2.3	14700	6.6
Colombia	2800	0.6	2800	1.3
Venezuela	1467	0.3	1387	0.6
TEMPERATE L.A.	7030	1.6	4150	1.9
Argentina	5200	1.2	2970	1.3
ASIA	37212	8.3	51158	23.1
AFRICA	10930	2.4	22392	10.1
OCEANIA	13631	3.0	3888	1.8

COW MILK PRODUCTION PER CAPITA 1968/84

COUNTRY	ANNUAL GROWTH RATE 1968/84 %	AVERAGE 1968/75	AVERAGE 1976/83	1984
		KG/YEAR		
BRAZIL	0.88**	79.6	88.6	79.2
MEXICO	2.09***	77.0	95.4	93.8
	1.33***	78.7	91.1	84.5
BOLIVIA	3.16***	9.3	11.8	12.9
COLOMBIA	-0.94***	103.3	94.5	99.6
CUBA	3.29***	82.3	115.7	110.4
DOMINICAN RP	1.53***	63.0	69.7	75.4
ECUADOR	-0.75**	117.1	109.3	108.9
PARAGUAY	2.04***	39.7	49.6	46.1
PERU	-2.78***	57.7	46.5	39.1
VENEZUELA	0.16	87.0	87.2	83.5
TROPICAL SOUTH AMERICA	-0.19	80.3	79.4	78.3
COSTA RICA	1.56***	117.3	139.3	134.2
SALVADOR	0.88	48.5	57.1	46.2
GUATEMALA	-1.22***	48.8	44.5	40.4
HONDURAS	0.27	62.2	62.5	66.2
NICARAGUA	-10.65***	182.4	111.6	39.5
PANAMA	-0.44	46.1	47.5	43.1
CENTRAL AMERICA PANAMA	-1.71***	73.4	67.8	55.3
BARBADOS	1.79***	24.3	28.6	30.5
GUYANA	-4.24***	23.2	15.5	16.0
HAITI	-1.48***	4.1	3.7	3.4
JAMAICA	-0.65**	23.6	22.3	21.0
TRINIDAD ETC	-2.19**	8.2	6.0	7.2
CARIBBEAN	-1.67***	11.1	9.6	9.2
TROPICAL LATIN AMERICA	0.71***	76.5	83.4	78.2
ARGENTINA	-0.61*	202.2	193.6	172.8
CHILE	-1.38***	100.8	94.5	80.0
URUGUAY	0.97***	255.3	275.3	294.3
TEMPERATE SOUTH AMERICA	-0.61**	179.9	173.2	156.4
LATIN AMERICA	0.28	89.7	94.0	87.2

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 *P<0.05

COW MILK   ANNUAL GROWTH RATES OF PRODUCTION,POPULATION AND PRODUCTION PER CAPITA. 1969/84

	PRODUCTION		POPULATION		PRODUCTION PER CAPITA	
	1969/76	1977/84	1969/76	1977/84	1969/76	1977/84
BRAZIL	5.8***	1.9*	2.6***	2.2***	3.3**	-0.2
MEXICO	4.8***	2.8***	3.2***	2.6***	1.6**	0.1
	5.5***	2.3***	2.8***	2.3***	2.7**	-0.1
BOLIVIA	7.1***	6.5***	2.4***	2.6***	4.7**	3.8**
COLOMBIA	-0.6	2.6***	2.2***	2.2***	-2.8**	0.3
CUBA	5.5***	-0.2	1.7***	0.6***	3.9***	-0.9
DOMINICAN RP	3.4***	4.2**	2.9***	1.2***	0.5	3.0*
ECUADOR	2.2***	3.2*	2.9***	3.1***	-0.7***	0.1
PARAGUAY	5.9***	2.2**	3.1***	3.1***	2.7**	-0.9
PERU	0.2	-1.3***	2.7***	2.3***	-2.5**	-3.7***
VENEZUELA	4.4***	3.0***	3.6***	3.4***	0.8	-0.4
TROPICAL SOUTH AMERICA	1.9***	2.0***	2.6***	2.3***	-0.7	-0.4**
COSTA RICA	5.8***	1.1*	2.5***	3.1***	3.3***	-1.9**
SALVADOR	7.4***	0.2	2.9***	2.9***	4.4**	-2.7*
GUATEMALA	3.4***	0.7**	3.1***	3.0***	0.3***	-2.3***
HONDURAS	1.9***	6.6***	3.2***	3.5***	-1.3**	3.1*
NICARAGUA	3.6***	-23.1***	3.3***	3.5***	0.3	-26.6***
PANAMA	-1.2	-0.3	2.7***	2.4***	-3.9**	-2.7**
CENTRAL AMERICA PANAMA	4.0***	-2.4***	3.0***	3.1***	1.0*	-5.5***
BARBADOS	1.7***	1.5	0.5***	0.8**	1.3***	0.7
GUYANA	-8.8***	3.1***	2.2***	1.7***	-11.0***	1.4
HAITI	3.3***	-1.0	2.3***	2.4***	1.0***	-3.5**
JAMAICA	0.7	0.0	1.7***	1.2***	-1.0*	-1.2**
TRINIDAD ETC	-4.4*	4.9***	1.1***	-0.5	-5.5**	5.4***
CARIBBEAN	-0.7	0.7**	1.9***	1.8***	-2.6***	-1.1***
TROPICAL LATIN AMERICA	4.3***	1.9***	2.7***	2.4***	1.6**	-0.5
ARGENTINA	4.1***	0.2	1.7***	1.6***	2.4**	-1.4**
CHILE	-0.5	-1.0	1.7***	1.7***	-2.2	-2.7
URUGUAY	-0.2	2.9***	0.2***	0.6***	-0.3	2.3***
TEMPERATE SOUTH AMERICA	2.9***	0.3	1.6***	1.6***	1.3**	-1.2*
LATIN AMERICA	3.9***	1.6***	2.6***	2.3***	1.4**	-0.7

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005   ** P<0.01   * P<0.05

COW MILK PRODUCTION PER HEAD IN STOCK 1969/84

COUNTRY	ANNUAL GROWTH RATE 1968/84 %	AVERAGE 1968/75	AVERAGE 1976/83	1984
		KG/HEAD		
BRAZIL	-0.29	784.2	756.9	714.3
MEXICO	3.05***	568.2	761.1	812.0
	0.99***	693.2	758.3	751.1
BOLIVIA	0.78***	1300.5	1368.3	1428.6
COLOMBIA	0.80***	908.2	978.4	1000.0
CUBA	2.30***	1220.6	1416.7	1571.4
DOMINICAN RP	2.60***	1419.2	1711.2	2008.7
ECUADOR	-0.14	1325.0	1317.9	1375.0
PARAGUAY	-0.01	1906.0	1906.8	1896.6
PERU	-1.29***	1288.0	1131.8	1111.1
VENEZUELA	1.24***	1021.9	1199.1	1072.1
TROPICAL SOUTH AMERICA	0.90***	1078.0	1170.5	1177.0
COSTA RICA	1.52***	973.0	1078.4	1259.3
SALVADOR	1.70***	803.7	980.5	954.0
GUATEMALA	-0.58***	905.4	875.1	825.0
HONDURAS	1.42***	541.3	605.8	651.2
NICARAGUA	-3.69***	1091.7	835.8	625.0
PANAMA	-0.09	974.6	975.3	958.3
CENTRAL AMERICA PANAMA	-0.01	868.5	874.4	854.6
BARBADOS	1.62***	1073.0	1241.8	1333.3
GUYANA	-0.25	778.2	754.6	750.0
HAITI	1.37***	202.6	226.9	236.6
JAMAICA	-0.00	1000.0	1000.0	1000.0
TRINIDAD ETC	0.58	1560.0	1622.8	1600.0
CARIBBEAN	0.57***	550.7	573.0	587.2
TROPICAL LATIN AMERICA	0.78***	789.2	845.9	843.9
ARGENTINA	-0.56**	1904.5	1840.7	1750.8
CHILE	0.60	1322.9	1436.6	1461.5
URUGUAY	0.40*	1567.8	1640.1	1660.4
TEMPERATE SOUTH AMERICA	-0.21	1751.2	1745.9	1694.0
LATIN AMERICA	0.40***	918.5	953.1	941.3

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 *P<0.05

COW MILK   ANNUAL GROWTH RATES OF PRODUCTION ,STOCKS AND PRODUCTION/MILKING COW   1969/84

COUNTRY	PRODUCTION 1969/76	PRODUCTION 1977/84	STOCK 1969/76	STOCK 1977/84	PRODUCTION/HEAD IN STOCK 1969/76	PRODUCTION/HEAD IN STOCK 1977/84
BRAZIL	5.8***	1.9*	4.5***	0.5	1.3*	1.4
MEXICO	4.8***	2.8***	2.7***	1.2*	2.1**	1.6***
	5.5***	2.3***	3.8***	0.8*	1.7**	1.5**
BOLIVIA	7.1***	6.5***	5.4***	5.1*	1.7***	1.4***
COLOMBIA	-0.6	2.6***	-1.7	2.4*	1.1***	0.2
CUBA	5.5***	-0.2	2.9*	-2.3*	2.7**	2.1**
DOMINICAN RP	3.4***	4.2**	2.4***	-0.2	1.0	4.4**
ECUADOR	2.2***	3.2*	2.1***	3.9	0.2	-0.8
PARAGUAY	5.9***	2.2**	5.8***	2.2*	0.1	-0.0
PERU	0.2	-1.3***	0.5	-1.3*	-0.3	-0.0
VENEZUELA	4.4***	3.0***	2.2**	4.7*	2.2**	-1.7**
TROPICAL SOUTH AMERICA	1.9***	2.0***	0.4	1.9*	1.5***	0.0
COSTA RICA	5.8***	1.1*	4.1***	-1.5*	1.8**	2.7***
SALVADOR	7.4***	0.2	3.2***	0.3	4.2**	-0.1**
GUATEMALA	3.4***	0.7**	3.0***	2.2*	0.4***	-1.5*
HONDURAS	1.9***	6.6***	1.6***	4.4*	0.3**	2.2***
NICARAGUA	3.6***	-23.1***	1.3	-15.5*	2.3***	-7.6***
PANAMA	-1.2	-0.3	-0.2	0.5	-1.0**	-0.8*
CENTRAL AMERICA PANAMA	4.0***	-2.4***	2.3***	-1.6*	1.7***	-0.9**
BARBADOS	1.7***	1.5	1.0***	0.8*	0.8***	0.7
GUYANA	-8.8***	3.1***	-8.9***	2.9*	0.1	0.1
HAITI	3.3***	-1.0	0.6***	-1.7	2.6***	0.7
JAMAICA	0.7	0.0	0.7	0.0	0.0	0.0***
TRINIDAD ETC	-4.4*	4.9***	-8.9**	6.3*	4.5	-1.4
CARIBBEAN	-0.7	0.7**	-0.7**	-0.4	0.1	1.1*
TROPICAL LATIN AMERICA	4.3***	1.9***	3.0***	0.9*	1.3***	1.0**
ARGENTINA	4.1***	0.2	4.2***	1.6*	-0.1	-1.4
CHILE	-0.5	-1.0	0.1	-1.1	-0.6	0.1
URUGUAY	-0.2	2.9***	-1.8**	2.5*	1.7*	0.4
TEMPERATE SOUTH AMERICA	2.9***	0.3	2.7***	1.2	0.2	-0.9
LATIN AMERICA	3.9***	1.6***	2.9***	0.9*	1.0***	0.7*

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005   ** P<0.01   * P<0.05

DRY MILK SUMMARY OF LATIN AMERICA TRADE(THOUSAND TONS) *

REGION	EXPORT			IMPORT			+IMPORT-EXPORT		
	1968/75	1976/83	1984	1968/75	1976/83	1984	1968/75	1976/83	1984
BRAZIL	1	1	1	21	23	25	20	22	24
MEXICO	1	1	0	44	90	111	43	89	111
	2	2	1	65	113	136	63	111	135
BOLIVIA	0	0	0	3	6	7	3	6	7
COLOMBIA	1	0	0	9	13	3	8	13	3
CUBA	0	0	0	49	39	36	49	39	36
DOMINICAN RP	1	1	0	5	7	10	4	6	10
ECUADOR	0	0	0	2	5	4	2	5	4
PARAGUAY	0	0	0	1	1	2	1	1	2
PERU	0	0	0	22	24	29	22	24	29
VENEZUELA	1	1	0	23	91	107	22	90	107
TROPICAL SOUTH AMERICA	3	2	0	114	186	198	111	184	198
COSTA RICA	1	1	0	1	3	3	0	2	3
SALVADOR	1	1	0	5	11	5	4	10	5
GUATEMALA	1	1	0	3	7	18	2	6	18
HONDURAS	0	1	0	3	5	8	3	4	8
NICARAGUA	2	2	0	1	5	12	-1	3	12
PANAMA	0	0	0	3	4	4	3	4	4
CENTRAL AMERICA PANAMA	5	6	0	16	35	50	11	29	50
BARBADOS	1	1	1	2	2	2	1	1	1
GUYANA	0	0	0	2	3	4	2	3	4
HAITI	0	0	0	1	4	5	1	4	5
JAMAICA	1	1	0	10	12	11	9	11	11
TRINIDAD	1	1	1	9	12	13	8	11	12
CARIBBEAN	3	3	2	24	33	35	21	30	33
TROPICAL LATIN AMERICA	13	13	3	219	367	419	206	354	416
ARGENTINA	6	13	2	3	8	1	-3	-5	-1
CHILE	1	1	0	15	13	17	14	12	17
URUGUAY	0	2	3	1	1	1	1	-1	-2
TEMPERATE SOUTH AMERICA	7	16	5	19	22	19	12	6	14
LATIN AMERICA	20	29	8	238	389	438	218	360	430

COW MILK * PRODUCTION, TRADE AND APPARENT CONSUMPTION

COUNTRY	1969/76 PRODUCTION	+IMPORT -EXPORT	APPARENT CONSUMPTION	APPARENT PER CAPITA CONSUMPTION	SELF SUFFICIENCY INDEX	1977/84 PRODUCTION	+IMPORT -EXPORT	APPARENT CONSUMPTION	APPARENT PER CAPITA CONSUMPTION	SELF SUFFICIENCY INDEX
	1000 MT			KG		1000 MT			KG	
BRAZIL	8337.1	181.7	8518.8	83.7	97.9	10669	198.5	10867	88.1	98.2
MEXICO	4375.0	437.1	4812.1	86.6	90.9	6794.9	891.2	7686.2	109.0	88.4
	12712	618.80	13331	84.70	95.36	17464	1089.8	18554	95.70	94.13
BOLIVIA	44.8	38.2	83.0	18.0	54.0	68.5	57.8	126.3	22.3	54.2
COLOMBIA	2237.5	68.5	2306.0	105.0	97.0	2486.1	120.3	2606.5	99.5	95.4
CUBA	776.6	473.6	1250.2	139.8	62.1	1133.0	352.0	1485.0	152.3	76.3
DOMINICAN RP	311.5	37.2	348.7	71.5	89.3	418.4	65.0	483.4	82.4	86.6
ECUADOR	745.9	15.5	761.4	118.5	98.0	888.6	43.7	932.3	114.1	95.3
PARAGUAY	101.2	6.8	108.0	43.4	93.7	159.6	6.1	165.6	51.4	96.3
PERU	818.9	200.3	1019.2	70.7	80.3	792.3	203.7	996.0	56.2	79.5
VENEZUELA	1066.6	222.3	1288.9	107.2	82.8	1377.2	842.9	2220.1	139.5	62.0
TROPICAL SOUTH AMERICA	6103.1	1062.3	7165.4	94.58	85.17	7323.7	1691.5	9015.2	97.46	81.24
COSTA RICA	224.8	8.8	233.6	126.4	96.2	314.8	26.9	341.7	150.1	92.1
EL SALVADOR	199.2	43.8	243.0	62.9	82.0	263.8	87.8	351.6	72.1	75.0
GUATEMALA	285.6	18.9	304.5	52.5	93.8	319.1	70.1	389.1	52.7	82.0
HONDURAS	175.1	26.1	201.2	70.2	87.0	240.1	42.8	282.9	75.1	84.9
NICARAGUA	397.5	-11.7	385.8	179.8	103.0	247.1	26.8	273.9	97.7	90.2
PANAMA	72.4	19.5	91.9	57.0	78.8	92.9	24.6	117.6	59.9	79.0
CENTRAL AMERICA PANAMA	1354.7	105.29	1460	89.68	92.79	1477.8	279.02	1756.8	84.49	84.12
BARBADOS	6.0	18.4	24.4	100.7	24.5	7.5	9.8	17.3	67.4	43.3
GUYANA	15.7	29.2	44.8	59.8	35.0	13.8	41.2	55.0	62.2	25.1
HAITI	20.3	16.4	36.7	7.5	55.2	21.0	43.3	64.4	10.9	32.7
JAMAICA	46.6	88.5	135.1	69.1	34.5	48.6	94.7	143.3	65.2	33.9
TRINIDAD TOB	8.3	77.5	85.8	81.3	9.7	7.0	120.2	127.1	112.7	5.5
CARIBBEAN	96.76	230.01	326.76	36.78	29.61	97.95	309.25	407.20	39.31	24.05
TROPICAL LATIN AMERICA	20267	2016.4	22283	86.3	91.0	26363	3369.5	29733	93.6	88.7
ARGENTINA	5116.1	-66.4	5049.6	202.0	101.3	5342.1	-9.6	5332.5	187.3	100.2
CHILE	980.9	122.3	1103.1	112.7	88.9	1026.5	119.2	1145.7	102.3	89.6
URUGUAY	731.9	2.4	734.3	259.1	99.7	816.9	-6.8	810.1	276.4	100.8
TEMPERATE SOUTH AMERIC	6828.8	58.2	6887.1	183.1	99.2	7185.5	102.8	7288.3	171.0	98.6
LATIN AMERICA	27096	2074.6	29170	98.0	92.9	33549	-3472.3	37021	102.1	90.6

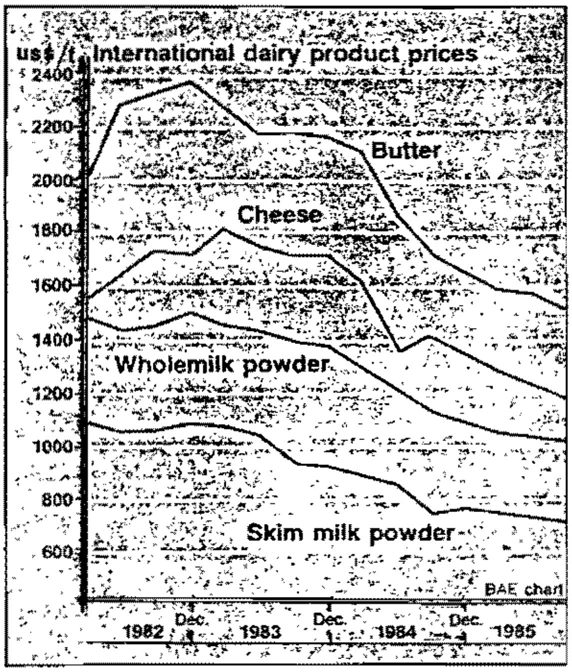
*INCLUDES FRESH, DRY AND CONDENSED MILK IN TERMS OF FRESH MILK

Real Producer Price of Fresh Milk in Selected Countries
1978/84

Year	Brazil cr/lt	Colombia $/lt.	Argentina real price index	Chile $/lt.
1978	661.79	8.10	74.00	14.99
1979	595.06	9.32	77.60	16.48
1980	626.11	9.64	67.60	15.24
1981	642.67	9.10	66.60	11.95
1982	537.79	9.66	54.20	13.08
1983	517.85	9.30	53.70	14.2
1984	460.42	8.36	43.40	12.08
Average annual Growth rate (%)	-5.4	0.3	-9.1	-3.9

* Estimated

Sources: Brazil:Fgv(1984) Colombia:Fadegan(1894)
Argentina:Banco ganadero argentino(1984)
Chile:Corfo(1984)



Source: BAE (1985)

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PPPPPPPP    IIIIII     GGGGGGG          M       M  EEEEEEEEE     AAA     TTTTTTTT
PPPPPPPPP   IIIIII    GGGGGGGGG         MM     MM  EEEEEEEEE    AAAAA    TTTTTTTT
PP     PP     II      GG     GG         MMM   MMM  EE          AA   AA      TT
PP     PP     II      GG                MMMM MMMM  EE         AA     AA     TT
PPPPPPPPP     II      GG                MM MMM MM  EEEEEE     AA     AA     TT
PPPPPPPP      II      GG   GGGG         MM  M  MM  EEEEEE     AAAAAAAAA     TT
PP            II      GG   GGGG         MM     MM  EE         AAAAAAAAA     TT
PP            II      GG     GG         MM     MM  EE         AA     AA     TT
PP          IIIIII    GGGGGGGGG         MM     MM  EEEEEEEEE  AA     AA     TT
PP          IIIIII     GGGGGGG          MM     MM  EEEEEEEEE  AA     AA     TT
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PIGMEAT: STOCKS AND PRODUCTION FOR SELECTED REGIONS
1984

Region and Country	Production Total 000mt	Production %	Stocks Total 0000 head	Stocks %
WORLD	55460	100.0	786608	100.0
UNITED STATES	6719	12.1	55819	7.1
EUROPE	19783	35.7	180890	23.0
LATIN AMERICA	2478	4.5	77976	9.9
TROPICAL L.A.	2162	3.9	72576	9.2
Brazil	860	1.6	33000	4.2
Colombia	112	0.2	2386	0.3
Venezuela	104	0.2	2564	0.3
TEMPERATE L.A.	316	0.6	5400	0.7
Argentina	240	0.4	3830	0.5
ASIA	19055	34.4	366580	46.6
AFRICA	414	0.7	11045	1.4
OCEANIA	326	0.6	4890	0.6

PIGMEAT PRODUCTION,RELATIVE IMPORTANCE IN THE REGION AND PER CAPITA PRODUCTION LEVELS

COUNTRY	PRODUCTION -----1000 MT----- 1968/75	1976/83	1984	PERCENTAGE OF TOTAL % 1984	PER CAPITA PRODUCTION KG 1984
BRAZIL	745	906	860	36.83	6
MEXICO	292	452	500	21.41	6
	1037	1358	1360	58.24	6
BOLIVIA	19	30	35	1.50	6
COLOMBIA	77	101	112	4.80	4
CUBA	36	61	82	3.51	8
DOMINICAN RP	14	13	6	0.26	1
ECUADOR	33	53	61	2.61	7
PARAGUAY	46	75	90	3.85	25
PERU	66	72	71	3.04	4
VENEZUELA	56	82	104	4.45	6
TROPICAL SOUTH AMERICA	345	489	561	24.03	6
COSTA RICA	7	10	8	0.34	3
EL SALVADOR	12	14	13	0.56	2
GUATEMALA	13	15	17	0.73	2
HONDURAS	10	9	11	0.47	3
NICARAGUA	15	17	14	0.60	4
PANAMA	5	7	9	0.39	4
CENTRAL AMERICA PANAMA	62	72	72	3.08	3
BARBADOS	3	5	6	0.26	23
GUYANA	1	2	1	0.04	1
HAITI	25	21	8	0.34	1
JAMAICA	6	8	8	0.34	3
TRINIDAD TOB	3	3	3	0.13	3
CARIBBEAN	38	39	26	1.11	2
TROPICAL LATIN AMERICA	1482	1958	2019	86.47	6
ARGENTINA	227	247	240	10.28	8
CHILE	46	45	58	2.48	5
URUGUAY	22	20	18	0.77	6
TEMPERATE SOUTH AMERICA	294	312	316	13.53	7
LATIN AMERICA	1777	2270	2335	100.00	6

COLUMNS MAY NOT ADD EXACTLY DUE TO ROUNDING

PIGMEAT PRODUCTION PER CAPITA 1968/84

COUNTRY	ANNUAL GROWTH RATE 1968/84 %	AVERAGE 1968/75	AVERAGE 1976/83	1984
		KG/YEAR		
BRAZIL	-0.48	7.5	7.5	6.5
MEXICO	2.55***	5.4	6.6	6.5
	0.37*	6.8	7.2	6.5
BOLIVIA	3.31***	4.2	5.5	5.6
COLOMBIA	1.10***	3.6	4.0	4.0
CUBA	5.04***	4.0	6.3	8.2
DOMINICAN RP	-9.83**	3.0	.	1.0
ECUADOR	2.53***	5.2	6.7	6.7
PARAGUAY	2.62***	19.0	24.0	25.2
PERU	-1.28***	4.7	4.2	3.7
VENEZUELA	1.86**	4.7	5.4	5.8
TROPICAL SOUTH AMERICA	1.69***	4.7	5.4	5.6
COSTA RICA	-0.14	4.1	4.3	3.2
SALVADOR	-1.54***	3.2	3.0	2.4
GUATEMALA	-0.91	2.4	2.1	2.1
HONDURAS	-3.17***	3.5	2.6	2.6
NICARAGUA	-3.17***	7.2	6.3	4.4
PANAMA	3.10***	2.9	3.7	4.2
CENTRAL AMERICA PANAMA	-1.36***	3.5	3.2	2.8
BARBADOS	6.57***	12.2	21.0	22.9
GUYANA	-2.95*	1.8	1.8	1.1
HAITI	-8.65***	5.3	3.8	1.2
JAMAICA	2.36***	3.1	3.7	3.5
TRINIDAD ETC	0.82***	2.5	2.7	2.7
CARIBBEAN	-3.11***	4.4	3.9	2.4
TROPICAL LATIN AMERICA	0.56***	5.9	6.3	5.8
ARGENTINA	-0.53	9.2	8.8	8.0
CHILE	-0.25	4.8	4.1	4.9
URUGUAY	-1.86**	7.7	7.0	6.0
TEMPERATE SOUTH AMERICA	-0.55	7.9	7.4	7.0
LATIN AMERICA	0.37**	6.1	6.4	6.0

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 *P<0.05

PIGMEAT ANNUAL GROWTH RATES OF PRODUCTION,POPULATION AND PRODUCTION PER CAPITA. 1969/84

	PRODUCTION		POPULATION		PRODUCTION PER CAPITA	
	1969/76	1977/84	1969/76	1977/84	1969/76	1977/84
BRAZIL	0.2	1.2	2.6***	2.2***	-2.4**	-1.0
MEXICO	8.9***	3.2***	3.2***	2.6***	5.7***	0.6
	2.7***	1.9*	2.8***	2.3***	-0.1	-0.5
BOLIVIA	8.2***	3.4***	2.4***	2.6***	5.8***	0.7***
COLOMBIA	6.2***	1.6	2.2***	2.2***	4.0***	-0.6
CUBA	2.6*	4.5***	1.7***	0.6***	1.0	3.9***
DOMINICAN RP	11.0***	-34.4*	2.9***	1.2***	8.1***	-35.7*
ECUADOR	5.4***	3.1**	2.9***	3.1***	2.5***	0.0
PARAGUAY	5.3***	4.9***	3.1***	3.1***	2.1***	1.8**
PERU	2.3**	0.8	2.7***	2.3***	-0.4	-1.5**
VENEZUELA	10.9***	2.9**	3.6***	3.4***	7.3***	-0.5
TROPICAL SOUTH AMERICA	6.0***	2.1***	2.6***	2.3***	3.4***	-0.2
COSTA RICA	3.5*	-2.7**	2.5***	3.1***	0.9	-5.7***
SALVADOR	3.6***	-2.0	2.9***	2.9***	0.7	-4.9***
GUATEMALA	-0.1	5.8**	3.1***	3.0***	-3.2**	2.8
HONDURAS	-2.5**	4.1**	3.2***	3.5***	-5.7***	0.6
NICARAGUA	3.5	-6.7*	3.3***	3.5***	0.3	-10.2**
PANAMA	3.5*	6.1***	2.7***	2.4***	0.8	3.7***
CENTRAL AMERICA PANAMA	1.9***	-0.0	3.0***	3.1***	-1.1**	-3.1***
BARBADOS	7.0***	7.2*	0.5***	0.8**	6.5***	6.4
GUYANA	5.2	-12.5***	2.2***	1.7***	3.0	-14.2***
HAITI	3.9***	-24.3***	2.3***	2.4***	1.6***	-26.7***
JAMAICA	6.3*	0.0	1.7***	1.2***	4.6	-1.2
TRINIDAD ETC	2.6***	-0.2	1.1***	-0.5	1.6**	0.3
CARIBBEAN	4.5***	-10.7***	1.9***	1.8***	2.5***	-12.4***
TROPICAL LATIN AMERICA	3.5***	1.6**	2.7***	2.4***	0.7***	-0.7
ARGENTINA	3.2**	-0.0	1.7***	1.6***	1.5	-1.6
CHILE	-4.5	9.1***	1.7***	1.7***	-6.2	7.4***
URUGUAY	1.3	-4.5**	0.2***	0.6***	1.2	-5.1**
TEMPERATE SOUTH AMERICA	2.1*	1.1	1.6***	1.6***	0.5	-0.5
LATIN AMERICA	3.3***	1.6**	2.6***	2.3***	0.7**	-0.7

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

PIGMEAT PRODUCTION PER HEAD IN STOCK 1968/84

COUNTRY	ANNUAL GROWTH RATE 1968/84 %	AVERAGE 1968/75	AVERAGE 1976/83	1984
		-KG/HEAD-		
BRAZIL	1.39***	23.3	26.9	26.1
MEXICO	1.29	27.4	31.6	27.2
	1.33***	24.3	28.0	26.5
BOLIVIA	0.88***	19.2	20.8	20.6
COLOMBIA	0.23	47.6	50.3	46.9
CUBA	3.39***	24.3	33.3	35.7
DOMINICAN RP	-1.00	19.6	.	7.2
ECUADOR	0.09	15.6	16.2	14.3
PARAGUAY	-0.32	65.9	59.6	66.7
PERU	0.91***	33.1	35.0	40.0
VENEZUELA	1.95**	33.6	38.1	40.2
TROPICAL SOUTH AMERICA	0.99***	30.7	33.6	32.6
COSTA RICA	1.27**	35.7	42.6	35.9
SALVADOR	1.70***	27.6	31.5	34.3
GUATEMALA	1.87***	17.4	20.4	21.0
HONDURAS	1.88**	18.2	19.8	27.5
NICARAGUA	0.72	24.8	27.1	25.9
PANAMA	4.40***	25.9	35.6	45.0
CENTRAL AMERICA PANAMA	1.86***	22.8	26.6	28.2
BARBADOS	2.90***	92.4	112.6	120.0
GUYANA	-5.07***	14.2	11.5	7.0
HAITI	-0.57	16.1	15.2	16.0
JAMAICA	0.60	30.8	32.2	29.1
TRINIDAD ETC	-0.05	50.4	51.5	48.4
CARIBBEAN	1.69***	19.7	21.6	25.3
TROPICAL LATIN AMERICA	1.36***	25.3	29.0	28.0
ARGENTINA	2.01***	52.6	65.3	63.2
CHILE	0.62	47.5	43.0	50.4
URUGUAY	-2.24***	52.8	46.6	40.0
TEMPERATE SOUTH AMERICA	1.46***	51.6	59.4	58.5
LATIN AMERICA	1.22***	27.6	31.2	30.1

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 *P<0.05 .

PIGMEAT ANNUAL GROWTH RATES OF PRODUCTION,STOCKS AND PRODUCTION /HEAD IN STOCK 1969/84

COUNTRY	PRODUCTION 1969/76	PRODUCTION 1977/84	STOCK 1969/76	STOCK 1977/84	PRODUCTION/HEAD IN STOCK 1969/76	PRODUCTION/HEAD IN STOCK 1977/84
BRAZIL	0.2	1.2	2.4***	-1.1*	-2.2**	2.3
MEXICO	8.9***	3.2***	2.2***	7.9*	6.7***	-4.7**
	2.7***	1.9*	2.3***	1.7*	0.3	0.1
BOLIVIA	8.2***	3.4***	5.2***	4.3*	3.0***	-1.0**
COLOMBIA	6.2***	1.6	4.5***	3.5*	1.6**	-1.9*
CUBA	2.6*	4.5***	-0.4**	4.7*	3.0*	-0.2
DOMINICAN RP	11.0***	-34.4*	-0.3	-13.7	11.2***	-27.3**
ECUADOR	5.4***	3.1**	5.6***	4.2*	-0.2**	-1.1
PARAGUAY	5.3***	4.9***	9.1***	2.0*	-3.8*	2.9***
PERU	2.3**	0.8	2.2***	-0.4	0.1	1.2
VENEZUELA	10.9***	2.9**	2.6**	4.1*	8.3***	-1.2
TROPICAL SOUTH AMERICA	6.0***	2.1***	3.5***	3.0*	2.5***	-0.9***
COSTA RICA	3.5*	-2.7**	1.6**	1.5*	1.9	-4.2***
SALVADOR	3.6***	-2.0	0.6	-5.2*	3.1**	3.2*
GUATEMALA	-0.1	5.8**	-5.1*	2.6*	5.0**	3.2
HONDURAS	-2.5**	4.1**	-1.1*	-5.1*	-1.4	9.2***
NICARAGUA	3.5	-6.7*	1.4*	-4.8*	2.2	-1.9
PANAMA	3.5*	6.1***	-1.0	0.0	4.5***	6.1***
CENTRAL AMERICA PANAMA	1.9***	-0.0	-1.1	-2.0*	3.0***	2.0***
BARBADOS	7.0***	7.2*	3.1***	2.3	3.9**	4.9
GUYANA	5.2	-12.5***	7.3***	1.4*	-2.1	-14.0***
HAITI	3.9***	-24.3***	2.4***	-23.0*	1.5***	-1.3
JAMAICA	6.3*	0.0	4.8***	1.9*	1.5	-1.9*
TRINIDAD ETC	2.6***	-0.2	1.7**	1.5*	0.9*	-1.8**
CARIBBEAN	4.5***	-10.7***	2.8***	-14.5*	1.6**	3.9***
TROPICAL LATIN AMERICA	3.5***	1.6**	2.4***	1.5*	1.0***	0.2
ARGENTINA	3.2**	-0.0	-0.7	1.2*	3.9***	-1.3
CHILE	-4.5	9.1***	-2.7***	2.9*	-1.7	6.2***
URUGUAY	1.3	-4.5**	1.9***	0.5	-0.6	-5.0**
TEMPERATE SOUTH AMERICA	2.1*	1.1	-0.9	1.5*	2.9***	-0.5
LATIN AMERICA	3.3***	1.6**	2.1***	1.5*	1.1***	0.1

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

PIGMEAT*　　SUMMARY OF LATIN AMERICA TRADE(THOUSAND TONS)

REGION	EXPORT			IMPORT			+IMPORT-EXPORT		
	1968/75	1976/83	1984	1968/75	1976/83	1984	1968/75	1976/83	1984
BRAZIL	2	5	7	1	0	0	-1	-5	-7
MEXICO	1	1	1	1	0	0	0	-1	-1
	3	6	8	2	0	0	-1	-6	-8
BOLIVIA	1	0	0	0	0	0	-1	0	0
COLOMBIA	0	0	0	0	1	1	0	1	1
CUBA	0	0	0	0	1	0	0	1	0
DOMINICAN RP	0	0	0	0	3	3	0	3	3
ECUADOR	0	0	0	0	0	0	0	0	0
PARAGUAY	0	0	0	0	0	0	0	0	0
PERU	0	0	0	1	0	0	1	-0	0
VENEZUELA	0	4	1	2	6	0	2	2	-1
TROPICAL SOUTH AMERICA	1	4	1	3	11	4	2	7	3
COSTA RICA	0	1	0	1	1	0	1	0	0
SALVADOR	0	0	0	1	1	1	1	1	1
GUATEMALA	1	0	0	1	1	0	0	1	0
HONDURAS	0	1	0	0	1	0	0	0	0
NICARAGUA	1	1	0	0	1	0	-1	0	0
PANAMA	1	0	0	1	1	0	0	1	0
CENTRAL AMERICA PANAMA	3	3	0	4	6	1	1	3	1
BARBADOS	1	0	0	1	1	1	0	1	1
GUYANA	1	1	0	1	0	0	0	-1	0
HAITI	0	1	0	1	1	1	1	0	1
JAMAICA	1	1	0	1	1	1	0	0	1
TRINIDAD	1	1	1	1	1	1	0	0	0
CARIBBEAN	4	4	1	5	4	4	1	0	3
TROPICAL LATIN AMERICA	11	17	10	14	21	9	3	4	-1
ARGENTINA	3	3	1	0	1	0	-3	-2	-1
CHILE	0	0	0	2	1	1	2	1	1
URUGUAY	1	0	0	0	1	1	-1	1	1
TEMPERATE SOUTH AMERICA	4	3	1	2	3	2	-2	0	1
LATIN AMERICA	15	20	11	16	24	11	1	4	0

*FRESH,CHILLED OR FROZEN

PIGMEAT

PRODUCTION, TRADE AND APPARENT CONSUMPTION

COUNTRY	1969/76 PRODUCTION	1969/76 +IMPORT -EXPORT	1969/76 APPARENT CONSUMPTION	1969/76 APPARENT PER CAPITA CONSUMPTION	1969/76 SELF SUFFICIENCY INDEX	1977/84 PRODUCTION	1977/84 +IMPORT -EXPORT	1977/84 APPARENT CONSUMPTION	1977/84 APPARENT PER CAPITA CONSUMPTION	1977/84 SELF SUFFICIENC INDEX
	-----1000 MT-----			-----KG-----		-----1000 MT-----			-----KG-----	
BRAZIL	753.5	-3.4	750.1	7.4	100.4	915.5	-3.7	911.8	7.4	100.4
MEXICO	312.9	-0.6	312.3	5.6	100.2	466.0	-0.6	465.5	6.6	100.1
	1066.4	-3.96	1062.4	6.75	100.37	1381.5	-4.29	1377.2	7.10	100.31
BOLIVIA	20.4	-0.0	20.4	4.4	100.0	31.4	0.0	31.4	5.6	100.0
COLOMBIA	80.4	0.0	80.4	3.7	100.0	102.7	0.1	102.8	3.9	99.9
CUBA	37.0	0.0	37.0	4.1	100.0	66.3	0.1	66.4	6.8	99.8
DOMINICAN RP	15.5	0.0	15.5	3.2	100.0	11.1	3.3	14.4	2.5	77.3
ECUADOR	34.2	0.0	34.2	5.3	100.0	55.8	0.0	55.8	6.8	100.0
PARAGUAY	48.5	0.0	48.5	19.5	100.0	79.0	0.0	79.0	24.5	100.0
PERU	67.7	0.1	67.8	4.7	99.9	72.4	0.0	72.4	4.1	100.0
VENEZUELA	61.3	0.8	62.1	5.2	98.8	84.4	2.8	87.2	5.5	96.8
TROPICAL SOUTH AMERICA	364.95	0.86	365.81	4.83	99.77	503.24	6.29	509.53	5.51	98.77
COSTA RICA	7.8	0.0	7.9	4.3	99.7	9.5	0.0	9.5	4.2	99.6
EL SALVADOR	12.3	0.0	12.3	3.2	100.0	14.0	0.0	14.0	2.9	99.7
GUATEMALA	13.1	0.0	13.1	2.3	99.9	15.6	0.1	15.7	2.1	99.4
HONDURAS	9.6	0.0	9.6	3.3	100.0	9.5	-0.0	9.5	2.5	100.0
NICARAGUA	15.8	-0.1	15.8	7.3	100.5	16.0	-0.0	16.0	5.7	100.1
PANAMA	4.7	0.0	4.8	3.0	99.5	7.6	0.0	7.6	3.9	100.0
CENTRAL AMERICA PANAMA	63.44	-0.01	63.43	3.90	100.02	72.14	0.15	72.29	3.48	99.79
BARBADOS	3.2	0.0	3.2	13.2	98.5	5.7	0.4	6.1	23.7	92.9
GUYANA	1.5	-0.0	1.5	1.9	100.0	1.4	-0.0	1.4	1.6	100.0
HAITI	26.4	0.0	26.4	5.4	99.9	18.4	0.2	18.6	3.2	99.0
JAMAICA	6.4	0.3	6.8	3.5	95.2	8.3	0.0	8.3	3.8	100.0
TRINIDAD TOB	2.7	0.5	3.2	3.0	85.6	3.0	0.5	3.5	3.1	86.9
CARIBBEAN	40.15	0.85	41.00	4.62	97.92	36.73	1.08	37.81	3.65	97.14
TROPICAL LATIN AMERICA	1534.9	-2.3	1532.6	5.9	100.1	1993.6	3.2	1996.9	6.3	99.8
ARGENTINA	236.2	-4.3	232.0	9.3	101.8	244.3	-0.3	244.0	8.6	100.1
CHILE	44.1	1.5	45.5	4.7	96.8	48.9	0.4	49.3	4.4	99.1
URUGUAY	22.1	-0.0	22.0	7.8	100.1	19.4	0.1	19.5	6.6	99.6
TEMPERATE SOUTH AMERIC	302.4	-2.8	299.5	8.0	100.9	312.6	0.2	312.8	7.3	99.9
LATIN AMERICA	1837.3	-5.1	1832.2	6.2	100.3	2306.2	3.5	2309.7	6.4	99.8

POULTRY MEAT

POULTRY MEAT — PRODUCTION, RELATIVE IMPORTANCE IN THE REGION AND PER CAPITA PRODUCTION LEVELS

COUNTRY	PRODUCTION 1000 MT 1968/75	PRODUCTION 1000 MT 1976/83	PRODUCTION 1000 MT 1984	PERCENTAGE OF TOTAL % 1984	PER CAPITA PRODUCTION KG 1984
BRAZIL	426	1178	1616	43.34	12
MEXICO	265	417	489	13.11	6
	692	1595	2105	56.45	10
BOLIVIA	4	8	12	0.32	2
COLOMBIA	50	99	121	3.24	4
CUBA	44	69	107	2.87	11
DOMINICAN RP	30	55	74	1.98	12
ECUADOR	10	22	30	0.80	3
PARAGUAY	8	14	16	0.43	4
PERU	84	157	182	4.88	9
VENEZUELA	115	241	332	8.90	19
TROPICAL SOUTH AMERICA	345	665	874	23.44	9
COSTA RICA	3	5	5	0.13	2
EL SALVADOR	4	14	16	0.43	3
GUATEMALA	9	39	50	1.34	6
HONDURAS	5	9	13	0.35	3
NICARAGUA	6	9	11	0.29	3
PANAMA	8	13	14	0.38	7
CENTRAL AMERICA PANAMA	36	88	109	2.92	4
BARBADOS	1	5	6	0.16	23
GUYANA	7	12	15	0.40	16
HAITI	4	6	9	0.24	1
JAMAICA	17	26	27	0.72	12
TRINIDAD TOB	15	20	21	0.56	19
CARIBBEAN	45	70	78	2.09	7
TROPICAL LATIN AMERICA	1117	2418	3166	84.90	9
ARGENTINA	207	375	466	12.50	15
CHILE	52	74	75	2.01	6
URUGUAY	15	19	22	0.59	7
TEMPERATE SOUTH AMERICA	274	468	563	15.10	13
LATIN AMERICA	1391	2886	3729	100.00	10

COLUMNS MAY NOT ADD EXACTLY DUE TO ROUNDING

POULTRY MEAT :. STOCKS AND PRODUCTION FOR SELECTED REGIONS 1984

Region and Country	Production		Stocks	
	Total 000mt	%	Total millions heads	%
WORLD	29858	100.0	7305	100.0
UNITED STATES	7475	25.0	383	5.2
EUROPE	7508	25.1	1235	16.9
LATIN AMERICA	3761	12.7	1023	14.0
TROPICAL L.A.	3218	10.8	953	13.0
Brazil	1616	5.4	450	6.2
Colombia	[illegible]	0.4	34	0.5
Venezuela	[illegible]	1.1	43	0.6
TEMPERATE L.A.	552	1.9	70	1.0
Argentina	466	1.6	44	0.6
ASIA	[illegible]	20.4	2764	37.8
AFRICA	1517	5.1	682	9.3
OCEANIA	339	1.1	60	0.8

POULTRY MEAT PRODUCTION PER CAPITA 1968/84

COUNTRY	ANNUAL GROWTH RATE 1968/84 %	AVERAGE 1968/75	AVERAGE 1976/83	1984
		KG/YEAR		
BRAZIL	9.55***	4.3	9.6	12.2
MEXICO	2.76***	4.9	6.1	6.3
	7.43***	4.5	8.3	10.0
BOLIVIA	6.76***	0.8	1.5	1.9
COLOMBIA	5.55***	2.3	3.8	4.3
CUBA	4.94***	5.0	7.1	10.7
DOMINICAN RP	4.88***	6.3	9.5	12.1
ECUADOR	5.92***	1.7	2.7	3.3
PARAGUAY	2.93***	3.4	4.4	4.5
PERU	6.16***	5.9	9.0	9.5
VENEZUELA	5.84***	9.7	15.5	18.6
TROPICAL SOUTH AMERICA	5.77***	4.6	7.3	8.7
COSTA RICA	2.83***	1.6	2.4	2.0
SALVADOR	8.19***	1.2	2.9	3.0
GUATEMALA	12.17***	1.6	5.3	6.1
HONDURAS	3.05***	1.9	2.4	3.1
NICARAGUA	1.19	3.1	3.4	3.5
PANAMA	3.32***	4.8	6.5	6.6
CENTRAL AMERICA PANAMA	6.88***	2.0	3.9	4.3
BARBADOS	16.77***	6.0	19.5	22.9
GUYANA	4.73***	9.8	13.9	16.0
HAITI	4.11***	0.8	1.0	1.4
JAMAICA	3.96***	8.9	12.1	11.8
TRINIDAD ETC	2.44***	14.7	18.0	19.0
CARIBBEAN	3.59***	5.1	6.8	7.1
TROPICAL LATIN AMERICA	6.79***	4.4	7.7	9.1
ARGENTINA	6.06***	8.4	13.3	15.5
CHILE	2.57**	5.4	6.7	6.3
URUGUAY	3.12***	5.4	6.3	7.4
TEMPERATE SOUTH AMERICA	5.28***	7.4	11.1	12.5
LATIN AMERICA	6.47***	4.8	8.1	9.5

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 *P<0.05

POULTRY MEAT ANNUAL GROWTH RATES OF PRODUCTION,POPULATION AND PRODUCTION PER CAPITA. 1969/84

	PRODUCTION		POPULATION		PRODUCTION PER CAPITA	
	1969/76	1977/84	1969/76	1977/84	1969/76	1977/84
BRAZIL	9.0***	12.3***	2.6***	2.2***	6.4***	10.2***
MEXICO	7.5***	4.1***	3.2***	2.6***	4.3**	1.5**
	8.5***	10.1***	2.8***	2.3***	5.7***	7.8***
BOLIVIA	6.1***	11.2***	2.4***	2.6***	3.6**	8.6***
COLOMBIA	6.9***	5.6***	2.2***	2.2***	4.6**	3.4***
CUBA	3.7**	8.9***	1.7***	0.6***	2.0	8.2***
DOMINICAN RP	4.2***	8.4***	2.9***	1.2***	1.2	7.2***
ECUADOR	8.4***	7.5***	2.9***	3.1***	5.5***	4.4***
PARAGUAY	7.9***	4.5***	3.1***	3.1***	4.7***	1.4*
PERU	15.8***	7.5**	2.7***	2.3***	13.1***	5.2*
VENEZUELA	11.2***	8.9***	3.6***	3.4***	7.7***	5.6***
TROPICAL SOUTH AMERICA	9.9***	7.9***	2.6***	2.3***	7.3***	5.6***
COSTA RICA	6.9**	-2.0*	2.5***	3.1***	4.4	-5.0***
SALVADOR	7.4**	2.1	2.9***	2.9***	4.5	-0.8
GUATEMALA	8.5***	11.7**	3.1***	3.0***	5.4***	8.7*
HONDURAS	3.6***	8.6**	3.2***	3.5***	0.5	5.1
NICARAGUA	13.7***	2.1	3.3***	3.5***	10.4***	-1.4
PANAMA	5.8***	3.8*	2.7***	2.4***	3.1*	1.4
CENTRAL AMERICA PANAMA	7.9***	6.5***	3.0***	3.1***	5.0***	3.4*
BARBADOS	29.1***	7.4***	0.5***	0.8**	28.7***	6.6***
GUYANA	9.6***	4.6***	2.2***	1.7***	7.4***	2.9***
HAITI	6.5***	8.8***	2.3***	2.4***	4.2***	6.3***
JAMAICA	8.1***	1.5*	1.7***	1.2***	6.4**	0.3
TRINIDAD ETC	5.5**	1.0*	1.1***	-0.5	4.4**	1.5
CARIBBEAN	7.9***	3.0***	1.9***	1.8***	6.0***	1.3***
TROPICAL LATIN AMERICA	8.9***	9.1***	2.7***	2.4***	6.1***	6.8***
ARGENTINA	8.3***	7.1***	1.7***	1.6***	6.6***	5.5**
CHILE	-3.8	7.6*	1.7***	1.7***	-5.5**	6.0
URUGUAY	5.3*	3.7***	0.2***	0.6***	5.1*	3.1***
TEMPERATE SOUTH AMERICA	6.0***	7.0***	1.6***	1.6***	4.4**	5.5**
LATIN AMERICA	8.3***	8.8***	2.6***	2.3***	5.7***	6.5***

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

POULTRY MEAT PRODUCTION PER HEAD IN STOCK 1968/84

COUNTRY	ANNUAL GROWTH RATE 1968/84 %	AVERAGE 1968/75	AVERAGE 1976/83	1984
		---KG/HEAD---		
BRAZIL	5.64***	1.8	2.8	3.6
MEXICO	3.07***	2.0	2.5	2.5
	4.98***	1.8	2.8	3.3
BOLIVIA	2.11**	0.8	0.9	1.2
COLOMBIA	2.26***	2.8	3.4	3.6
CUBA	0.79	3.0	3.0	4.0
DOMINICAN RP	5.39***	4.3	6.8	8.2
ECUADOR	-4.70***	1.2	0.8	0.7
PARAGUAY	-0.03	1.2	1.1	1.1
PERU	2.91***	3.5	4.1	4.4
VENEZUELA	2.60***	5.4	6.3	7.7
TROPICAL SOUTH AMERICA	1.58***	3.3	3.6	4.0
COSTA RICA	2.41***	0.7	1.0	0.8
SALVADOR	4.51***	2.0	3.0	4.0
GUATEMALA	11.60***	0.9	2.8	3.3
HONDURAS	1.98**	1.7	1.9	2.6
NICARAGUA	0.53	1.9	2.0	2.2
PANAMA	1.26**	2.2	2.6	2.3
CENTRAL AMERICA PANAMA	5.78***	1.4	2.3	2.7
BARBADOS	9.16***	3.8	6.3	6.0
GUYANA	0.29	1.0	1.0	1.0
HAITI	2.08***	1.0	1.2	1.1
JAMAICA	1.42**	5.3	6.2	5.4
TRINIDAD ETC	-0.56	2.8	2.7	2.6
CARIBBEAN	0.49	2.2	2.3	2.1
TROPICAL LATIN AMERICA	4.02***	2.1	2.9	3.3
ARGENTINA	5.77***	6.2	10.1	10.6
CHILE	2.36*	3.0	3.6	4.2
URUGUAY	2.50***	2.4	2.7	3.7
TEMPERATE SOUTH AMERICA	5.00***	4.8	7.2	8.3
LATIN AMERICA	3.87***	2.4	3.2	3.7

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 *P<0.05

POULTRY MEAT   ANNUAL GROWTH RATES OF PRODUCTION,STOCKS AND PRODUCTION/HEAD IN STOCK 1969/84

COUNTRY	PRODUCTION 1969/76	PRODUCTION 1977/84	STOCK 1969/76	STOCK 1977/84	PRODUCTION/HEAD IN STOCK 1969/76	PRODUCTION/HEAD IN STOCK 1977/84
BRAZIL	9.0***	12.3***	8.3***	4.8*	0.7	7.5***
MEXICO	7.5***	4.1***	0.9	4.8*	6.6***	-0.7
	8.5***	10.1***	5.7***	4.8*	2.8**	5.3***
BOLIVIA	6.1***	11.2***	9.1***	3.4*	-3.1***	7.8***
COLOMBIA	6.9***	5.6***	6.3***	4.3*	0.5	1.3
CUBA	3.7**	8.9***	6.6***	3.3*	-2.9	5.6***
DOMINICAN RP	4.2***	8.4***	1.4***	2.2*	2.7***	6.2***
ECUADOR	8.4***	7.5***	13.5***	12.1*	-5.1**	-4.7**
PARAGUAY	7.9***	4.5***	6.9***	4.3*	1.0	0.1
PERU	15.8***	7.5**	10.7***	1.4*	5.2*	6.1**
VENEZUELA	11.2***	8.9***	7.7***	3.5*	3.5***	5.4***
TROPICAL SOUTH AMERICA	9.9***	7.9***	8.1***	4.5*	1.8*	3.4***
COSTA RICA	6.9**	-2.0*	4.3***	1.2	2.6	-3.2**
SALVADOR	7.4**	2.1	5.9***	-2.5	1.5	4.7*
GUATEMALA	8.5***	11.7**	1.9	3.3*	6.6**	8.4*
HONDURAS	3.6***	8.6**	4.9***	3.1*	-1.3	5.4
NICARAGUA	13.7***	2.1	5.4***	3.4*	8.3***	-1.3
PANAMA	5.8***	3.8*	4.5***	3.9*	1.2	-0.1
CENTRAL AMERICA PANAMA	7.9***	6.5***	3.9***	2.4*	4.1**	4.1**
BARBADOS	29.1***	7.4***	6.0***	8.3*	23.2***	-1.6***
GUYANA	9.6***	4.6***	7.7***	4.5*	1.9***	0.1
HAITI	6.5***	8.8***	3.7***	8.2*	2.8***	0.6
JAMAICA	8.1***	1.5*	4.9*	4.0*	3.2	-2.5
TRINIDAD ETC	5.5**	1.0*	4.9***	2.5*	0.6	-1.5**
CARIBBEAN	7.9***	3.0***	5.7***	4.7*	2.2**	-1.6**
TROPICAL LATIN AMERICA	8.9***	9.1***	6.1***	4.6*	2.8***	4.5***
ARGENTINA	8.3***	7.1***	0.8	5.2*	7.5***	1.9
CHILE	-3.8	7.6*	2.5**	-1.1	-6.4***	8.7**
URUGUAY	5.3*	3.7***	5.6***	-4.4*	-0.3	8.1***
TEMPERATE SOUTH AMERICA	6.0***	7.0***	1.9**	2.3*	4.1***	4.7**
LATIN AMERICA	8.3***	8.8***	5.7***	4.5*	2.6**	4.3***

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005   ** P<0.01   * P<0.05

POULTRY MEAT* SUMMARY OF LATIN AMERICA TRADE(THOUSAND TONS)

REGION	EXPORT			IMPORT			+IMPORT-EXPORT		
	1968/75	1976/83	1984	1968/75	1976/83	1984	1968/75	1976/83	1984
BRAZIL	1	149	282	1	1	0	0	-148	-282
MEXICO	1	1	0	1	5	11	0	4	11
	2	150	282	2	6	11	0	-144	-271
BOLIVIA	0	0	0	0	0	0	0	0	0
COLOMBIA	1	1	0	1	1	1	0	0	1
CUBA	0	0	0	4	16	19	4	16	19
DOMINICAN RP	0	0	0	1	2	1	1	2	1
ECUADOR	0	0	0	0	0	0	0	0	0
PARAGUAY	0	0	0	0	0	0	0	0	0
PERU	0	1	0	1	1	0	1	0	0
VENEZUELA	1	1	2	1	16	2	0	15	0
TROPICAL SOUTH AMERICA	2	3	2	8	36	23	6	33	21
COSTA RICA	1	1	0	1	1	0	0	0	0
SALVADOR	1	1	1	1	1	1	0	0	0
GUATEMALA	1	1	0	1	1	0	0	0	0
HONDURAS	1	1	0	1	1	0	0	0	0
NICARAGUA	1	1	0	1	2	0	0	1	0
PANAMA	1	1	0	1	1	1	0	0	1
CENTRAL AMERICA PANAMA	6	6	1	6	7	2	0	1	1
BARBADOS	1	1	0	3	3	3	2	2	3
GUYANA	1	0	0	1	1	0	0	1	0
HAITI	0	0	0	1	1	1	1	1	1
JAMAICA	1	0	0	8	22	21	7	22	21
TRINIDAD	1	1	1	1	3	3	0	2	2
CARIBBEAN	4	2	1	14	30	28	10	28	27
TROPICAL LATIN AMERICA	14	161	286	30	79	64	16	-82	-222
ARGENTINA	1	3	0	1	5	2	0	2	2
CHILE	1	0	0	3	2	1	2	2	1
URUGUAY	1	3	4	0	1	0	-1	-2	-4
TEMPERATE SOUTH AMERICA	3	6	4	4	8	3	1	2	-1
LATIN AMERICA	17	167	290	34	87	67	17	-80	-223

*FRESH,CHILLED OR FROZEN

POULTRY MEAT — PRODUCTION, TRADE AND APPARENT CONSUMPTION

COUNTRY	1969/76 PRODUCTION	1969/76 +IMPORT -EXPORT	1969/76 APPARENT CONSUMPTION	1969/76 APPARENT PER CAPITA CONSUMPTION	1969/76 SELF SUFFEICIENCY INDEX	1977/84 PRODUCTION	1977/84 +IMPORT -EXPORT	1977/84 APPARENT CONSUMPTION	1977/84 APPARENT PER CAPITA CONSUMPTION	1977/84 SELF SUFFICIENCY INDEX
	-----1000 MT-----			-----KG-----		-----1000 MT-----			-----KG-----	
BRAZIL	467.1	-2.5	464.6	4.6	100.5	1303.3	-180.8	1122.6	9.1	116.1
MEXICO	284.1	0.5	284.6	5.1	99.8	434.5	6.1	440.6	6.2	98.6
	751.23	-2.00	749.23	4.76	100.27	1737.8	-174.7	1563.1	8.06	111.18
BOLIVIA	4.0	0.0	4.0	0.9	100.0	9.1	0.0	9.1	1.6	100.0
COLOMBIA	53.1	-0.0	53.1	2.4	100.0	105.4	0.3	105.7	4.0	99.7
CUBA	45.6	4.9	50.5	5.6	90.2	75.8	16.9	92.7	9.5	81.8
DOMINICAN RP	31.4	0.1	31.5	6.5	99.5	59.8	1.4	61.2	10.4	97.7
ECUADOR	11.5	0.0	11.5	1.8	100.0	23.7	0.0	23.7	2.9	100.0
PARAGUAY	8.8	0.0	8.8	3.5	100.0	14.3	0.0	14.3	4.5	100.0
PERU	95.6	0.0	95.6	6.6	100.0	162.5	0.0	162.5	9.2	100.0
VENEZUELA	127.4	0.1	127.5	10.6	99.9	260.3	15.5	275.8	17.3	94.4
TROPICAL SOUTH AMERICA	377.35	5.20	382.54	5.05	98.64	710.94	34.06	745.00	8.05	95.43
COSTA RICA	3.2	-0.0	3.2	1.7	100.1	5.3	0.0	5.3	2.3	99.8
EL SALVADOR	5.0	0.0	5.0	1.3	99.2	14.8	-0.1	14.6	3.0	100.9
GUATEMALA	10.1	-0.2	9.9	1.7	102.1	43.0	-0.1	43.0	5.8	100.2
HONDURAS	5.3	0.0	5.3	1.9	99.9	9.6	-0.0	9.6	2.5	-100.2
NICARAGUA	7.2	0.2	7.5	3.5	96.7	9.0	1.1	10.2	3.6	88.9
PANAMA	8.3	0.1	8.4	5.2	99.0	12.9	0.2	13.2	6.7	98.2
CENTRAL AMERICA PANAMA	39.19	0.16	39.35	2.42	99.59	94.69	1.16	95.85	4.61	98.79
BARBADOS	1.8	2.8	4.6	19.1	38.6	5.4	2.7	8.1	31.3	66.7
GUYANA	8.0	0.0	8.0	10.7	99.9	12.7	0.0	12.7	14.4	100.0
HAITI	4.0	0.0	4.0	0.8	99.5	6.5	0.2	6.7	1.1	96.9
JAMAICA	18.8	9.6	28.4	14.5	66.2	26.7	21.7	48.4	22.0	55.2
TRINIDAD TOB	16.1	0.1	16.3	15.4	99.3	20.4	2.3	22.7	20.2	89.7
CARIBBEAN	48.72	12.60	61.32	6.90	79.46	71.66	26.93	98.59	9.52	72.68
TROPICAL LATIN AMERICA	1216.5	16.0	1232.4	4.8	98.7	2615.1	-112.6	2502.6	7.9	104.5
ARGENTINA	222.5	-0.6	221.8	8.9	100.3	400.3	3.7	403.9	14.2	99.1
CHILE	50.5	2.6	53.1	5.4	95.1	79.1	1.6	80.7	7.2	98.0
URUGUAY	16.0	-0.1	15.9	5.6	100.9	19.2	-3.1	16.1	5.5	119.2
TEMPERATE SOUTH AMERIC	289.0	1.8	290.8	7.7	99.4	498.5	2.2	500.7	11.8	99.6
LATIN AMERICA	1505.5	17.8	1523.3	5.1	98.8	3113.7	-110.4	3003.3	8.3	103.7

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RRRRRRRR   IIIIII    CCCCCCC   EEEEEEEEE
RRRRRRRRR  IIIIII   CCCCCCCCC  EEEEEEEEE
RR     RR    II     CC     CC  EE
RR     RR    II     CC         EE
RRRRRRRRR    II     CC         EEEEEE
RRRRRRRR     II     CC         EEEEEE
RR  RR       II     CC         EE
RR   RR      II     CC     CC  EE
RR    RR   IIIIII   CCCCCCCCC  EEEEEEEEE
RR     RR  IIIIII    CCCCCCC   EEEEEEEEE
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RICE, PADDY — PRODUCTION, RELATIVE IMPORTANCE IN THE REGION AND PER CAPITA PRODUCTION LEVELS

COUNTRY	PRODUCTION 1000 MT 1962/64	1972/74	1982/84	PERCENTAGE OF TOTAL % 1982/84	PER CAPITA PRODUCTION KG 1982/84
BRAZIL	5881	6895	8833	55.132	68
MEXICO	286	448	521	3.250	7
	6167	7343	9354	58.381	46
BOLIVIA	43	75	114	0.714	19
COLOMBIA	578	1230	1831	11.430	67
CUBA	164	358	531	3.314	54
DOMINICAN RP	124	233	382	2.384	63
ECUADOR	182	231	376	2.347	43
PARAGUAY	18	44	65	0.404	19
PERU	332	487	903	5.634	48
VENEZUELA	133	254	489	3.050	28
TROPICAL SOUTH AMERICA	1574	2912	4691	29.277	48
COSTA RICA	64	107	171	1.069	70
EL SALVADOR	27	35	46	0.287	9
GUATEMALA	18	26	46	0.287	6
HONDURAS	11	19	46	0.285	11
NICARAGUA	44	78	170	1.059	56
PANAMA	116	155	183	1.144	88
CENTRAL AMERICA, PANAMA	280	419	662	4.132	27
GUYANA	227	203	283	1.766	306
HAITI	64	110	118	0.734	19
JAMAICA	5	0	3	0.017	1
TRINIDAD TOB	10	14	17	0.108	15
CARIBBEAN	306	327	421	2.626	39
TROPICAL LATIN AMERICA	8327	11001	15127	94.416	45
ARGENTINA	183	290	397	2.476	14
CHILE	79	59	137	0.857	12
URUGUAY	62	141	361	2.251	121
TEMPERATE SOUTH AMERICA	324	489	895	5.584	20
LATIN AMERICA	8651	11491	16022	100.000	42

COLUMNS MAY NOT ADD EXACTLY DUE TO ROUNDING

RICE, PADDY ANNUAL GROWTH RATES

COUNTRY	PRODUCTION 1965/74	1975/84	1965/84	AREA 1965/74	1975/84	1965/84	YIELD 1965/74	1975/84	1965/84
BRASIL	0.3	0.4	1.8***	1.1*	-0.8	1.8***	-0.8	1.3	0.0
MEXICO	2.3**	-0.6	2.2***	1.1	-1.8	0.4	1.1	1.2	1.8***
	0.5	0.4	1.9***	1.1*	-0.9	1.8***	-0.7	1.2	0.1
BOLIVIA	4.8**	-0.9	3.4***	5.3**	-0.1	3.8***	-0.6	-0.8	-0.3
COLOMBIA	8.2***	2.2	6.6***	-1.7	1.2	2.1***	9.8***	1.0**	4.5***
CUBA	23.7***	2.2***	10.2***	20.4***	-1.5**	5.6***	3.3	3.8***	4.6***
DOMINICAN RP	4.5***	4.5**	5.2***	-2.2**	1.2	2.6***	6.7***	3.2	2.6***
ECUADOR	1.9	2.1	4.0***	-3.1	1.2	1.5*	5.0	0.9	2.5***
PARAGUAY	14.7***	1.6	7.8***	17.7***	1.4	8.7***	-3.0**	0.2	-0.9**
PERU	5.6**	6.9**	4.3***	4.8**	6.3**	3.6***	0.8	0.6	0.7***
VENEZUELA	2.2	5.1	6.7***	-1.0	7.0	3.8***	3.1	-1.9***	2.9***
TROPICAL SOUTH AMERICA	7.3***	3.4***	6.0***	1.9**	2.2***	2.9***	5.3***	1.2***	3.1***
COSTA RICA	3.1*	-0.8	5.1***	0.0	-0.7	2.8***	3.1	-0.1	2.3***
SALVADOR	-4.7	0.9	-0.2	-7.8*	-1.2	-1.4	3.2**	2.1	1.2**
GUATEMALA	7.2**	2.4	5.2***	6.3**	-1.7	2.8**	0.9	4.1	2.4**
HONDURAS	7.5***	6.0***	8.3***	5.1***	1.6	5.5***	2.3***	4.4**	2.8***
NICARAGUA	3.3**	12.3**	4.4***	0.4	8.3**	2.6***	2.9**	4.0	1.8**
PANAMA	0.5	1.2	1.4***	-3.2**	-2.1**	-1.5***	3.7***	3.3**	2.9***
CENTRAL AMERICA,PANAMA	1.7	3.2**	3.4***	-1.4	-0.0	0.8*	3.1**	3.2**	2.7***
GUYANA	-3.0	1.1	1.7*	-3.9**	-4.6**	-1.8***	0.9	5.6***	3.5***
HAITI	5.3***	0.4	2.4***	-1.5	3.8***	1.6**	6.7***	-3.4*	0.8
JAMAICA	-23.0***	3.7	7.5**	-27.0***	-0.3	3.7	4.0***	4.0**	3.8***
TRINIDAD ETC	4.6***	-1.8	5.0***	1.2	-5.0*	3.2***	3.4***	3.3***	1.8***
CARIBBEAN	-0.5	0.5	2.1***	-3.2**	-2.0*	-0.6	2.8**	2.5***	2.6***
TROPICAL LATIN AMERICA	2.0**	1.3	3.0***	1.0*	-0.4	1.8***	0.9*	1.7***	1.1***
ARGENTINA	3.9	1.9	2.0**	4.3*	1.3	2.5***	-0.4	0.6	-0.4
CHILE	-6.1	4.7	4.1***	-7.4**	3.2	1.9	1.3	1.5	2.1***
URUGUAY	5.8***	7.4***	7.9***	2.6**	4.9***	5.7***	3.1**	2.5	2.2***
TEMPERATE SOUTH AMERICA	2.9	4.4***	4.2***	1.6	2.8**	3.2***	1.3	1.6	1.0***
LATIN AMERICA	2.0**	1.5	3.0***	1.1*	-0.3	1.9***	1.0**	1.8***	1.1***

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

RICE, PADDY TRENDS IN AREA LEVEL BY COUNTRY 1962/84

COUNTRY	ANNUAL GROWTH RATE IN AREA 1962/84 %	AVERAGE AREA 1962/64	AVERAGE AREA 1972/74	AVERAGE AREA 1982/84
		1000 HA		
BRASIL	2.144***	3751.3	4664.2	5496.3
MEXICO	0.752	134.0	159.8	164.3
	2.105***	3885.3	4824.0	5660.7
BOLIVIA	4.291***	29.0	48.1	73.0
COLOMBIA	1.934***	285.0	301.2	402.3
CUBA	4.195***	106.7	166.7	148.0
DOMINICAN RP	2.886***	61.0	66.6	109.0
ECUADOR	0.787	111.3	92.9	125.7
PARAGUAY	8.711***	7.3	22.0	30.7
PERU	3.627***	80.7	117.2	201.3
VENEZUELA	4.089***	78.0	98.6	180.7
TROPICAL SOUTH AMERICA	2.785***	759.0	913.3	1270.7
COSTA RICA	2.533***	50.3	59.0	78.0
EL SALVADOR	-0.199	11.7	10.5	13.0
GUATEMALA	2.171**	11.3	12.7	16.3
HONDURAS	5.113***	9.0	13.4	22.3
NICARAGUA	2.459***	22.7	26.9	44.0
PANAMA	-0.903**	108.0	107.6	100.0
CENTRAL AMERICA,PANAMA	0.973***	213.0	230.1	273.7
GUYANA	-1.089*	104.0	96.3	88.0
HAITI	0.396	56.3	42.0	55.3
JAMAICA	-2.014	2.7	0.1	1.0
TRINIDAD ETC	2.414***	5.0	5.1	5.0
CARIBBEAN	-0.526	168.0	143.5	149.3
TROPICAL LATIN AMERICA	2.097***	5025.3	6111.0	7354.3
ARGENTINA	2.956***	53.0	80.8	104.3
CHILE	1.159	30.0	19.3	35.7
URUGUAY	6.176***	20.0	36.1	72.7
TEMPERATE SOUTH AMERICA	3.404***	103.0	136.2	212.7
LATIN AMERICA	2.129***	5128.3	6247.2	7567.0

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

RICE, PADDY　　TRENDS IN YIELD LEVEL BY COUNTRY 1962/84

COUNTRY	ANNUAL GROWTH RATE IN YIELD 1962/84 %	AVERAGE YIELD 1962/64	AVERAGE YIELD 1972/74	AVERAGE YIELD 1982/84
		KG/HA		
BRASIL	-0.160	1572.7	1478.2	1605.3
MEXICO	2.068***	2136.5	2806.8	3172.1
	-0.072	1592.3	1522.2	1650.4
BOLIVIA	-0.039	1481.1	1568.0	1541.2
COLOMBIA	4.582***	2036.2	4054.7	4555.9
CUBA	4.332***	1594.0	2147.6	3588.4
DOMINICAN RP	2.807***	2026.8	3499.0	3593.6
ECUADOR	3.065***	1630.7	2485.1	2975.5
PARAGUAY	-0.952***	2404.8	1983.7	2104.7
PERU	0.593***	4092.7	4153.1	4469.7
VENEZUELA	3.022***	1695.7	2573.2	2707.5
TROPICAL SOUTH AMERICA	3.152***	2076.4	3173.9	3689.4
COSTA RICA	2.915***	1277.4	1985.8	2160.2
SALVADOR	1.801***	2299.0	3345.7	3496.5
GUATEMALA	2.558***	1600.9	2078.7	2955.2
HONDURAS	2.470***	1224.1	1439.7	2050.7
NICARAGUA	2.444***	1944.0	2893.3	3859.8
PANAMA	2.845***	1078.5	1439.6	1838.0
CENTRAL AMERICA,PANAMA	2.946***	1315.2	1827.1	2418.2
GUYANA	2.444***	2182.7	2072.4	3217.4
HAITI	2.454***	1136.0	2627.2	2135.4
JAMAICA	2.634***	1722.2	1721.8	2666.7
TRINIDAD ETC	2.028***	2066.7	2803.0	3466.7
CARIBBEAN	2.364***	1818.5	2257.7	2814.1
TROPICAL LATIN AMERICA	0.961***	1659.7	1799.2	2055.5
ARGENTINA	-0.157	3458.5	3585.1	3762.3
CHILE	1.786***	2638.2	2938.6	3844.1
URUGUAY	2.221***	3097.9	3925.3	4996.8
TEMPERATE SOUTH AMERICA	1.077***	3148.2	3590.4	4193.8
LATIN AMERICA	0.994***	1689.8	1838.4	2115.4

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005　** P<0.01　*P<0.05

RICE SUMMARY OF LATIN AMERICA TRADE(THOUSAND TONS)

REGION	EXPORT			IMPORT			+IMPORT-EXPORT		
	1962/64	1972/74	1982/84	1962/64	1972/74	1982/84	1962/64	1972/74	1982/84
BRAZIL	29	31	8	0	7	174	-29	-24	166
MEXICO	32	10	0	1	37	42	-31	27	42
	61	41	8	1	44	216	-60	3	208
BOLIVIA	0	2	0	5	0	6	5	-2	6
COLOMBIA	3	8	14	2	1	1	-1	-7	-13
CUBA	0	0	0	224	245	198	224	245	198
DOMINICAN RP	0	0	0	28	37	1	28	37	1
ECUADOR	17	0	0	0	1	28	-17	1	28
PARAGUAY	0	1	0	0	0	0	0	-1	0
PERU	0	30	0	17	0	52	17	-30	52
VENEZUELA	0	37	17	3	2	1	3	-35	-16
TROPICAL SOUTH AMERICA	20	78	31	279	286	287	259	208	256
COSTA RICA	1	5	20	1	1	21	0	-4	1
EL SALVADOR	2	3	1	3	1	7	1	-2	6
GUATEMALA	1	1	2	1	2	3	0	1	1
HONDURAS	1	1	0	2	3	3	1	2	3
NICARAGUA	2	6	1	6	1	8	4	-5	7
PANAMA	0	2	6	4	3	1	4	1	-5
CENTRAL AMERICA,PANAMA	7	18	30	17	11	43	10	-7	13
BARBADOS	0	1	1	9	7	7	9	6	6
GUYANA	78	57	43	0	0	0	-78	-57	-43
HAITI	0	0	0	2	1	15	2	1	15
JAMAICA	1	1	0	24	36	48	23	35	48
TRINIDAD ETC	1	1	1	28	33	46	27	32	45
CARIBBEAN	80	60	45	63	77	116	-17	17	71
TROPICAL LATIN AMERICA	168	197	114	360	418	662	192	221	548
ARGENTINA	20	33	71	0	0	1	-20	-33	-70
CHILE	13	0	0	14	32	21	1	32	21
URUGUAY	22	49	198	0	0	1	-22	-49	-197
TEMPERATE SOUTH AMERICA	55	82	269	14	32	23	-41	-50	-246
LATIN AMERICA	223	279	383	374	450	685	151	171	302

RICE

PRODUCTION,TRADE AND APPARENT CONSUMPTION

COUNTRY	1972/74 PRODUCTION	1972/74 +IMPORT -EXPORT	1972/74 APPARENT CONSUMPTION	1972/74 APPARENT PER CAPITA CONSUMPTION	1972/74 SELF SUFFICIENCY INDEX	1982/84 PRODUCTION	1982/84 +IMPORT -EXPORT	1982/84 APPARENT CONSUMPTION	1982/84 APPARENT PER CAPITA CONSUMPTION	1982/84 SELF SUFFICIENCY INDEX
	1000 MT			KG		1000 MT			KG	
BRAZIL	4482	-24	4458	43	100.53	5741	166	5908	45	97.19
MEXICO	291	27	319	6	91.43	338	42	380	5	89.06
	4773	4	4777	30	99.92	6080	208	6288	31	96.70
BOLIVIA	49	-2	47	10	103.78	74	6	80	13	92.79
COLOMBIA	799	-8	792	36	100.97	1190	-14	1177	43	101.15
CUBA	233	244	477	53	48.80	345	197	542	55	63.64
DOMINICAN RP	152	36	188	38	80.68	248	0	248	41	99.99
ECUADOR	150	0	150	23	99.93	244	28	272	31	89.72
PARAGUAY	28	-0	28	11	101.65	42	0	42	12	100.00
PERU	316	-30	286	20	110.44	587	51	638	34	91.93
VENEZUELA	165	-35	130	11	127.15	318	-16	302	17	105.31
TROPICAL SOUTH AMERICA	1893	206	2098	27	90.20	3049	253	3302	34	92.34
COSTA RICA	69	-3	66	35	105.10	111	1	112	46	99.10
EL SALVADOR	23	-2	21	5	107.47	30	6	36	7	82.95
GUATEMALA	17	1	18	3	91.87	30	1	31	4	97.74
HONDURAS	13	2	15	5	85.68	30	3	32	8	92.11
NICARAGUA	50	-5	46	21	110.73	110	7	117	38	94.10
PANAMA	101	1	102	62	99.33	119	-5	114	55	104.67
CENTRAL AMERICA,PANAMA	272	-6	267	16	102.09	430	12	442	20	97.29
BARBADOS	0	6	6	26	0.00	0	7	7	26	0.00
GUYANA	132	-57	75	99	175.70	184	-43	141	153	130.23
HAITI	71	1	72	15	98.74	76	15	91	15	83.60
JAMAICA	0	36	36	18	0.42	2	47	49	22	3.53
TRINIDAD ETC	9	33	42	40	21.85	11	46	57	50	19.77
CARIBBEAN	213	19	232	26	91.73	273	72	346	32	79.11
TROPICAL LATIN AMERICA	7151	223	7374	28	96.98	9833	545	10377	31	94.75
ARGENTINA	188	-32	156	6	120.71	258	-70	188	6	137.15
CHILE	38	32	70	7	54.69	89	20	110	9	81.46
URUGUAY	92	-48	43	15	211.22	234	-197	37	12	632.19
TEMPERATE SOUTH AMERIC	318	-49	269	7	118.23	582	-247	335	8	173.77
LATIN AMERICA	7469	174	7643	25	97.73	10414	298	10712	28	97.22

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WW     WW  HH     HH  EEEEEEEEE     AAA     TTTTTTTT
WW     WW  HH     HH  EEEEEEEEE    AAAAA    TTTTTTTT
WW     WW  HH     HH  EE          AA   AA      TT
WW     WW  HH     HH  EE         AA     AA     TT
WW     WW  HHHHHHHHH  EEEEEE     AA     AA     TT
WW     WW  HHHHHHHHH  EEEEEE     AAAAAAAAA     TT
WW  W  WW  HH     HH  EE         AAAAAAAAA     TT
WW WWW WW  HH     HH  EE         AA     AA     TT
 WWW WWW   HH     HH  EEEEEEEEE  AA     AA     TT
  W   W    HH     HH  EEEEEEEEE  AA     AA     TT
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WHEAT — PRODUCTION, RELATIVE IMPORTANCE IN THE REGION AND PER CAPITA PRODUCTION LEVELS

COUNTRY	PRODUCTION -1000 MT- 1962/64	1972/74	1982/84	PERCENTAGE OF TOTAL % 1982/84	PER CAPITA PRODUCTION KG 1982/84
BRAZIL	580	1958	1964	9.352	15
MEXICO	1562	2230	4063	19.345	54
	2142	4187	6028	28.697	29
BOLIVIA	51	58	58	0.278	10
COLOMBIA	112	67	75	0.357	3
ECUADOR	56	50	30	0.143	3
PARAGUAY	8	25	91	0.432	26
PERU	150	123	88	0.421	5
VENEZUELA	1	1	0	0.002	0
TROPICAL SOUTH AMERICA	377	324	343	1.632	3
GUATEMALA	35	48	37	0.178	5
HONDURAS	1	1	1	0.005	0
CENTRAL AMERICA,PANAMA	36	49	38	0.183	2
CARIBBEAN	0	0	0	0.000	0
TROPICAL LATIN AMERICA	2555	4560	6409	30.511	19
ARGENTINA	8633	6810	13433	63.955	461
CHILE	1088	960	741	3.529	63
URUGUAY	445	337	421	2.004	142
TEMPERATE SOUTH AMERICA	10167	8107	14596	69.489	333
LATIN AMERICA	12721	12667	21004	100.000	55

COLUMNS MAY NOT ADD EXACTLY DUE TO ROUNDING

WHEAT ANNUAL GROWTH RATES

COUNTRY	PRODUCTION 1965/74	PRODUCTION 1975/84	PRODUCTION 1965/84	AREA 1965/74	AREA 1975/84	AREA 1965/84	YIELD 1965/74	YIELD 1975/84	YIELD 1965/84
BRASIL	16.8***	-2.2	6.8***	15.2***	-6.7**	6.0***	1.6	4.5*	0.8
MEXICO	3.2	4.6**	4.1***	-1.4	3.1	0.9	4.6***	1.5**	3.2***
	8.2***	1.9	5.0***	9.3***	-4.1**	4.2***	-1.0	6.0***	0.8
BOLIVIA	4.1	-1.1	2.2**	1.1	0.8	2.4***	3.1*	-1.8	-0.2
COLOMBIA	-7.7***	9.6***	-3.1**	-10.0***	4.9***	-5.3***	2.2**	4.7**	2.1***
ECUADOR	-3.7	-8.6**	-5.9***	-3.8	-11.0***	-6.8***	0.1	2.5*	0.9**
PARAGUAY	12.7*	18.1***	9.3***	14.1**	14.1***	8.0***	-1.5	4.0*	1.3
PERU	-1.5*	-4.5**	-2.4***	-1.2***	-6.3***	-3.7***	-0.3	1.8*	1.3***
VENEZUELA	-8.9**	-5.7***	-5.8***	-6.7**	-5.5***	-4.2***	-2.2*	-0.3	-1.6***
TROPICAL SOUTH AMERICA	-1.9**	1.8	-1.0**	-2.3***	-0.7	-1.8***	0.4	2.5***	0.8***
GUATEMALA	7.0***	-4.4*	2.2**	2.1	-1.0	2.3***	4.9***	-3.4	-0.1
HONDURAS	-1.5	8.8***	2.6**	-0.5	6.5***	1.8**	-1.1*	2.3***	0.8**
CENTRAL AMERICA,PANAMA	6.8***	-4.2*	2.2**	2.0	-0.9	2.3***	4.8***	-3.3	-0.1
TROPICAL LATIN AMERICA	7.2***	1.9	4.5***	7.4***	-3.8**	3.4***	-0.2	5.6***	1.1
ARGENTINA	0.1	5.9*	3.7***	-2.9*	3.6	1.3*	3.0*	2.3	2.4***
CHILE	-3.2	-4.1	-3.0***	-2.9**	-7.0***	-3.4***	-0.3	2.8*	0.3
URUGUAY	-1.4	2.9	0.4	-4.1	-5.6*	-2.5**	2.7	8.5***	2.9***
TEMPERATE SOUTH AMERICA	-0.4	5.0*	2.9***	-3.0**	2.3	0.7	2.5**	2.7	2.2***
LATIN AMERICA	2.2***	3.9*	3.4***	0.3	0.1	1.6***	1.9**	3.8***	1.8***

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

WHEAT   TRENDS IN AREA LEVEL BY COUNTRY 1962/84

COUNTRY	ANNUAL GROWTH RATE IN AREA 1962/84 %	AVERAGE AREA 1962/64	AVERAGE AREA 1972/74	AVERAGE AREA 1982/84
		-----1000 HA-----		
BRASIL	6.710***	756.7	2210.2	2147.7
MEXICO	0.639	770.0	700.4	986.3
	4.572***	1526.7	2910.6	3134.0
BOLIVIA	0.860	98.3	68.9	85.3
COLOMBIA	-6.106***	121.0	54.1	44.7
ECUADOR	-5.635***	74.3	52.9	27.3
PARAGUAY	8.637***	10.3	27.6	71.7
PERU	-3.212***	152.0	136.3	81.0
VENEZUELA	-2.969***	1.7	1.5	1.0
TROPICAL SOUTH AMERICA	-2.066***	457.7	341.3	311.0
GUATEMALA	1.419**	38.7	35.2	38.0
HONDURAS	0.526	1.0	0.7	1.0
CENTRAL AMERICA,PANAMA	1.399**	39.7	35.9	39.0
TROPICAL LATIN AMERICA	3.613***	2024.0	3287.8	3484.0
ARGENTINA	0.968	5185.3	4385.3	6773.3
CHILE	-2.895***	756.0	605.5	401.3
URUGUAY	-2.432**	427.0	299.3	260.3
TEMPERATE SOUTH AMERICA	0.432	6368.3	5290.2	7435.0
LATIN AMERICA	1.424***	8392.3	8578.0	10919.0

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

WHEAT TRENDS IN YIELD LEVEL BY COUNTRY 1962/84

COUNTRY	ANNUAL GROWTH RATE IN YIELD 1962/84 %	AVERAGE YIELD 1962/64	AVERAGE YIELD 1972/74	AVERAGE YIELD 1982/84
		KG/HA		
BRASIL	0.934	773.5	894.9	963.4
MEXICO	3.482***	2026.6	3167.1	4120.6
	0.785	1406.1	1443.7	1959.1
BOLIVIA	0.855	513.9	836.7	675.4
COLOMBIA	2.383***	908.8	1241.7	1680.3
ECUADOR	1.410***	747.1	950.8	1087.9
PARAGUAY	1.814**	745.5	947.6	1253.3
PERU	0.803***	984.4	905.1	1089.6
VENEZUELA	-2.372***	666.7	433.7	372.7
TROPICAL SOUTH AMERICA	1.020***	821.8	950.0	1102.0
GUATEMALA	0.554	897.0	1410.4	989.8
HONDURAS	0.228	1000.0	861.1	1000.0
CENTRAL AMERICA,PANAMA	0.551	899.6	1397.6	989.9
TROPICAL LATIN AMERICA	1.142**	1263.7	1391.0	1867.2
ARGENTINA	1.308**	1644.2	1553.0	1987.1
CHILE	0.660*	1441.2	1574.1	1822.6
URUGUAY	2.176***	1008.4	1093.9	1613.2
TEMPERATE SOUTH AMERICA	1.290***	1577.8	1532.2	1966.1
LATIN AMERICA	1.158***	1505.1	1483.9	1929.0

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 *P<0.05

WHEAT SUMMARY OF LATIN AMERICA TRADE(THOUSAND TONS)

REGION	EXPORT			IMPORT			+IMPORT-EXPORT		
	1962/64	1972/74	1982/84	1962/64	1972/74	1982/84	1962/64	1972/74	1982/84
BRAZIL	0	1	3	2337	2393	4426	2337	2392	4423
MEXICO	217	16	1	41	779	389	-176	763	388
	217	17	4	2378	3172	4815	2161	3155	4811
BOLIVIA	0	0	1	153	190	315	153	190	314
COLOMBIA	0	0	0	130	385	606	130	385	606
CUBA	0	0	0	679	912	1398	679	912	1398
DOMINICAN RP	0	0	1	62	90	167	62	90	166
ECUADOR	0	0	0	48	126	284	48	126	284
PARAGUAY	0	0	0	89	53	69	89	53	69
PERU	2	1	2	390	538	894	388	537	892
VENEZUELA	0	1	1	406	590	876	406	589	875
TROPICAL SOUTH AMERICA	2	2	5	1957	2884	4609	1955	2882	4604
COSTA RICA	0	1	3	58	74	100	58	73	97
EL SALVADOR	1	0	1	43	66	135	42	66	134
GUATEMALA	0	1	0	61	69	114	61	68	114
HONDURAS	0	1	2	24	47	87	24	46	85
NICARAGUA	0	1	4	26	39	70	26	38	66
PANAMA	0	1	1	36	44	59	36	43	58
CENTRAL AMERICA,PANAMA	1	5	11	248	339	565	247	334	554
BARBADOS	1	1	0	17	20	19	16	19	19
GUYANA	0	3	0	41	48	9	41	45	9
HAITI	0	1	0	50	77	182	50	76	182
JAMAICA	1	1	0	134	182	171	133	181	171
TRINIDAD ETC	1	1	1	85	94	100	84	93	99
CARIBBEAN	3	7	1	327	421	481	324	414	480
TROPICAL LATIN AMERICA	223	31	21	4910	6816	10470	4687	6785	10449
ARGENTINA	2814	2243	7159	0	141	0	-2814	-2102	-7159
CHILE	0	0	0	280	735	1049	280	735	1049
URUGUAY	25	3	117	5	114	39	-20	111	-78
TEMPERATE SOUTH AMERICA	2839	2246	7276	285	990	1088	-2554	-1256	-6188
LATIN AMERICA	3062	2277	7297	5195	7806	11558	2133	5529	4261

WHEAT — PRODUCTION, TRADE AND APPARENT CONSUPTION

COUNTRY	1972/74 PRODUCTION	1972/74 +IMPORT -EXPORT	1972/74 APPARENT CONSUMPTION	1972/74 APPARENT PER CAPITA CONSUMPTION	1972/74 SELF SUFFICIENCY INDEX	1982/84 PRODUCTION	1982/84 +IMPORT -EXPORT	1982/84 APPARENT CONSUMPTION	1982/84 APPARENT PER CAPITA CONSUMPTION	1982/84 SELF SUFFICIENCY INDEX
	1000 MT			KG		1000 MT			KG	
BRAZIL	1958	2393	4350	42	45.00	1964	4423	6388	49	30.75
MEXICO	2230	763	2993	53	74.50	4063	389	4452	59	91.27
	4187	3156	7343	46	57.02	6028	4812	10840	53	55.61
BOLIVIA	58	190	247	53	23.31	58	315	373	62	15.64
COLOMBIA	67	384	451	20	14.81	75	605	680	25	11.02
CUBA	0	911	911	101	0.00	0	1397	1397	141	0.00
DOMINICAN RP	0	90	90	18	0.00	0	166	166	27	0.00
ECUADOR	50	125	176	27	28.64	30	284	314	36	9.56
PARAGUAY	25	53	78	31	32.33	91	68	159	46	56.97
PERU	123	537	660	45	18.68	88	892	980	52	9.01
VENEZUELA	1	589	590	48	0.11	0	875	875	51	0.04
TROPICAL SOUTH AMERICA	324	2880	3204	42	10.11	343	4602	4945	50	6.93
COSTA RICA	0	74	74	39	0.00	0	97	97	40	0.00
EL SALVADOR	0	66	66	17	0.00	0	134	134	26	0.00
GUATEMALA	48	68	116	20	41.51	37	113	151	19	24.79
HONDURAS	1	46	47	16	1.36	1	85	86	21	1.16
NICARAGUA	0	38	38	18	0.00	0	66	66	22	0.00
PANAMA	0	44	44	27	0.00	0	58	58	28	0.00
CENTRAL AMERICA,PANAMA	49	335	384	23	12.74	38	553	592	26	6.48
BARBADOS	0	19	19	78	0.00	0	19	19	71	0.00
GUYANA	0	45	45	59	0.00	0	8	8	9	0.00
HAITI	0	76	76	15	0.00	0	181	181	29	0.00
JAMAICA	0	181	181	92	0.00	0	170	170	75	0.00
TRINIDAD ETC	0	94	94	88	0.00	0	99	99	88	0.00
CARIBBEAN	0	414	414	46	0.00	0	478	478	44	0.00
TROPICAL LATIN AMERICA	4560	6785	11345	43	40.19	6409	10446	16855	50	38.02
ARGENTINA	6810	-2101	4709	191	144.63	13433	-7159	6275	215	214.09
CHILE	960	734	1695	172	56.67	741	1049	1790	153	41.41
URUGUAY	337	110	447	158	75.29	421	-78	343	115	122.76
TEMPERATE SOUTH AMERIC	8107	-1257	6850	183	118.34	14596	-6188	8408	192	173.60
LATIN AMERICA	12667	5528	18195	60	69.62	21004	4258	25262	66	83.14

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M       M     AAA     IIIIII    ZZZZZZZZZ  EEEEEEEEE
MM     MM    AAAAA    IIIIII    ZZZZZZZZZ  EEEEEEEEE
MMM-  MMM   AA   AA     II           ZZ    EE
MMMM MMMM  AA     AA    II          ZZ     EE
MM MMM MM  AA     AA    II         ZZ      EEEEEE
MM  M  MM  AAAAAAAAA    II        ZZ       EEEEEE
MM     MM  AAAAAAAAA    II       ZZ        EE
MM     MM  AA     AA    II      ZZ         EE
MM     MM  AA     AA  IIIIII    ZZZZZZZZZ  EEEEEEEEE
MM     MM  AA     AA  IIIIII    ZZZZZZZZZ  EEEEEEEEE
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MAIZE PRODUCTION,RELATIVE IMPORTANCE IN THE REGION AND PER CAPITA PRODUCTION LEVELS

COUNTRY	PRODUCTION 1000 MT 1962/64	PRODUCTION 1000 MT 1972/74	PRODUCTION 1000 MT 1982/84	PERCENTAGE OF TOTAL % 1982/84	PER CAPITA PRODUCTION KG 1982/84
BRAZIL	9804	15117	20587	42.151	158
MEXICO	7220	8560	12380	25.348	164
	17025	23677	32967	67.499	160
BOLIVIA	245	274	426	0.872	71
COLOMBIA	835	779	879	1.800	32
CUBA	140	90	96	0.197	10
DOMINICAN RP	46	48	49	0.100	8
ECUADOR	153	253	284	0.582	32
PARAGUAY	150	246	477	0.976	137
PERU	481	611	597	1.223	32
VENEZUELA	482	505	512	1.048	30
TROPICAL SOUTH AMERICA	2532	2806	3320	6.798	34
COSTA RICA	64	64	95	0.194	39
EL SALVADOR	204	332	455	0.932	87
GUATEMALA	597	805	1061	2.173	134
HONDURAS	299	342	459	0.939	112
NICARAGUA	150	175	200	0.410	66
PANAMA	77	53	70	0.144	34
CENTRAL AMERICA,PANAMA	1391	1771	2341	4.792	94
BARBADOS	1	2	2	0.004	8
GUYANA	1	3	1	0.002	1
HAITI	230	222	178	0.364	28
JAMAICA	4	6	3	0.006	1
TRINIDAD TOB	3	4	3	0.006	3
CARIBBEAN	240	236	187	0.382	17
TROPICAL LATIN AMERICA	21187	28490	38814	79.471	114
ARGENTINA	4977	8487	9367	19.178	321
CHILE	200	314	553	1.132	47
URUGUAY	151	198	107	0.219	36
TEMPERATE SOUTH AMERICA	5327	8999	10026	20.529	229
LATIN AMERICA	26514	37489	48841	100.000	128

COLUMNS MAY NOT ADD EXACTLY DUE TO ROUNDING

MAIZE ANNUAL GROWTH RATES

COUNTRY	PRODUCTION 1965/74	1975/84	1965/84	AREA 1965/74	1975/84	1965/84	YIELD 1965/74	1975/84	1965/84
BRASIL	3.2***	3.0*	3.1***	2.2***	0.8	1.6***	1.0**	2.2	1.5***
MEXICO	-0.6	5.6**	2.1***	-1.2**	1.5	-0.5	0.6	4.1***	2.6***
	1.7***	3.9***	2.7***	0.7**	1.1	0.7***	1.0***	2.8**	2.0***
BOLIVIA	0.1	4.5**	2.8***	0.5	3.4***	2.1***	-0.5**	1.1	0.7**
COLOMBIA	-1.4**	1.5*	0.1	-5.0***	-0.1	-1.7***	3.6***	1.6***	1.8***
CUBA	-1.3	0.3***	0.2	-0.1	-0.2	-2.2***	-1.2	0.5*	2.4***
DOMINICAN RP	2.9***	-2.7	0.7	0.8	2.6	1.2	2.2**	-5.3*	-0.5
ECUADOR	4.2***	1.8	1.6**	-0.2	-3.4**	-2.6***	4.4***	5.3***	4.2***
PARAGUAY	3.7*	5.0**	6.7***	2.7*	6.6***	6.1***	1.1	-1.6	0.6
PERU	1.2**	-2.2	0.2	1.1	-6.0**	-1.6**	0.1	3.9*	1.7***
VENEZUELA	-1.0	-2.9	-0.5	-1.3	-5.6**	-3.2***	0.2	2.7**	2.6***
TROPICAL SOUTH AMERICA	0.3	0.6	1.1***	-1.4**	-0.8*	-0.7***	1.7***	1.4**	1.9***
COSTA RICA	-4.1	1.8	1.5*	-5.4***	0.8	-1.5*	1.3	0.9	3.0***
SALVADOR	6.0**	2.1	4.5***	0.7*	0.1	1.9***	5.3**	2.1*	2.6***
GUATEMALA	3.5***	2.4***	2.9***	-2.4**	3.1***	0.2	6.0***	-0.6	2.6***
HONDURAS	0.3***	2.7	2.0***	0.0	-2.1	1.5**	0.3	4.8***	0.5
NICARAGUA	0.2	0.3	0.0	1.7	-2.9	-1.7***	-1.5	3.2**	1.7***
PANAMA	-6.9***	0.4	-1.1	-6.6***	-1.6	-2.5***	-0.3	1.9*	1.5***
CENTRAL AMERICA,PANAMA	2.2***	2.1***	2.5***	-1.2**	0.4	0.3	3.5***	1.7**	2.2***
BARBADOS	9.6***	0.0	3.6***	6.3***	4.1***	4.0***	3.3***	-4.1***	-0.3
GUYANA	13.7***	-18.6***	-0.4	5.1**	-14.9***	0.7	8.6***	-3.7	-1.1
HAITI	-1.0	0.3	-2.2***	-2.0*	-1.1	-1.3***	1.1	1.4	-0.8
JAMAICA	5.3	-17.6***	-0.0	3.4	-14.0***	-2.2	1.9	-3.6**	2.2***
TRINIDAD ETC	9.0**	-6.8***	3.7**	5.9	-2.3***	4.6***	3.2	-4.5***	-0.9
CARIBBEAN	-0.5	-0.6	-2.0***	-1.9*	-1.4	-1.3***	1.4	0.8	-0.7
TROPICAL LATIN AMERICA	1.6***	3.5***	2.5***	0.3	0.8	0.5***	1.3***	2.6***	2.0***
ARGENTINA	4.7*	3.7	1.9**	1.2	1.3	-1.1**	3.5*	2.5	3.0***
CHILE	0.9	9.1***	4.1***	1.0	3.6**	2.9***	-0.1	5.5***	1.2*
URUGUAY	10.3**	-4.7	0.1	-0.4	-5.5**	-4.1***	10.7***	0.8	4.2***
TEMPERATE SOUTH AMERICA	4.7*	3.9	1.9**	1.1	1.1	-1.2**	3.6**	2.8	3.1***
LATIN AMERICA	2.3***	3.5***	2.4***	0.4	0.9	-0.3**	1.9***	2.7***	2.1***

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

MAIZE TRENDS IN AREA LEVEL BY COUNTRY 1962/84

COUNTRY	ANNUAL GROWTH RATE IN AREA 1962/84 %	AVERAGE AREA 1962/64	AVERAGE AREA 1972/74	AVERAGE AREA 1982/84
		1000 HA		
BRASIL	1.959***	7804.0	10378.3	11855.3
MEXICO	-0.163	6932.0	7205.3	7329.7
	1.082***	14736.0	17583.6	19185.0
BOLIVIA	1.705***	217.3	216.4	289.7
COLOMBIA	-1.367***	719.3	591.6	604.3
CUBA	-2.824***	142.0	107.1	77.0
DOMINICAN RP	0.446	30.7	26.7	34.3
ECUADOR	-1.561***	253.0	296.0	201.0
PARAGUAY	6.235***	116.7	192.0	396.7
PERU	-1.067**	339.0	371.2	253.3
VENEZUELA	-2.057***	451.0	455.5	308.3
TROPICAL SOUTH AMERICA	-0.377**	2269.0	2256.5	2164.7
COSTA RICA	-1.202*	59.3	52.3	59.3
EL SALVADOR	1.916***	178.7	205.8	241.0
GUATEMALA	0.062	675.0	577.3	743.0
HONDURAS	1.632***	263.0	285.8	327.3
NICARAGUA	-0.513	169.7	226.1	173.0
PANAMA	-2.212***	92.0	69.6	71.7
CENTRAL AMERICA,PANAMA	0.428**	1437.7	1416.9	1615.3
BARBADOS	3.835***	0.5	0.8	1.0
GUYANA	1.358	1.0	1.5	1.0
HAITI	-1.825***	300.0	220.0	185.7
JAMAICA	-2.417**	5.0	4.6	2.0
TRINIDAD ETC	2.444*	1.0	0.9	1.0
CARIBBEAN	-1.780***	307.5	227.8	190.7
TROPICAL LATIN AMERICA	0.844***	18750.2	21484.8	23155.7
ARGENTINA	-0.367	2791.0	3399.5	3055.0
CHILE	2.275***	85.7	92.8	123.7
URUGUAY	-3.707***	223.3	199.8	99.3
TEMPERATE SOUTH AMERICA	-0.453	3100.0	3692.1	3278.0
LATIN AMERICA	0.673***	21850.2	25176.9	26433.7

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

MAIZE TRENDS IN YIELD LEVEL BY COUNTRY 1962/84

COUNTRY	ANNUAL GROWTH RATE IN YIELD 1962/84 %	AVERAGE YIELD 1962/64	AVERAGE YIELD 1972/74	AVERAGE YIELD 1982/84
		KG/HA		
BRASIL	1.513***	1258.2	1455.8	1736.9
MEXICO	2.470***	1038.1	1188.3	1701.2
	1.944***	1155.6	1346.6	1720.8
BOLIVIA	0.958***	1130.2	1264.7	1462.4
COLOMBIA	1.490***	1156.9	1317.7	1455.7
CUBA	1.752***	987.9	861.2	1251.1
DOMINICAN RP	0.019	1488.9	1823.3	1423.6
ECUADOR	3.959***	619.4	867.5	1423.8
PARAGUAY	0.385	1283.6	1275.6	1199.8
PERU	1.829***	1418.4	1646.3	2488.9
VENEZUELA	2.313***	1065.8	1107.2	1660.4
TROPICAL SOUTH AMERICA	1.712***	1116.1	1244.9	1534.1
COSTA RICA	2.616***	1079.1	1204.3	1594.6
SALVADOR	2.703***	1147.5	1613.3	1888.7
GUATEMALA	2.809***	884.0	1416.7	1439.2
HONDURAS	0.387	1142.9	1197.6	1401.9
NICARAGUA	1.338***	884.0	775.4	1154.8
PANAMA	1.103***	834.8	757.3	979.0
CENTRAL AMERICA,PANAMA	2.159***	967.3	1257.1	1450.7
BARBADOS	0.131	2061.6	2657.9	2000.0
GUYANA	0.153	1000.0	1984.1	1000.0
HAITI	0.029	767.8	1008.1	958.7
JAMAICA	2.830***	905.6	1257.9	1500.0
TRINIDAD ETC	0.021	3000.0	3922.3	3000.0
CARIBBEAN	0.173	779.4	1038.5	980.8
TROPICAL LATIN AMERICA	1.953***	1130.1	1326.2	1677.5
ARGENTINA	3.060***	1780.8	2474.2	3066.4
CHILE	2.024***	2324.9	3388.0	4419.8
URUGUAY	3.546***	666.1	987.2	1076.7
TEMPERATE SOUTH AMERICA	3.163***	1716.0	2416.3	3059.0
LATIN AMERICA	2.109***	1213.8	1489.4	1848.7

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 *P<0.05

MAIZE SUMMARY OF LATIN AMERICA TRADE(THOUSAND TONS)

REGION	EXPORT			IMPORT			+IMPORT-EXPORT		
	1962/64	1972/74	1982/84	1962/64	1972/74	1982/84	1962/64	1972/74	1982/84
BRAZIL	381	441	496	6	4	157	-375	-437	-339
MEXICO	96	151	9	188	874	2473	92	723	2464
	477	592	505	194	878	2630	-283	286	2125
BOLIVIA	0	0	6	0	4	1	0	4	-5
COLOMBIA	0	1	0	21	46	80	21	45	80
CUBA	0	0	0	140	245	398	140	245	398
DOMINICAN RP	9	1	1	3	42	206	-6	41	205
ECUADOR	2	1	6	0	2	19	-2	1	13
PARAGUAY	8	3	8	0	0	0	-8	-3	-8
PERU	1	1	2	12	2	322	11	1	320
VENEZUELA	0	0	1	60	213	1251	60	213	1250
TROPICAL SOUTH AMERICA	20	7	24	236	554	2277	216	547	2253
COSTA RICA	0	1	1	7	33	53	7	32	52
EL SALVADOR	2	8	1	33	25	67	31	17	66
GUATEMALA	1	4	0	17	41	5	16	37	5
HONDURAS	39	4	5	1	2	12	-38	-2	7
NICARAGUA	1	6	1	7	29	60	6	23	59
PANAMA	0	0	0	5	27	29	5	27	29
CENTRAL AMERICA;PANAMA	43	23	8	70	157	226	27	134	218
BARBADOS	0	1	1	2	7	26	2	6	25
GUYANA	0	0	0	2	7	2	2	7	2
HAITI	0	1	0	0	1	9	0	0	9
JAMAICA	0	1	0	20	109	174	20	108	174
TRINIDAD ETC	0	3	1	15	51	100	15	48	99
CARIBBEAN	0	6	2	39	175	311	39	169	309
TROPICAL LATIN AMERICA	540	628	539	539	1764	5444	-1	1136	4905
ARGENTINA	2906	4188	5757	0	1	1	-2906	-4187	-5756
CHILE	0	1	0	30	120	193	30	119	193
URUGUAY	0	15	0	23	4	4	23	-11	4
TEMPERATE SOUTH AMERICA	2906	4204	5757	53	125	198	-2853	-4079	-5559
LATIN AMERICA	3446	4832	6296	592	1889	5642	-2854	-2943	-654

MAIZE PRODUCTION,TRADE AND APPARENT CONSUPTION

COUNTRY	1972/74 PRODUCTION	+IMPORT -EXPORT	APPARENT CONSUMPTION	APPARENT PER CAPITA CONSUMPTION	SELF SUFFICIENCY INDEX	1982/84 PRODUCTION	+IMPORT -EXPORT	APPARENT CONSUMPTION	APPARENT PER CAPITA CONSUMPTION	SELF SUFFICIENCY INDEX
	1000 MT			KG		1000 MT			KG	
BRAZIL	15117	-437	14679	143	102.98	20587	-339	20247	156	101.68
MEXICO	8560	723	9283	165	92.21	12380	2464	14844	197	83.40
	23677	286	23962	150	98.81	32967	2124	35091	171	93.95
BOLIVIA	274	4	277	60	98.71	426	-5	421	70	101.12
COLOMBIA	779	45	824	37	94.49	879	79	958	35	91.74
CUBA	90	244	334	37	26.98	96	398	494	50	19.50
DOMINICAN RP	48	41	90	18	54.08	49	206	254	42	19.13
ECUADOR	253	1	255	39	99.43	284	13	298	34	95.47
PARAGUAY	246	-3	243	96	101.13	477	-7	469	135	101.53
PERU	611	0	611	42	99.97	597	320	918	49	65.09
VENEZUELA	505	213	718	59	70.36	512	1250	1762	102	29.06
TROPICAL SOUTH AMERICA	2806	546	3352	44	83.71	3320	2255	5575	57	59.55
COSTA RICA	64	32	96	51	67.00	95	52	147	60	64.55
EL SALVADOR	332	18	349	89	94.98	455	66	521	100	87.34
GUATEMALA	805	37	842	143	95.62	1061	5	1066	134	99.57
HONDURAS	342	-2	340	117	100.66	459	7	465	114	98.59
NICARAGUA	175	23	198	91	88.26	200	59	260	85	77.17
PANAMA	53	26	79	48	66.90	70	28	99	47	71.25
CENTRAL AMERICA,PANAMA	1771	133	1904	115	93.00	2341	217	2557	114	91.52
BARBADOS	2	6	8	34	24.64	2	25	27	103	7.34
GUYANA	3	6	9	12	32.82	1	1	2	2	44.59
HAITI	222	0	222	45	99.92	178	8	186	30	95.64
JAMAICA	6	109	115	58	5.24	3	173	176	78	1.70
TRINIDAD ETC	4	48	52	49	7.07	3	100	103	91	2.92
CARIBBEAN	236	170	406	45	58.19	187	308	494	46	37.76
TROPICAL LATIN AMERICA	28490	1135	29624	113	96.17	38814	4904	43718	130	88.78
ARGENTINA	8487	-4187	4299	174	197.40	9367	-5757	3610	124	259.46
CHILE	314	119	434	44	72.46	553	192	745	64	74.18
URUGUAY	198	-12	187	66	106.25	107	4	111	37	96.65
TEMPERATE SOUTH AMERIC	8999	-4080	4920	131	182.92	10026	-5561	4466	102	224.51
LATIN AMERICA	37489	-2945	34544	115	108.53	48841	-657	48184	126	101.36

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 SSSSSSS   OOOOOOO  RRRRRRRR   GGGGGGG  HH     HH UU     UU M       M
SSSSSSSSS OOOOOOOOO RRRRRRRRR GGGGGGGGG HH     HH UU     UU MM     MM
SS     SS OO     OO RR     RR GG     GG HH     HH UU     UU MMM   MMM
SS        OO     OO RR     RR GG        HH     HH UU     UU MMMM MMMM
SSSSSSSS  OO     OO RRRRRRRRR GG        HHHHHHHHH UU     UU MM MMM MM
 SSSSSSSS OO     OO RRRRRRRR  GG   GGGG HHHHHHHHH UU     UU MM  M  MM
       SS OO     OO RR  RR    GG   GGGG HH     HH UU     UU MM     MM
SS     SS OO     OO RR   RR   GG     GG HH     HH UU     UU MM     MM
SSSSSSSSS OOOOOOOOO RR    RR  GGGGGGGGG HH     HH UUUUUUUUU MM     MM
 SSSSSSS   OOOOOOO  RR     RR  GGGGGGG  HH     HH  UUUUUUU  MM     MM
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SORGHUM PRODUCTION,RELATIVE IMPORTANCE IN THE REGION AND PER CAPITA PRODUCTION LEVELS

COUNTRY	PRODUCTION 1000 MT 1962/64	1972/74	1982/84	PERCENTAGE OF TOTAL % 1982/84	PER CAPITA PRODUCTION KG 1982/84
BRAZIL	0	165	248	1.628	2
MEXICO	408	3021	5432	35.648	72
	408	3186	5680	37.275	28
BOLIVIA	0	0	9	0.059	1
COLOMBIA	27	276	588	3.861	21
CUBA	22	1	1	0.007	0
DOMINICAN RP	0	14	41	0.271	7
ECUADOR	0	0	2	0.015	0
PARAGUAY	4	6	10	0.066	3
PERU	2	26	31	0.203	2
VENEZUELA	2	17	404	2.654	23
TROPICAL SOUTH AMERICA	57	339	1087	7.136	11
COSTA RICA	9	14	32	0.212	13
EL SALVADOR	89	144	129	0.849	25
GUATEMALA	22	49	86	0.567	11
HONDURAS	52	47	54	0.352	13
NICARAGUA	46	45	97	0.637	32
CENTRAL AMERICA,PANAMA	218	300	399	2.616	16
HAITI	0	162	116	0.761	19
CARIBBEAN	0	162	116	0.761	11
TROPICAL LATIN AMERICA	683	3988	7282	47.789	21
ARGENTINA	1420	4568	7832	51.401	269
URUGUAY	16	158	123	0.809	41
TEMPERATE SOUTH AMERICA	1436	4726	7955	52.211	182
LATIN AMERICA	2119	8714	15237	100.000	40

COLUMNS MAY NOT ADD EXACTLY DUE TO ROUNDING

SORGHUM ANNUAL GROWTH RATES

COUNTRY	PRODUCTION 1965/74	PRODUCTION 1975/84	PRODUCTION 1965/84	AREA 1965/74	AREA 1975/84	AREA 1965/84	YIELD 1965/74	YIELD 1975/84	YIELD 1965/84
BRASIL	56.9**	-0.7	34.6***	57.6**	1.4	35.3***	-0.7	-2.1	-0.7
MEXICO	13.2***	4.6**	8.3***	12.0***	3.0**	6.5***	1.2	1.6	1.8***
	13.9***	4.3**	8.6***	12.9***	2.9**	7.0***	1.0	1.4	1.6***
BOLIVIA	0.0	-16.7*	-16.7*	0.0	-20.1**	-20.1**	0.0	3.4	3.4
COLOMBIA	19.3***	5.6***	12.6***	18.9***	6.9***	12.8***	0.5	-1.3	-0.2
CUBA	-30.6***	-1.4***	-13.7***	-30.1***	0.0	0.0	-0.4	-1.4***	-0.5***
DOMINICAN RP	6.9**	10.8*	6.8***	6.0**	13.6**	7.9***	0.9	-2.8*	-1.1**
ECUADOR	0.0	10.2	10.2	0.0	17.6	17.6	0.0	-7.4	-7.4
PARAGUAY	5.8***	2.5***	5.2***	6.2***	1.8**	4.9***	-0.4	0.6	0.3
PERU	29.6***	-5.6	15.0***	20.4**	-5.1	12.6***	9.2***	-0.5	2.4***
VENEZUELA	4.5	15.6***	28.6***	12.0	15.0***	28.8***	-7.5**	0.7	-0.2
TROPICAL SOUTH AMERICA	16.7***	8.0***	14.8***	14.7***	9.3***	14.9***	1.9*	-1.3*	-0.1
COSTA RICA	4.2*	1.7	9.6***	2.1	3.2	9.1***	2.1**	-1.5	0.5
SALVADOR	3.9***	-3.2***	0.9*	2.1***	-2.0**	0.5	1.8*	-1.2*	0.5
GUATEMALA	3.4	6.2***	5.0***	-3.4**	-0.2	-1.2**	6.8**	6.4***	6.3***
HONDURAS	0.8	1.7	1.1**	3.6**	-0.4	4.1***	-2.9	2.0	-3.0***
NICARAGUA	-0.6	8.3***	3.8***	-1.2	-2.5*	-0.6	0.5	10.7***	4.4***
CENTRAL AMERICA,PANAMA	2.5***	1.9**	2.9***	0.8	-1.2	1.0***	1.7***	3.0***	1.8***
HAITI	-3.4	-1.2	-4.1***	-2.9	1.5*	-2.0***	-0.5	-2.7	-2.2***
CARIBBEAN	-3.4	-1.2	-4.1***	-2.9	1.5*	-2.0***	-0.5	-2.7	-2.2***
TROPICAL LATIN AMERICA	12.4***	4.5***	8.3***	9.8***	3.3***	6.2***	2.6***	1.2	2.1***
ARGENTINA	15.9***	4.3	8.4***	11.6***	1.8	4.1***	4.3**	2.4	4.3***
URUGUAY	28.6***	2.4	10.5***	12.3***	-0.2	3.6**	16.3***	2.6	6.9***
TEMPERATE SOUTH AMERICA	16.2***	4.2	8.4***	11.6***	1.8	4.1***	4.5**	2.5	4.4***
LATIN AMERICA	14.4***	4.4**	8.4***	10.8***	2.6**	5.1***	3.6***	1.8**	3.2***

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

SORGHUM TRENDS IN AREA LEVEL BY COUNTRY 1962/84

COUNTRY	ANNUAL GROWTH RATE IN AREA 1962/84 %	AVERAGE AREA 1962/64	AVERAGE AREA 1972/74	AVERAGE AREA 1982/84
			1000 HA	
BRASIL	35.339***	0.0	86.3	128.7
MEXICO	9.643***	197.3	1149.8	1631.3
	10.099***	197.3	1236.0	1760.0
BOLIVIA	-20.109**	0.0	0.0	2.7
COLOMBIA	16.837***	10.7	123.5	275.7
CUBA	-15.696***	20.3	1.3	1.0
DOMINICAN RP	7.901***	0.0	4.0	14.3
ECUADOR	17.588	0.0	0.0	1.0
PARAGUAY	4.942***	3.0	5.1	7.3
PERU	13.571***	1.0	7.2	10.0
VENEZUELA	29.214***	1.0	13.2	217.7
TROPICAL SOUTH AMERICA	14.771***	35.3	154.4	529.7
COSTA RICA	8.219***	5.7	7.6	21.0
EL SALVADOR	1.112***	92.0	125.6	115.3
GUATEMALA	-0.372	38.3	36.9	38.0
HONDURAS	3.057***	42.0	45.0	59.0
NICARAGUA	-0.287	48.3	45.1	43.7
CENTRAL AMERICA,PANAMA	1.271***	226.3	260.1	277.0
HAITI	-1.965***	0.0	174.7	156.7
CARIBBEAN	-1.965***	0.0	174.7	156.7
TROPICAL LATIN AMERICA	8.268***	459.0	1825.2	2723.3
ARGENTINA	4.801***	891.0	2094.9	2478.7
URUGUAY	3.849***	32.3	85.1	60.7
TEMPERATE SOUTH AMERICA	4.774***	923.3	2179.9	2539.3
LATIN AMERICA	6.361***	1382.3	4005.1	5262.7

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

SORGHUM TRENDS IN YIELD LEVEL BY COUNTRY 1962/84

COUNTRY	ANNUAL GROWTH RATE IN YIELD 1962/84 %	AVERAGE YIELD 1962/64	AVERAGE YIELD 1972/74	AVERAGE YIELD 1982/84
		KG/HA		
BRASIL	-0.701	0.0	2220.3	1922.8
MEXICO	1.992***	2148.2	2623.0	3339.9
	1.837***	2148.2	2567.4	3233.8
BOLIVIA	3.444	0.0	0.0	3527.8
COLOMBIA	-0.446*	2522.2	2265.2	2139.9
CUBA	-0.435***	1106.9	1066.7	1000.0
DOMINICAN RP	-1.124**	0.0	3391.5	2761.9
ECUADOR	-7.368	0.0	0.0	2333.3
PARAGUAY	0.374	1222.2	1231.2	1369.0
PERU	2.685***	2000.0	3597.5	3079.4
VENEZUELA	-0.386	2000.0	1344.1	1853.8
TROPICAL SOUTH AMERICA	1.061**	1523.3	2236.0	2053.1
COSTA RICA	0.479	1662.7	1901.1	1583.9
SALVADOR	0.798***	968.5	1153.6	1121.9
GUATEMALA	6.477***	585.0	1327.2	2303.4
HONDURAS	-2.576***	1230.2	1082.6	912.2
NICARAGUA	3.612***	951.4	1017.1	2216.0
CENTRAL AMERICA,PANAMA	1.838***	963.1	1155.0	1438.2
HAITI	-2.163***	0.0	918.8	740.1
CARIBBEAN	-2.163***	0.0	918.8	740.1
TROPICAL LATIN AMERICA	2.662***	1481.2	2178.3	2666.4
ARGENTINA	3.948***	1595.8	2111.6	3158.6
URUGUAY	7.599***	495.9	1755.7	2034.4
TEMPERATE SOUTH AMERICA	4.018***	1556.8	2097.9	3131.7
LATIN AMERICA	3.312***	1536.4	2144.3	2895.4

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 *P<0.05

SORGHUM SUMMARY OF LATIN AMERICA TRADE(THOUSAND TONS)

REGION	EXPORT			IMPORT			+IMPORT-EXPORT		
	1962/64	1972/74	1982/84	1962/64	1972/74	1982/84	1962/64	1972/74	1982/84
BRAZIL	7	49	49	11	26	20	4	-23	-29
MEXICO	1	1	7	67	230	2844	66	229	2837
	8	50	56	78	256	2864	70	206	2808
BOLIVIA	0	1	1	1	1	1	1	0	0
COLOMBIA	0	1	0	4	21	105	4	20	105
CUBA	0	0	0	0	0	0	0	0	0
DOMINICAN RP	0	0	0	1	2	1	1	2	1
ECUADOR	0	0	0	0	2	10	0	2	10
PARAGUAY	0	2	0	0	0	0	0	-2	0
PERU	0	0	1	1	1	1	1	1	0
VENEZUELA	0	1	0	1	396	421	1	395	421
TROPICAL SOUTH AMERICA	0	5	2	8	423	539	8	418	537
COSTA RICA	0	1	0	1	6	1	1	5	1
EL SALVADOR	1	3	1	2	1	1	1	-2	0
GUATEMALA	1	1	0	1	2	1	0	1	1
HONDURAS	1	1	0	1	1	1	0	0	1
NICARAGUA	1	2	1	2	6	6	1	4	5
PANAMA	0	0	0	0	1	1	0	1	1
CENTRAL AMERICA,PANAMA	4	8	2	7	17	11	3	9	9
BARBADOS	0	0	0	0	2	1	0	2	1
GUYANA	0	0	0	0	1	0	0	1	0
HAITI	0	0	0	0	0	1	0	0	1
JAMAICA	0	0	0	0	4	2	0	4	2
TRINIDAD ETC	0	0	1	1	1	1	1	1	0
CARIBBEAN	0	0	1	1	8	5	1	8	4
TROPICAL LATIN AMERICA	12	63	61	94	704	3419	82	641	3358
ARGENTINA	725	2056	5065	0	1	1	-725	-2055	-5064
CHILE	0	1	1	1	101	13	1	100	12
URUGUAY	0	12	46	0	0	4	0	-12	-42
TEMPERATE SOUTH AMERICA	725	2069	5112	1	102	18	-724	-1967	-5094
LATIN AMERICA	737	2132	5173	95	806	3437	-642	-1326	-1736

SORGHUM PRODUCTION,TRADE AND APPARENT CONSUPTION

COUNTRY	1972/74 PRODUCTION	1972/74 +IMPORT -EXPORT	1972/74 APPARENT CONSUMPTION	1972/74 APPARENT PER CAPITA CONSUMPTION	1972/74 SELF SUFFICIENCY INDEX	1982/84 PRODUCTION	1982/84 +IMPORT -EXPORT	1982/84 APPARENT CONSUMPTION	1982/84 APPARENT PER CAPITA CONSUMPTION	1982/84 SELF SUFFICIENCY INDEX
	1000 MT			KG		1000 MT			KG	
BRAZIL	165	-23	142	1	116.33	248	-29	219	2	113.00
MEXICO	3021	229	3250	58	92.96	5432	2836	8268	110	65.69
	3186	206	3392	21	93.93	5680	2808	8488	41	66.92
BOLIVIA	0	-0	-0	-0	0.00	9	0	9	2	98.07
COLOMBIA	276	20	296	13	93.20	588	104	693	25	84.94
CUBA	1	0	1	0	100.00	1	0	1	0	100.00
DOMINICAN RP	14	2	15	3	89.14	41	1	42	7	98.20
ECUADOR	0	1	1	0	0.00	2	10	12	1	18.92
PARAGUAY	6	-1	5	2	127.10	10	0	10	3	100.00
PERU	26	1	27	2	97.05	31	0	31	2	99.08
VENEZUELA	17	395	412	34	4.04	404	421	825	48	49.02
TROPICAL SOUTH AMERICA	339	417	757	10	44.86	1087	536	1623	17	66.98
COSTA RICA	14	5	20	11	72.95	32	0	33	13	99.45
EL SALVADOR	144	-2	142	36	101.63	129	0	129	25	99.89
GUATEMALA	49	1	50	9	97.15	86	0	87	11	99.63
HONDURAS	47	-1	46	16	102.12	54	0	54	13	99.87
NICARAGUA	45	4	49	23	92.40	97	5	102	34	94.83
PANAMA	0	0	0	0	0.00	0	0	0	0	0.00
CENTRAL AMERICA,PANAMA	300	7	308	19	97.60	399	6	405	18	98.44
BARBADOS	0	2	2	8	0.00	0	1	1	3	0.00
GUYANA	0	0	0	0	0.00	0	0	0	0	
HAITI	162	0	162	33	100.00	116	0	116	19	99.90
JAMAICA	0	3	3	2	0.00	0	2	2	1	0.00
TRINIDAD ETC	0	0	0	0	0.00	0	0	0	0	0.00
CARIBBEAN	162	5	167	19	96.89	116	3	119	11	97.47
TROPICAL LATIN AMERICA	3988	636	4623	18	86.25	7282	3353	10635	32	68.47
ARGENTINA	4568	-2055	2513	102	181.81	7832	-5065	2767	95	283.01
CHILE	0	101	101	10	0.00	0	12	12	1	0.00
URUGUAY	158	-11	147	52	107.75	123	-42	81	27	151.63
TEMPERATE SOUTH AMERIC	4726	-1966	2760	74	171.24	7955	-5094	2861	65	278.06
LATIN AMERICA	8714	-1331	7383	25	118.02	15237	-1741	13496	35	112.90

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PPPPPPPP    OOOOOOO   TTTTTTTT      AAA     TTTTTTTT    OOOOOOO   EEEEEEEEE   SSSSSSS
PPPPPPPPP  OOOOOOOOO  TTTTTTTT     AAAAA    TTTTTTTT   OOOOOOOOO  EEEEEEEEE  SSSSSSSSS
PP     PP  OO     OO     TT       AA   AA      TT      OO     OO  EE         SS     SS
PP     PP  OO     OO     TT      AA     AA     TT      OO     OO  EE         SS
PPPPPPPPP  OO     OO     TT      AA     AA     TT      OO     OO  EEEEEE     SSSSSSSS
PPPPPPPP   OO     OO     TT      AAAAAAAAA     TT      OO     OO  EEEEEE      SSSSSSSS
PP         OO     OO     TT      AAAAAAAAA     TT      OO     OO  EE                SS
PP         OO     OO     TT      AA     AA     TT      OO     OO  EE         SS     SS
PP         OOOOOOOOO     TT      AA     AA     TT      OOOOOOOOO  EEEEEEEEE  SSSSSSSSS
PP          OOOOOOO*     TT      AA     AA     TT       OOOOOOO*  EEEEEEEEE   SSSSSSS
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POTATOES — PRODUCTION, RELATIVE IMPORTANCE IN THE REGION AND PER CAPITA PRODUCTION LEVELS

COUNTRY	PRODUCTION 1000 MT 1962/64	PRODUCTION 1000 MT 1972/74	PRODUCTION 1000 MT 1982/84	PERCENTAGE OF TOTAL % 1982/84	PER CAPITA PRODUCTION KG 1982/84
BRAZIL	1189	1533	2061	18.519	16
MEXICO	402	613	869	7.805	12
	1591	2146	2930	26.324	14
BOLIVIA	546	728	622	5.589	103
COLOMBIA	771	955	2176	19.549	79
CUBA	83	73	241	2.168	24
DOMINICAN RP	10	28	17	0.153	3
ECUADOR	301	505	364	3.274	41
PARAGUAY	6	4	9	0.084	3
PERU	1458	1716	1505	13.523	80
VENEZUELA	119	128	229	2.058	13
TROPICAL SOUTH AMERICA	3294	4138	5164	46.397	53
COSTA RICA	23	22	29	0.264	12
EL SALVADOR	4	9	6	0.057	1
GUATEMALA	16	28	29	0.264	4
HONDURAS	2	4	9	0.078	2
NICARAGUA	1	1	2	0.018	1
PANAMA	7	14	16	0.141	8
CENTRAL AMERICA,PANAMA	54	79	91	0.821	4
HAITI	4	7	9	0.081	1
JAMAICA	9	13	7	0.063	3
CARIBBEAN	13	20	16	0.144	1
TROPICAL LATIN AMERICA	4951	6383	8201	73.685	24
ARGENTINA	1376	1682	1939	17.419	67
CHILE	807	790	854	7.673	73
URUGUAY	101	123	136	1.222	46
TEMPERATE SOUTH AMERICA	2284	2595	2929	26.315	67
LATIN AMERICA	7235	8978	11129	100.000	29

COLUMNS MAY NOT ADD EXACTLY DUE TO ROUNDING

POTATOES ANNUAL GROWTH RATES

COUNTRY	PRODUCTION 1965/74	1975/84	1965/84	AREA 1965/74	1975/84	1965/84	YIELD 1965/74	1975/84	1965/84
BRASIL	1.9*	1.6*	2.5***	-0.9	-1.9**	-1.1***	2.8***	3.5***	3.6***
MEXICO	7.6***	3.3**	5.4***	4.0***	3.4***	3.4***	3.6***	-0.1	2.0***
	3.3***	2.1**	3.3***	0.0	-0.5	-0.1	3.2***	2.7***	3.4***
BOLIVIA	3.9***	-4.2	0.8	0.8	0.5	2.0***	3.1**	-4.8*	-1.2
COLOMBIA	3.0***	5.2***	6.8***	3.4***	4.5***	5.1***	-0.4	0.7	1.6***
CUBA	-4.3*	8.5***	6.7***	-4.7	5.4***	3.2***	0.4	3.1*	3.5***
DOMINICAN RP	6.4***	-2.8	-3.0**	9.1***	0.7	-0.5	-2.7**	-3.5	-2.5***
ECUADOR	4.3**	-3.3	-1.7*	-1.2	-2.7*	-2.8***	5.5***	-0.7	1.1**
PARAGUAY	-14.2**	11.4***	0.8	-14.8***	8.8***	-2.8*	0.6	2.6***	3.6***
PERU	1.4	-1.6	-0.6	0.7	-5.0***	-2.3***	0.7*	3.4***	1.7***
VENEZUELA	-0.4	4.8**	3.6***	-2.9***	3.0**	0.7	2.5**	1.8*	2.9***
TROPICAL SOUTH AMERICA	2.3***	1.1	2.2***	0.8**	-0.6	0.4**	1.6***	1.7**	1.8***
COSTA RICA	-2.0*	2.6*	0.5	-5.4***	7.3***	0.4	3.4***	-4.7***	0.0
SALVADOR	8.2	7.1	1.7	-3.9	3.4	-4.6***	12.1***	3.8	6.3***
GUATEMALA	4.2*	-8.4***	3.3**	5.2**	-11.1***	2.7*	-1.0	2.7**	0.6*
HONDURAS	3.2**	10.6***	5.7***	-1.2	3.5***	3.1***	4.4	7.1***	2.6***
NICARAGUA	3.4***	3.0***	3.8***	1.4	2.5***	3.4***	1.9**	0.5***	0.4
PANAMA	7.0**	7.4**	4.0***	6.2*	11.4***	4.5***	0.8***	-4.1	-0.5
CENTRAL AMERICA,PANAMA	2.9**	-0.8	2.6***	1.8	-3.9*	2.3***	1.1***	3.1**	0.3
HAITI	1.6**	2.8***	2.2***	3.5***	9.4***	5.5***	-1.9***	-6.6***	-3.3***
JAMAICA	0.5	-4.7	-2.1*	2.6	-4.1*	-0.6	-2.1	-0.7	-1.5*
CARIBBEAN	0.9	-1.2	-0.2	2.8	1.0	1.6**	-1.9	-2.2	-1.8***
TROPICAL LATIN AMERICA	2.7***	1.4*	2.6***	0.6**	-0.6	0.3*	2.1***	2.0***	2.3***
ARGENTINA	-1.5	3.9***	-0.4	-5.6**	-0.1	-3.6***	4.1	4.0***	3.3***
CHILE	1.3	2.7	1.4*	-0.4	0.3	0.1	1.7	2.4*	1.3***
URUGUAY	1.8	0.9	1.3	0.8	-3.2	-1.0	1.0	4.1*	2.3***
TEMPERATE SOUTH AMERICA	-0.7	3.4**	0.2	-3.3**	-0.3	-2.2***	2.6	3.7***	2.4***
LATIN AMERICA	1.6*	1.9**	1.8***	-0.4	-0.5	-0.3*	2.0***	2.5***	2.1***

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005   ** P<0.01   * P<0.05

POTATOES TRENDS IN AREA LEVEL BY COUNTRY 1962/84

COUNTRY	ANNUAL GROWTH RATE IN AREA 1962/84 %	AVERAGE AREA 1962/64	AVERAGE AREA 1972/74	AVERAGE AREA 1982/84
		1000 HA		
BRASIL	-0.781***	201.7	194.5	175.0
MEXICO	2.577***	48.0	54.5	70.7
	-0.027	249.7	248.9	245.7
BOLIVIA	1.503***	110.3	115.3	136.7
COLOMBIA	4.576***	73.3	93.4	167.0
CUBA	1.211	14.0	7.3	15.0
DOMINICAN RP	0.803	1.0	2.1	1.7
ECUADOR	-1.531***	34.7	40.1	31.7
PARAGUAY	-3.374**	1.7	0.7	1.0
PERU	-1.674***	256.3	268.8	181.7
VENEZUELA	0.497	15.3	13.2	17.7
TROPICAL SOUTH AMERICA	0.517***	506.7	540.9	552.3
COSTA RICA	0.047	3.0	2.1	3.7
EL SALVADOR	-5.778***	1.0	0.5	0.3
GUATEMALA	3.502***	4.3	7.3	6.0
HONDURAS	1.684**	1.0	0.6	1.0
NICARAGUA	3.115***	0.3	0.3	0.5
PANAMA	3.233***	1.0	1.3	2.0
CENTRAL AMERICA,PANAMA	2.351***	10.3	12.2	13.5
HAITI	6.295***	0.2	0.5	1.0
JAMAICA	0.016	1.0	1.5	1.0
CARIBBEAN	2.132***	1.2	1.9	2.0
TROPICAL LATIN AMERICA	0.382***	767.8	804.0	813.5
ARGENTINA	-2.928***	162.7	123.0	107.7
CHILE	-0.279	88.3	79.7	75.0
URUGUAY	-0.775	22.7	24.6	20.0
TEMPERATE SOUTH AMERICA	-1.845***	273.7	227.4	202.7
LATIN AMERICA	-0.139	1041.5	1031.3	1016.1

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 * P<0.05

POTATOES TRENDS IN YIELD LEVEL BY COUNTRY 1962/84

COUNTRY	ANNUAL GROWTH RATE IN YIELD 1962/84 %	AVERAGE YIELD 1962/64	AVERAGE YIELD 1972/74	AVERAGE YIELD 1982/84
		KG/HA		
BRASIL	3.516***	5891.2	7878.4	11766.2
MEXICO	2.214***	8381.7	11256.1	12326.4
	3.306***	6369.8	8620.8	11918.8
BOLIVIA	-0.384	4948.9	6312.3	4377.3
COLOMBIA	1.394***	10446.3	10217.1	13027.9
CUBA	4.516***	5926.3	10746.6	16119.5
DOMINICAN RP	-0.949	10333.3	13060.6	10500.0
ECUADOR	1.438***	8714.6	12593.5	11505.1
PARAGUAY	4.316***	3666.7	6230.1	9333.3
PERU	1.635***	5686.2	6384.1	8265.1
VENEZUELA	2.730***	7743.1	9705.8	12964.9
TROPICAL SOUTH AMERICA	1.823***	6497.6	7648.3	9336.3
COSTA RICA	0.647	7666.7	10421.4	7944.4
SALVADOR	7.460***	4000.0	16714.0	19047.6
GUATEMALA	0.797**	3733.3	3856.1	4888.9
HONDURAS	4.022***	.	6149.9	8666.7
NICARAGUA	0.570**	3803.2	4666.7	4285.7
PANAMA	0.742	7000.0	10623.1	7833.3
CENTRAL AMERICA,PANAMA	0.683**	5232.4	6476.4	6775.4
HAITI	-2.829***	16444.4	14333.3	9000.0
JAMAICA	-0.897	8666.7	9009.2	7000.0
CARIBBEAN	-1.169**	10163.8	10375.7	8000.0
TROPICAL LATIN AMERICA	2.281***	6445.9	7938.8	10066.3
ARGENTINA	3.543***	8456.0	14306.6	18009.3
CHILE	1.097***	9146.9	9818.8	11311.4
URUGUAY	2.274***	4450.0	4989.4	6777.4
TEMPERATE SOUTH AMERICA	2.515***	8337.0	11504.3	14442.1
LATIN AMERICA	2.214***	6944.5	8707.5	10944.5

LEVEL OF SIGNIFICANCE IS REPRESENTED AS FOLLOWS
*** P<0.005 ** P<0.01 *P<0.05

POTATOES SUMMARY OF LATIN AMERICA TRADE (THOUSAND TONS)

REGION	EXPORT			IMPORT			+IMPORT-EXPORT		
	1962/64	1972/74	1982/84	1962/64	1972/74	1982/84	1962/64	1972/74	1982/84
BRAZIL	8	14	0	7	27	7	-1	13	7
MEXICO	0	2	1	1	6	6	1	4	5
	8	16	1	8	33	13	0	17	12
BOLIVIA	0	1	0	0	0	1	0	-1	1
COLOMBIA	3	2	1	1	0	1	-2	-2	0
CUBA	0	0	12	46	26	33	46	26	21
DOMINICAN RP	0	1	2	3	1	0	3	0	-2
PARAGUAY	0	0	0	3	0	0	3	0	0
PERU	1	1	1	0	6	0	-1	5	-1
VENEZUELA	1	1	1	10	8	29	9	7	28
TROPICAL SOUTH AMERICA	5	6	17	63	41	64	58	35	47
COSTA RICA	1	1	1	1	1	1	0	0	0
EL SALVADOR	2	1	0	4	8	30	2	7	30
GUATEMALA	6	12	20	1	1	0	-5	-11	-20
HONDURAS	1	1	0	3	1	1	2	0	1
NICARAGUA	1	1	0	1	6	3	0	5	3
PANAMA	0	1	1	2	2	1	2	1	0
CENTRAL AMERICA,PANAMA	11	17	22	12	19	36	1	2	14
BARBADOS	1	1	1	5	7	8	4	6	7
GUYANA	1	1	0	8	6	1	7	5	1
HAITI	0	1	0	0	1	0	0	0	0
JAMAICA	1	3	0	5	4	1	4	1	1
TRINIDAD ETC	1	1	1	13	15	26	12	14	25
CARIBBEAN	4	7	2	31	33	36	27	26	34
TROPICAL LATIN AMERICA	28	46	42	114	126	149	86	80	107
ARGENTINA	5	2	2	66	122	4	61	120	2
CHILE	7	1	0	1	5	0	-6	4	0
URUGUAY	1	0	1	44	24	8	43	24	7
TEMPERATE SOUTH AMERICA	13	3	3	111	151	12	98	148	9
LATIN AMERICA	41	49	45	225	277	161	184	228	116

POTATOES PRODUCTION,TRADE AND APPARENT CONSUMPTION

COUNTRY	1972/74 PRODUCTION	1972/74 +IMPORT -EXPORT	1972/74 APPARENT CONSUMPTION	1972/74 APPARENT PER CAPITA CONSUMPTION	1972/74 SELF SUFFICIENCY INDEX	1982/84 PRODUCTION	1982/84 +IMPORT -EXPORT	1982/84 APPARENT CONSUMPTION	1982/84 APPARENT PER CAPITA CONSUMPTION	1982/84 SELF SUFFICIENCY INDEX
	1000 MT	1000 MT	1000 MT	KG		1000 MT	1000 MT	1000 MT	KG	
BRAZIL	1533	13	1546	15	99.13	2061	6	2067	16	99.70
MEXICO	613	4	618	11	99.31	869	6	874	12	99.36
	2146	18	2164	14	99.18	2930	12	2942	14	99.59
BOLIVIA	728	-0	727	156	100.01	622	0	622	103	99.98
COLOMBIA	955	-2	954	43	100.16	2176	-0	2175	79	100.02
CUBA	73	25	98	11	74.27	241	21	262	26	92.03
DOMINICAN RP	28	1	29	6	97.16	17	-1	16	3	109.35
ECUADOR	505	0	505	78	100.00	364	0	364	41	100.00
PARAGUAY	4	0	4	2	100.00	9	0	9	3	100.00
PERU	1716	5	1721	118	99.70	1505	-0	1505	80	100.00
VENEZUELA	128	7	135	11	95.00	229	28	257	15	89.14
TROPICAL SOUTH AMERICA	4138	36	4174	54	99.13	5164	47	5211	53	99.10
COSTA RICA	22	0	22	12	98.89	29	0	29	12	99.95
EL SALVADOR	9	8	17	4	53.69	6	30	36	7	17.55
GUATEMALA	28	-12	17	3	169.77	29	-20	10	1	303.45
HONDURAS	4	0	4	2	89.23	9	0	9	2	96.48
NICARAGUA	1	5	7	3	21.47	2	3	5	2	42.87
PANAMA	14	1	15	9	92.23	16	0	16	8	97.58
CENTRAL AMERICA,PANAMA	79	3	82	5	96.05	91	13	105	5	87.15
BARBADOS	0	6	6	25	0.00	0	8	8	29	0.00
GUYANA	0	6	6	8	0.00	0	0	0	0	0.00
HAITI	7	-0	7	1	100.55	9	0	9	1	100.00
JAMAICA	13	1	14	7	93.53	7	1	8	3	92.79
TRINIDAD ETC	0	14	14	13	0.00	0	25	25	22	0.00
CARIBBEAN	20	26	47	5	43.37	16	33	49	5	32.42
TROPICAL LATIN AMERICA	6383	84	6467	25	98.70	8201	106	8306	25	98.73
ARGENTINA	1682	121	1803	73	93.30	1939	2	1941	67	99.90
CHILE	790	4	794	80	99.44	854	0	854	73	100.00
URUGUAY	123	24	147	52	83.76	136	8	144	48	94.65
TEMPERATE SOUTH AMERIC	2595	149	2744	73	94.57	2929	10	2938	67	99.67
LATIN AMERICA	8978	233	9211	31	97.47	11129	115	11245	29	98.97

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