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Cochabamba Regional Development Project

Integrated Management Information System

Final Report

Volume I.

The Mitchell Group, Inc.

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A

CORDEP/IMIS FINAL REPORT

TABLE OF CONTENTS

VOLUME	CONTENTS	PAGE
Volume I.		
	Executive Summary	
	I. Introduction	1
	II. Background Information and Documents	1
	III. Features of the IMIS	4
	A. Software Design	4
	B. Project Elements Managed by the System	4
	C. Project Performance Indicators	5
	D. Project Feedback Mechanisms	6
	E. Data Available in the IMIS	6
	F. Reports Available from the IMIS	7
	G. Other IMIS Features	8
	IV. Data and Analysis	10
	A. Data Collection Methodology	10
	B. Selection Criteria of Survey Participants	12
	C. Statistical Extension of Data	16
	D. Success Rate of Survey	17
	E. Gender-specific Land Ownership Information	19
	F. Typical Farms and the Farm Enterprise Mix	20
	G. Historical Plantings and Forecasted Yields of Alternative Crops	30
	H. Genetic Material	78
	V. Final Comments	86
	VI. Map of the Chapare Showing Surveyed Areas	87

B

TABLE OF CONTENTS continued...

VOLUME	CONTENTS	PAGES
Volume II.		
	Appendix A: Map of Chapare and Surveyed Centrales	A1
	Appendix B: Centrales and Syndicates by Number of Affiliates and Farms Surveyed	B1 - B6
	Appendix C: Typical Farm Report	C1 - C69
	Appendix D: Historical Planting Report - Oranges	D1 - D78
	Appendix E: Historical Planting Report - Mandarins	E1 - E101
	Appendix F: Historical Planting Report - Pineapple	F1 - F136
Volume III.		
	Appendix G: Historical Planting Report - Banana	G1 - G204
	Appendix H: Historical Planting Report - Annatto	H1 - H33
	Appendix I: Historical Planting Report - Black Pepper	I1 - I14
	Appendix J: Historical Planting Report - Coconut	J1 - J43
	Appendix K: Historical Planting Report - Macadamia	K1 - K35
	Appendix L: Historical Planting Report - Passion Fruit	L1 - L32
	Appendix M: Historical Planting Report - Peach Palm	M1 - M62
	Appendix N: Historical Planting Report - Soursop	N1 - N14
	Appendix O: Expected Crop Yield Report, No New Plantings Assumed - Oranges	O1 - O78
Volume IV.		
	Appendix P: Expected Crop Yield Report, No New Plantings Assumed - Mandarins	P1 - P101
	Appendix Q: Expected Crop Yield Report, Maximum Planting Rate Assumed - Pineapple	Q1 - Q138
	Appendix R: Expected Crop Yield Report, No New Plantings Assumed - Banana	R1 - R208
	Appendix S: Genetic Material	S1 - S110

VOLUME I.
LIST OF EXHIBITS

EXHIBIT		PAGE
Exhibit 1.	Report: "Typical Farms for a Central"	26
Exhibit 2.	Report: "Crop Yields for a Central - No New Plantings"	44
Exhibit 3.	Report: "Crop Ages for a Central"	45
Exhibit 4.	Report: "Nursery Crops for a Central"	80

VOLUME I.
LIST OF TABLES

TABLE	PAGE
Table 1. Characteristics of Centrales Participating in the 1992 - 1993 IMIS Survey	15
Table 2. Number of Affiliates and Surveys from Centrales Surveyed	17
Table 3. Gender-Specific Land Ownership Information	19
Table 4. Average Crop Spacings in Meters	24
Table 5. "Typical Farm" Report Summary: 1992-1993 Average Crops and Animals per Farm by Central	27
Table 6. "Typical Farm" Report Summary: 1992-1993 Quantities of Commercial Crops by Central and Equivalent Hectares	28
Table 7. "Typical Farm" Report Summary: 1992-1993 Quantities of Alternative Crops and Animals by Central	29
Table 8. Estimated Citrus Yields, Area and Production from Other Sources	34
Table 9. Equivalent Hectares of Oranges Planted Each Year by Surveyed Farms	36
Table 10. Yield Curves Used for Principal Crops for "Zero-Syndicate" Methodology	43
Table 11. Estimated 1993 - 1996 Production of Oranges in Metric Tons, No New Plantings Assumed	46
Table 12. Estimated 1993 - 1996 Production of Mandarins in Metric Tons, No New Plantings Assumed	47
Table 13. Estimated 1993 - 1996 Production of Pineapple in Metric Tons, Maximum Planting Rate Assumed	48
Table 14. Estimated 1993 - 1996 Production of Banana in Metric Tons, No New Plantings Assumed	50
Table 15. Numbers of Plants by Crop Surveyed from Farmer Owned Nurseries and from the Experimental Stations	81
Table 16. Surveyed Genetic Material by Crop, Variety, Age, Quantity and Location	82

VOLUME I.
LIST OF GRAPHS

GRAPH	PAGE
Graph 1. Historical Plantings of Oranges - Surveyed Farms in Central San Miguel	51
Graph 2. Estimated Historic and Projected Yields of Oranges - Surveyed Farms Without New Plantings in Central San Miguel	52
Graph 3. Historical Plantings of Oranges - Surveyed Farms in Central Ivirgarzama	53
Graph 4. Estimated Historic and Projected Yields of Oranges - Surveyed Farms Without New Plantings in Central Ivirgarzama	54
Graph 5. Historical Plantings of Improved Orange Varieties - Surveyed Farms in Central Ivirgarzama	55
Graph 6. Historical Plantings of Oranges - Surveyed Farms in Central Bolivar	56
Graph 7. Estimated Historic and Projected Yields of Oranges - Surveyed Farms Without New Plantings in Central Bolivar	57
Graph 8. Historical Plantings of Oranges - Surveyed Farms in Central Bulo Bulo	58
Graph 9. Estimated Historic and Projected Yields of Oranges - Surveyed Farms Without New Plantings in Central Bulo Bulo	59
Graph 10. Historical Plantings of Mandarins - Surveyed Farms in Central Espiritu Santo	60
Graph 11. Estimated Historic and Projected Yields of Mandarins - Surveyed Farms Without New Plantings in Central Espiritu Santo	61
Graph 12. Estimated Historic and Projected Yields of Pineapples - Surveyed Farms With Continued Plantings in Central Mariposas	62
Graph 13. Estimated Historic and Projected Yields of Pineapples - Surveyed Farms With Continued Plantings in Central Eteramazama	63
Graph 14. Estimated Historic and Projected Yields of Pineapples - Surveyed Farms With Continued Plantings in Central San Gabriel	64
Graph 15. Estimated Historic and Projected Yields of Pineapples - Surveyed Farms With Continued Plantings in Central Villa Nueva	65

LIST OF GRAPHS continued...

GRAPH		PAGE
Graph 16.	Historical Plantings of Bananas - Surveyed Farms in Central Ibuelo	66
Graph 17.	Estimated Historic and Projected Yields of Bananas - Surveyed Farms Without New Plantings in Central Ibuelo	67
Graph 18.	Historical Plantings of Bananas - Surveyed Farms in Central Isiboro	68
Graph 19.	Estimated Historic and Projected Yields of Bananas - Surveyed Farms Without New Plantings in Central Isiboro	69
Graph 20.	Historical Plantings of Improved Bananas - Surveyed Farms in Central Ibuelo	70
Graph 21.	Historical Plantings of Improved Bananas - Surveyed Farms in Central Isiboro	71
Graph 22.	Historical Plantings of Annatto for Centrales with More Than 1,000 Plants	72
Graph 23.	Historical Plantings of Black Pepper for Centrales with More Than 50 Plants	73
Graph 24.	Historical Plantings of Coconut for Centrales with More Than 500 Trees	74
Graph 25.	Historical Plantings of Macadamia for Centrales with More Than 100 Trees	75
Graph 26.	Historical Plantings of Improved Varieties of Peach Palm for Centrales with More Than 500 Trees	76
Graph 27.	Historical Plantings of Soursop for Centrales with More Than 100 Plants	77

6

EXECUTIVE SUMMARY

The Integrated Management Information System (IMIS) was created by The Mitchell Group for the USAID/Bolivia Cochabamba Regional Development Project (CORDEP). This is a Unix-based, multiuser system with features such as language swapping between English and Spanish, a user access security system and on-line help screens. The software contains modules for agricultural production, production of genetic materials, packing and shipping, exports and foreign income generation.

In addition to creating the IMIS system, The Mitchell Group surveyed farms in the Chapare and inputted the agricultural data collected into the system. Of the seventeen *centrales* were surveyed, more than sixty percent of the affiliates of fourteen *centrales* were surveyed. Sample surveys were collected from 3 additional *centrales*. The total number of farms surveyed was 7535. Over 78,000 hectares were surveyed. Twenty-five percent of the *centrales* in the Chapare were surveyed and between twenty and twenty-five percent of the farms.

The demographic and agricultural data collected revealed the following:

- DEMOGRAPHICS: 11.3% of the farmers surveyed were women. 66.2% of the farms surveyed were titled. The more diverse crop mixes were found in the newer *centrales*.

- CITRUS: 1,832 hectares of oranges were surveyed. Since 1985, an average of 112 hectares have been planted each year on the surveyed farms. Improved variety oranges constitute an increasing percentage of the trees planted each year; in 1992 35.4% of the trees planted were improved varieties. The survey found 1,148 hectares of mandarins.

  For the total area surveyed, citrus production is increasing at an average of 11% per year. However, a difference exists between the older, established citrus areas in Subregions 1 and 3 and the more newly colonized areas. For example, orange production in Subregions 1 and 3 will increase 4.5% from 1993 to 1994, while production for all other areas surveyed will increase 36.8%. Furthermore, the production of the improved variety oranges will increase 78% for the same year. Estimated production from the surveyed farms for 1993 is 41,100 metric tons (mt) of oranges and 15,200mt of mandarins, and in 1994 46,400mt of oranges and 19,200mt of mandarins.

  Both the total number of hectares of citrus in the Chapare and the rate at which the number of hectares are increasing appear to have been underestimated by the project.

- PINEAPPLE: The IMIS survey found 553 hectares of pineapple, 110 of which were Cayena Lisa and 349 which were the Pucalpa variety. Pineapple is being planted at an increasing rate in the Chapare. As a result, pineapple prices have been falling, benefitting consumers and some farmers, but hurting those farmers which had been engaging in the monocropping of pineapple. Estimated production from the farms surveyed is 17,100mt in 1993 and 27,000mt in 1994.

- BANANA: 3,877 hectares of bananas were surveyed. Only 30% of these were of an improved variety. Estimated production for the bananas surveyed is 146,600mt total, 44,100mt of improved varieties.

  There appear to be fewer hectares of bananas than estimated by the project, and much less of the improved varieties. The IMIS data ragarding the distribution of plantings also raises questions about the locations chosen for the two banana packing facilities attempted by the project.

- OTHER ALTERNATIVE CROPS: Seven other crops were analyzed for this report: annatto, black pepper, coconut, macadamia, passion fruit, peach palm and soursop. The CORDEP project has been promoting these crops by distributing genetic material and providing instruction on their cultivation. The quantities found of six of the seven crops support or exceed estimates made by the project. Black pepper was the only crop which was surveyed at levels far below project estimates.

- GENETIC MATERIAL: Because almost every farmer produces at least some genetic material for his or her own use, only nurseries that produced commercial quantities of genetic material were surveyed. The two IBTA experimental stations were surveyed as well. The IMIS suggests that for some crops, more genetic material is being produced privately than by the project, implying that the private sector is beginning to assume the functions of propagating and distributing genetic material that were previously IBTA's. The quantities and types of crops found in the nurseries also indicate that many of the new crops and improved varieties promoted by IBTA have become accepted in the field.

THE EFFECT OF CORDEP IN THE CHAPARE: There is evidence supporting the conclusion that the CORDEP project has had a positive effect on agricultural development in the Chapare. This evidence includes the increased plantings of improved varieties and new crops, the increasing quantity of production in the Chapare and the development of private nurseries propagating and distributing the crops and varieties introduced by IBTA. Of course, evidence such as the presence of some improved varieties prior to the project suggests that not all development in the Chapare can be attributed to the CORDEP project.

RETURNING DATA TO THE FARMERS: The Chapare communities and individuals that participated in the IMIS survey did so based on the promise that the data concerning their syndicates and *centrales* from the IMIS system would be returned to them. This includes reports and analyses made for each individual farm, each syndicate and each *central*. The understanding between The Mitchell Group and the Chapare farmers was that they would use their information to understand what they individually and collectively have, and to begin to plan and strategize the production and marketing of their own produce. It is the farmers' desire to take destiny into their own hands that must be cultivated by the project, for this is true development. Because the publication of this information is understandably a very large project (7535 farms, 217 syndicates and 20 *centrales*), and in gratitude to the farmers for their enthusiastic participation in the survey, The Mitchell Group has offered to ARD/Cochabamba to assist in the publishing of these documents.

I. Introduction

The Mitchell Group has created a management information system for the USAID Cochabamba Regional Development Project (CORDEP). This Integrated Management Information System (IMIS), as it now exists at the conclusion of its first phase, contains modules for 1) agricultural production, 2) production of genetic materials, 3) packing and shipping, 4) exports and 5) foreign exchange generation, and agricultural data collected from 7,535 farms in the Chapare. User manuals with both operational and technical information accompany the system.

The CORDEP IMIS is a very large and powerful application designed to handle large amounts of data efficiently and in a manner that greatly reduces the risk of data corruption. Rather than being a simple database, like so many that are created in the lifetime of a development project, the IMIS is a professional grade multi-user application that meets private sector standards in terms of stability, functionality and user-friendliness. The IMIS differs from the standard database systems in that it allows for simultaneous multiple users. Furthermore, it can be configured to maintain concurrent databases that automatically update each other, providing for the integration of interactive multiuser systems across multiple platforms. This, combined with features such as the use of pick lists to enter data and the user access security system, prevent the accidental erasure or unauthorized change of data that commonly occurs with databases that are not properly secured at the appropriate user levels. The IMIS provides for user interfaces in both English and Spanish, and can be toggled between these interfaces with a single key stroke.

II. Background Information and Documents

Throughout the CORDEP/IMIS project, the development and features of the IMIS have been thoroughly documented, as has the data collection process. Rather than repeat the extensive information related to the conception of the IMIS project, software development and data collection methodology that has already been documented in full, the following lists and describes the more important publications associated with the project, to which the reader is referred.

- *Work Plan to Establish an Integrated Management Information System for the Cochabamba Regional Development Project in Bolivia*, February 20, 1992 by Donovan Rudisuhle for Management Systems International.

  This document outlines the original conception of the entire IMIS project covering eleven areas in need of a management information system, which was later extended to thirteen. Because they were deemed to be of the highest priority, the first three areas were included in this phase of the project: Agricultural Production in the Chapare, Packing and Shipping, and Exports. Later, a fourth area, Foreign Exchange Generation, was added. The "New Agricultural Extension Methodology", which espoused using farmer participation through their community structures in what at the time was a radical departure in methodology, was outlined in this document and consequently used in the collection of data.

- *Proposal for an Integrated Management Information System for the Cochabamba Regional Development Project in Bolivia*, June 1992, by Donovan Rudisuhle for The Mitchell Group, Inc.

  This document outlines the specific plan for Phase I of the IMIS Project, including software development for 1) agricultural production, 2) packing and shipping, 3) exports and 4) foreign exchange generation and the surveying of two pilot *centrales*, Villa Nueva and Agraria La Union.

- *CORDEP/IMIS Project Interim Report 3: Preliminary Data Analysis*, December 18, 1992, The Mitchell Group, Inc.

  A preliminary analysis of the data collected in the two pilot *centrales* is contained in this report.

- *Work Plan for the Expansion of the CORDEP/IMIS Survey*, December 1992, The Mitchell Group, Inc.

  In this publication, the expansion of the farmer survey is discussed, along with the data collection methodology. Also, changes to be made in the design of the IMIS system, such as the inclusion of a new section for genetic materials are mentioned. Revisions to the data collection methodology that were made based on lessons learned from the two pilot *centrales* are discussed.

- *The CORDEP/IMIS Project: Purpose, Methodology and Significance of Expected Results*, January 22, 1993, The Mitchell Group, Inc.

  This document was published in both English and Spanish to provide a summary of the field work and a discussion of the methodology for data collection and analysis.

- *The CORDEP/IMIS Project Field Report: Methodology and Results*, June 1993, The Mitchell Group, Inc.

  This report summarizes the field work which took place in the beginning of 1993, as well as the results from that effort.

- *CORDEP/IMIS Technical Reference for Version 2.20*, July 1993, The Mitchell Group, Inc.

  This manual provides database definitions, describes the menu system, presents screen designs and describes reports. It also provides instructions for the installation and maintenance of the IMIS, including instruction for data archiving.

- *CORDEP/IMIS PROJECT: Long Range Development Plan*, July 1993, The Mitchell Group, Inc.

  The plan for the entire IMIS, as conceptualized in the first document listed above, is revisited and reworked upon the completion of Phase I.

As portrayed above, the initial concept of the fully integrated management system was developed early in 1992. After the completion of the pilot data collection effort, many changes were made to the software design as the limitations of the original design became apparent. It became clear to The Mitchell Group (TMG) that agricultural data that merely identified what was present in the Chapare was not sufficient to explain the dynamics of agriculture in the Chapare or the effects of the CORDEP project on the Chapare. As a result, the system was redesigned to include much more detailed information about land ownership and other demographics, marketing of agricultural products, land/crop/animal problems and farmer involvement with alternative development, such as participation in project sponsored courses and contact with representatives from various institutions. Also, the ability to flag data according to its quality was added to allow the user to include all data in the database and yet exclude at will different data in reports and analyses.

Although all of the above items were not required by contract, it was clear that they were of great importance to the project, to which ARD/Cochabamba concurred. Another change to the system was a new module for genetic material, required in the extension of the contract. The effect of adding these components to the system design was great in terms of both power and size of the system. It also had a large effect on the engineering of the software. In the case of the table that describes a farm, the former 21 fields of data became 57 fields, every existing screen had to be modified and 36 new screens were added. It is important to understand that, because this is an *integrated* system, any change in the software, such as the inclusion of a new field, affects every single component of that module, requiring a major reworking of the code. This is very different from adding a new module, such as a module on Chapare infrastructure, in which the creation of links between modules is much less complicated and time consuming.

As a result of the changes to the agricultural production module, work which had been completed up to the extension of the contract was essentially nulled. **It became senseless to complete the original module of the software because making the changes described above in the software would mean repeating months of labor.** It was very important that these changes be made at this time, because the new information clearly was desired. To first create the software and then modify it at a later date would be prohibitively costly and time consuming. Nevertheless, the software was completed according to schedule, although there were some delays in final delivery, due to the fact that twice as much data had to be processed as had been anticipated.

III. Features of the IMIS

A. Software Design

The IMIS system was designed and created by Dr. Ted Pepin and Don Rudisuhle using proprietary CASE (Computer-Assisted Software Engineering) tools that had been developed by Dr. Pepin. The use of CASE tools allows the user to generate 4GL source code for an application once the detailed specifications have been created, instead of writing the code by hand. CASE tools therefore greatly reduce the amount of time required to create software and greatly reduce the risk of bugs, since all screens, databases and related structures are automatically adjusted to reflect any modifications. One of the unique features of these CASE tools are their ability to produce multilingual applications whereby different languages can by instantly swapped on a real-time basis. For the CORDEP IMIS, English and Spanish are both available.

B. Project Elements Managed by the IMIS

The CORDEP IMIS software manages the following elements of project data:

- Farm demographics - General information covering farm identification, location, ownership and titling, farmer gender etc.
- Crop plantings, by variety, age and number.
- Large and small animal presence on a farm, by sex, age and number.
- Problems experienced by farmers at 3 levels: farm, crops and animals.
- Marketing information covering the disposition of farm products, including farmgate prices.
- Dates of visits by project agents to individual farmers.
- Attendance dates by farmers to project-sponsored training courses, classified according to training topic.
- Nursery information including location, ownership, crops, varieties, genetic material type and transplant dates.
- Packing facility information by facility and by crop.
- Export transactions and foreign exchange generation analyzed by volumes of crop type exported, volumes per country of destination or by buyer name.
- Syndicate, *central* and federation lists, recorded in a fashion that permits the dynamic linking of the affiliation hierarchy, so that the system is easily updated as syndicates and farmers change affiliation.

All project elements noted above are all fully integrated with each other through the IMIS structure, which is tied together by references to farm numbers, crop and variety types, syndicate numbers, dates and other components. By means of its powerful SQL interface, the software is capable of performing sophisticated queries on virtually any data element contained within the system. For example, it has the ability to locate all of the farms with the following list of characteristics: 1) titled, 2) are worked by a woman farmer, 3) are in Sindicato Munaypata *or* Sindicato Nueva Esperanza, 4) which have at least 25 orange trees *and* 5) have no more than 5 chickens.

Aside from providing the capability of analyzing historical plantings and forecasting future production as discussed above, the data described above can be used for many other aspects of the CORDEP project. Some examples are:

- Adoption of extension themes, such as quantifying the new plantings of improved varieties being promoted by IBTA, the agency that provides agricultural extension services.

- Identification of obstacles to production, such as quantifying the number of farms experiencing plant diseases or insect infestation.

- Information on production of genetic materials, identifying the quantity, location and types of producers and end users for planting materials.

- Provide elements for calculating farm income. Once the total crop and animal inventory of a farm are known, it is possible to begin to construct a model of farm income. Combining this information with data available from other official sources such as DIRECO, the agency coordinating the coca reduction program, and INE, the Bolivian National Institute of Statistics, it is possible to gain a greater understanding of household income for the farmer and of the economic vitality of the various regions of the Chapare.

- Marketing of farm production. The IMIS is able to track quantities on a yearly basis, farmgate prices and type of buyer as well as problems encountered in the marketing of their crops.

- The need for infrastructure. The presence or lack of infrastructure and transportation is often commented upon by farmers in the survey. The IMIS can be used to identify areas of both production and population that currently lack the means of reaching markets.

C. Project Performance Indicators

The IMIS has been designed in a way that permits measurement of project performance by collecting data on indicators that relate to goals established in the project paper. Some major performance indicators are:

- Patterns of planting. The IMIS system can produce the history of farmer plantings, both on an individual basis and by *central* or syndicate, by crop

and variety. Verifiable, empirical evidence can answer questions such as: Is the farmer responding to stimuli presented by the project? Are courses effective in communicating new technologies? Are the extensionist's themes being accepted?

- Export volume and foreign exchange generation. The system can track many aspects of export transactions, such as destination, buyer, agents etc.

- Participation of women. Because the farmer's gender is recorded, statistics covering various aspects of women's agricultural activities can be derived. For example, women farmer's plantings and livestock can be compared with that of their male counterparts, which may reveal significant differences in things such as farming practices and farm income potential.

- Contact with Institutions The IMIS system is capable of tracking each farmer's contacts with the various development institutions as well as farmers contacts regarding the amount of technical assistance received. While this is not intended to be a means of measuring the performance of institutions, it does reflect farmer's attitudes towards their interactions with them.

D. Project Feedback Mechanisms

In addition to the structures designed to record crop and animal data, the IMIS system has several mechanisms for capturing feedback from farmers. First, comment fields are provided with many of the screens so that an extensionist or other agent can enter the comments about the farmer's observations concerning his or her farm, crops and animals. In addition, separate field with pick lists of specific types of common problems associated with farms, crops and animals are maintained. This allows for quantification of the incidence of a particular problem throughout an area. For example, farmer reports concerning animal or plant diseases can be quantified and located geographically. Comment fields are also provided for the packing facility operations. The system can also perform text searches through comment fields to look for key words.

Response on the part of project personnel can be carried out on several levels. First, on an individual basis, a flag can be inserted in a comment text field such as "URGENT" or "NEXT TRIP TO ISIBORO" and the system can search and locate all farms that have been tagged in this manner. On a larger scale, it is possible to address certain types of problems on a macro basis. For example, the system might be asked to search and locate all farms which have reported the "Mal de Panama" disease in Central San Miguel. This would facilitate a systematic approach to solving a particular problem.

E. Data Available in the IMIS

The capabilities of the IMIS database are currently much greater than the amount of data that has been inputted to date into the system. This is due partly to an absence of data and, where data existed, to both the budget and time constraints of TMG's data inputting

staff. At the time of delivery, the data in the IMIS system included 1) all farm data including demographics and land ownership information, 2) crops by age, number, hectares and planting dimensions where appropriate, 3) animals by age and number, 4) genetic materials by age, number, condition and planned disposition and 5) surveyor comments for farms and genetic materials. Most, but not all, of this data was required by contract.

By the installation of the IMIS system at ARD/Cochabamba, the CORDEP project did not have data for three of the five modules - packing and shipping, exports and foreign income generation - largely because little to no activity in these areas had taken place or was documented. This incidentally created a problem for the development of these software modules in that TMG was forced to assemble the modules using standard formats, without knowing exactly what data fields would be required in the event that these activities ever did take place. The lack of data meant also that the modules could not be tested upon completion, either.

In addition to data required by contract, the TMG field team took the opportunity to collect data during the survey operations not required by contract at very little extra cost or effort. This data includes detailed crop marketing information, farmer participation in project-sponsored courses, farmer contact with development institutions and farmer problems relating to their farms, crop and animals.

Much of this extra data is critical to demonstrating the effect of the CORDEP project on agricultural development in the Chapare. Unfortunately, TMG necessarily had to apply all of its limited data inputting resources to only that data which was required by contract. Copies of all data collected by TMG in Bolivia are located in the Cochabamba project office. The original copies are currently stored at TMG's offices.

F. Reports Available from the IMIS

There are 63 different reports available within the IMIS, many of which can be configured by the user with respect to crops, varieties, dates, *centrales* and syndicates, that provide literally thousands of possible combinations for report preparation. These reports were designed with the following objectives: 1) to keep the physical length of a report to a reasonable amount, 2) to allow the user the ability to manipulate the data, 3) to operate within the physical limitations of the hardware allocated to the system by ARD/Cochabamba and 4) to operate within the financial limits of the CORDEP project.

To meet the above requirements, the IMIS uses a list of reports designed by TMG that were deemed to be the most useful configurations of data. Software that allowed the user to design reports as needed not only would require a system capacity far beyond that which is available to ARD/Cochabamba, but would be prohibitively expensive to the CORDEP project. Instead, many of the IMIS reports are also available in a delimited form, which is then easily exported to a spreadsheet or word processing package. The use of delimited files thus gives the IMIS user the ability to combine files, condense files and manipulate data at will.

After delivery of the system, ARD/Cochabamba had the opportunity to review the system and offer feedback to the Mitchell Group. Requests concerning the reporting capabilities were incorporated into the final version of the software. ARD's comments have been addressed in this document. Examples of reports can be found in the appendices of this document. The need mentioned above to limit the length of each report, due to the vast amount of data available in the system, is underscored by the fact that the 17 reports required for this document and contained in Appendices C through S are collectively 1,456 pages in length.

Again, due to the budget and time constraints of the project, reporting capabilities for some data not required by contract were not included in the system, such as crop marketing information, farmer participation in project courses and farmer contact with development institutions. Although little effort would be required to ultimately incorporate them into the system, this simply could not be done under existing conditions. It is hoped that at some point in time provisions are made to include these capabilities into the system because of their great potential benefit to the project.

G. Other IMIS Features

Other IMIS features include:

- Pick lists. The use of pick lists for entering data ensure a greater degree of accuracy in the database. For example, under most systems, the following entries: "Oranges" and "oranges", would be considered two different crops.

- On-line help screens. From any menu pick, the description for the use of that function can be accessed with the F1 key. A master pick list of help topics is also available on the system.

- Language-swapping. At any menu selection in the system, the user can toggle between English and Spanish by simply typing an exclamation mark (!). All screens, pick lists and reports are available in both languages.

- Multiuser/multitasking capabilities. Under the IMIS, multiple users can simultaneously use the database from different terminals. The Informix On-Line engine can also be configured to co-exist on multiple computers that maintain their databases concurrently. This would allow, for example, the system to be on a computer in Cochabamba and on another in Washington, D.C.; changes made to the system at one location would be automatically reflected at the other. Another method of allowing multiple use of the IMIS system is through remote accessing, where, for example, someone located in Washington, D.C. could access the IMIS system located in Cochabamba through a modem in order to query the data or run reports. Remote access via modem was included in the IMIS workplan and the IMIS is optimized for this, although ARD/Cochabamba declined to purchase the modem necessary to do so. Remote access via modem has already been tested. A terminal was set up at USAID LAC/SAM in Washington, D.C., and the software on TMG's UNIX file server was successfully demonstrated.

The modem demonstration was conducted on a normal PC using a modem and terminal emulation software that had a total combined cost of less than $400.

- User access security system. The security system can limit user access to specific menu picks, denying the ability to modify records for example, and to the system's functions, to which only a "superuser" who maintains the system would have. This avoids the danger of accidental erasures and unauthorized changes in the data or to the system itself, while allowing the largest number of people access to the system possible. Menu items to which a user is denied access do not even appear on the screen.

IV. Data and Analysis

A. Data Collection Methodology

Inventory of Farms

The inventory of each farm relies upon the physical counting of each plant and animal on the farm, rather than on the word of the interviewee. This approach was both possible and necessary due to the sizes of most farms in the Chapare. Most farms are very diverse, with small numbers of many types of crops. The team knew from experience that most farmers, when reporting the number of plants that they have by memory, give inaccurate numbers.

For crops planted in large numbers, the reported quantity is usually exaggerated because the farmer only knows approximately how many plants were sown or transplanted, and fails to account for losses in plants that occur naturally over the years. Conversely, plants few in number are often overlooked and not reported by the farmer, as they do not play a significant role in the economy of that particular farm. However, many farmers market their produce collectively through their syndicate, and in many cases, the number of plants for each farm summed over the entire syndicate results to be more significant than thought. Another manner in which crops can be inaccurately reported is when they are recorded by area. In the Chapare, crops are rarely planted in measured rows and at consistent distances, due to both farming styles and to difficult terrain.

The inventory of farms is also extremely useful for gathering historical data. Experience has shown that reported historical data is often inaccurate and incomplete. However, the majority of crops in the Chapare are perennials and some have a life span up to thirty years. As a result, knowing the age of the plants currently in the ground gives a much more accurate picture of historical agricultural activity than could be obtained through interviews.

Audit of Data

Most importantly, the actual counting of each plant present on the farm is one of the many steps taken in the data collection process to ensure that the numbers that result from the surveys are valid and can be verified through audit. Any sum of crops can be tied to specific plants located on specific farms. This provides a solid baseline from which estimates and forecasts of production can be made. Although the assumptions used in these calculations can vary, any analysis can rely on the accuracy of the base numbers.

Data Collection Personnel

The Mitchell Group's field methodology relies heavily on community participation. The reasons for this are many. First, by participating, the community more readily accepts the project and has a stake in its success. Additionally, because the community understands that it too will benefit from the data being collected, they have an interest in the accuracy and quality of the data. Because of the agricultural diversity that exists within the Chapare, the knowledge and familiarity that the local data collectors have of their own areas is important to the project. Finally, involving communities in this type of

project increases overall involvement in alternative development, which is the ultimate goal of USAID.

The structure of the data collection team was as follows. The effort was managed by The Mitchell Group's two consultants, Joe Lopez and Christine Humenick. Assisting them in the field were two Bolivian administrative assistants. Nine Bolivian field assistants were employed to oversee the data collection effort in either one or two *centrales* each. In every case, these field assistants were individuals who originated from the community in which they were working and who had had more education and training than the average community member. In many cases, the field assistants had been trained as *promotores*, or agricultural "promoters", through the IBTA extension program. Three field assistants had university degrees in agronomy.

Next, the *dirigentes*, or "leaders", of each *central* played a crucial role in the data collection effort, securing the participation of each syndicate in his *central* and resolving any conflicts and problems that arose. Representatives from each syndicate, usually consisting of the syndicate leader and one or more others, took the actual surveys. In most syndicates there was an average of one *encuestador*, or surveyor, for every twenty syndicate members. In all, there were 274 *encuestadores* for the 17 *centrales*.

The Data Collection Process

The data collection process was designed to ensure that the highest quality data possible was gathered. The process began with an intensive training course for the *encuestadores* and then consisted of extensive and repeated reviewing and revision of the surveys.

The training course that was provided for the *encuestadores* was held for each *central* and lasted three days. The first day was an orientation session that explained the purpose of the survey, the type of information that was being requested and the uses of this information at the syndicate and *central* levels. All persons interested in the survey, whether this interest was positive or negative, were encouraged to attend the orientation. As a result, the members of the *central* were able to debate whether to participate in the survey or not in an informed manner. This process was absolutely critical to the widespread acceptance of the survey, given the natural tendency of the farmers to distrust projects of this nature. In a few cases, the orientation was repeated at individual syndicate meetings in instances where the syndicate affiliates wanted to know more about the survey before agreeing to participate.

After the orientation, representatives for each syndicate were chosen to be *encuestadores*, who were then the only people to attend the rest of the course. In this way, the number of participants for the rest of the course was kept to no more than twenty-five. This ensured that each participant received full attention from the trainers, of whom there were usually two.

For almost every *central*, an IBTA extensionist who normally worked in that area conducted the second day of training. Using large blown-up versions of the survey on posterboard, the group would talk their way through each page of the survey, discussing the types of data being requested and all the possible responses. Participants used roll-playing to acquaint themselves with the survey, surveying each other in front of the

group. On the third day of training, the group would select one farm to survey together, putting into practice what they had learned the day before.

After the training course, the *encuestadores* began surveying their syndicates. Upon completion of a handful of surveys, the *encuestadores* would deliver the surveys to the field assistant working in their *central*. It was the field assistants' job to thoroughly review the survey, looking not only at the data included in the survey, but also looking for missing data. The field assistants also reviewed the surveys to ensure that crops and animals were properly identified, that the farm identification data was complete and legible, et cetera.

After reviewing the surveys, those with problems were given back to the *encuestador* for corrections. Initially surveys were often returned and the problems explained to the *encuestadores*. In this way, the training process was completed. However, the *encuestadores* quickly learned from their mistakes and soon became very proficient in survey taking. Once a survey was reviewed and accepted by the field assistant as being complete, the *encuestador* was awarded a small remuneration for each survey, to compensate them for the large amount of time the surveys had taken from their normal activities, and to provide an incentive to continue this arduous task.

B. Selection Criteria of Survey Participants

The Chapare is divided by various political, social and geographical boundaries. First, there exists a local political structure, which is not considered part of the official Bolivian government, yet through which all decisions are made within the Chapare and which cannot be ignored by any institution wanting to work in the Chapare. This system can be best envisioned as a system of unions. The basic unit is the **syndicate**, which derives its power from the fact that the Bolivian government colonizes the Chapare by allocating land to the syndicates and the syndicates then distribute or sell for the government the parcels of land to individuals who become **affiliates** of that syndicate. Syndicates can have from 2 to approximately 150 members. These communities usually have homogenous terrain, crops and sometimes farming practices, due to their relatively small geographic size.

The next level of organization is the ***central***. All syndicates belong to a *central*, which is comprised of any number of neighboring syndicates, usually in the range of six to ten. Syndicates can and do change the *central* to which they belong. While syndicates may be the basic community unit, *centrales* are the basic political unit. This is not to say that *centrales* have absolute political control over the syndicates, because they usually function very much as democracies, but that it is at the *central* level that most local political activity takes place. Finally, most *centrales* are affiliated with a **federation**, although some opt to remain "independent". There are 6 federations in the Chapare. The federations are usually active in representing the farmers to the Bolivian government.

Centrales were chosen as the basic unit for surveying by The Mitchell Group for a number of reasons, which are discussed in detail in many documents, including the original proposal and the *CORDEP/IMIS Project Field Report*. These include the extensive problems associated with the random sampling of individual farms, the ability to attribute

agricultural development in the Chapare to the CORDEP project and the farmers' need to understand and document the agriculture in their communities. A judgement sample of representative *centrales* was prepared by Joe Lopez, TMG's agronomist and extension specialist, based on his eight years of experience working with farmers in the Chapare. The selection decisions for each *central* were based on the following criteria. These characteristics for each *central* are summarized in Table 1 found on page 15.

- Geographical location. The *centrales* surveyed represented all of the subregions of the Chapare. Subregions were originally designated as distinct geographical zones in the Chapare. Since then, problems with these classifications have been discovered (i.e. diversity within the subregions) and the boundaries of some subregions have been altered for non-geographical reasons.

- Agrobio climate and soils. All of the variations of climatic and soil conditions present in the Chapare known to IBTA were represented.

- Participation in alternative development. *Centrales* were selected according to the period of time they participated in the alternative development program and the types of participation that they have had with the project. Table 1 provides the year in which contact was established in each *central.* Participation is defined as the many types of contact and collaboration with IBTA and DIRECO that have occurred since the initial contact. These are also listed in detail in Table 1.

- Crop history. Selection was also based on farming systems history, where recent crop plantings were initiated by the spontaneous immigration to the Chapare versus the crop plantings by the "Colonos" who had been in the Chapare since 1980 and before. See "Average Time on Farm" in Table 1.

- Willingness to participate in the survey. Since the objective was to gather information for the IMIS system and the specific methodology used to perform this collection was a delicate affair, *centrales* that *might* cooperate were selected, based on the criteria set forth in the items above. Only one *central*, Paracti, declined to participate in the survey. In the process of obtaining participation for the survey, the number of *centrales* surveyed rose from the planned minimum of ten to an actual seventeen. In addition, sample surveys were collected from three other *centrales.*

The map of the Chapare contained in the back of this report and in Appendix A shows the geographical location of the *centrales* surveyed. Table 1 summarizes not only the attibutes that distinguish these *centrales* listed above, such as geographical characteristics and participation in alternative development, but includes important demographic statistics, as well.

Referring to the map of the Chapare at the back of this report, the various areas can be categorized as follows. Working from the upper left corner of the map, the first group of *centrales* are in Subregions 4 and 8, within the former "Red Zone". Many of these farmers are relative newcomers both to the Chapare and to farming, drawn by the coca heyday,

and there exists great variety in terms of participation in alternative development. Approximately 40 of these *centrales* lie within sloping terrain where infrastructure is poor or non-existent and no one crop or animal dominates the production in this subregion.

Central Isiboro in Subregion 8 merits mentioning not only because it lies within a national park, but that despite its relative inaccessibility, it is remarkably productive and although it has had very little contact with alternative development, it had a relatively high level of participation in the TMG survey. Central Eteramazama is characterized by a cooperative whose members are all from the *central* and who produce pineapple, macadamia, forest species and other tree crops.

The second group is composed of Espíritu Santo and Jatun Pampa, both of which were settled in the late 60's and are located in Subregion 5. These *centrales* lie on the highway to Cochabamba above Villa Tunari. Terrain here is extremely rugged and is at an altitude of approximately 400 meters. Although these *centrales* have access to the highway, many of the syndicates lie opposite large rivers which can only be crossed by cable, with few roads existing for transporting their products to the main road. Consequently, only those agricultural products that are carried to and then across the river by hand can be extracted from parts of this area. Many of the agricultural products from the subregion are sold at roadside stands to tourists and travelers.

The third group, consisting of San Miguel, Paraíso Todos Santos, Ibuelo, and German Busch, is located in an alluvial plain fed by many major rivers. As a result, the soil is rich and fertile and this was one of the first areas to be colonized about thirty years ago. Citrus, plantains and bananas are the major crops grown in this area. Primary forest no longer exists here. The infrastructure is relatively good by Chapare standards. Encroachment by rivers is a problem for many syndicates. Central Chimoré neighbors these *centrales* and shares many of their characteristics. Most notably, Chimoré is a *central* that has received more attention and aid from development projects than most, particularly from the U.N. San Miguel and Paraíso are in Subregion 1 and the others all are in Subregion 3.

The fourth group on the map consisting of Mariposas, Villa Nueva and Ivirgarzama do not have much in common beyond areas of rugged terrain. Mariposas is a major pineapple producing area. Villa Nueva was the first *central* to accept alternative development and eradicate their coca. Ivirgarzama is the largest *central* surveyed, and geographically marks the area where the temperate forest of the Chapare make the transition to lower areas. Villa Nueva is in Subregion 2. Mariposas and Ivirgarzama are in Subregion 6.

The last group of 22 de Mayo and Bulo Bulo, which are in Subregion 7, lie near the border of Santa Cruz and are characterized by grassland and cattle, although 22 de Mayo is considerably less developed than Bulo Bulo.

Table 1. Charactaristics of Centrales Participating in the 1992 - 1993 IMIS Survey

	San Miguel	Paraiso	Ibuelo	German Busch	Chimoré	Independiente	Eteramazama	Agr. La Union *	Bolivar	San Gabriel	Gran Chaco	Isinuta	Isiboro	Espiritu Santo	Jatun Pampa	Villa Nueva *	Mariposas	Ivirgarzama	22 de Mayo	Bulo Bulo
Descriptive Statistics																				
No. of Afiliates	326	N/A	735	N/A	169	744	506	589	358	841	N/A	791	288	357	273	230	340	1,621	502	370
No. of Farms Surveyed **	322	15	690	40	185	631	521	319	445	648	35	729	200	376	212	212	269	820	399	456
% with Title	64.0	66.7	72.2	92.5	47.6	1.4	91.6	0.0	84.3	67.7	97.1	59.7	0.0	47.9	47.6	0.0	93.7	69.6	94.5	81.4
% Female	16.2	13.3	10.4	7.5	3.8	10.1	18.0	10.0	12.1	11.4	8.6	13.3	12.5	13.8	9.9	6.1	5.2	7.9	7.5	10.1
Average Time on Farm	14.7		12.0	14.8	11.3	6.4	13.4		10.7	7.7	8.7	9.1	8.9	13.0	12.6		9.7	10.9	5.9	6.9
Average Size of Farm	6.35	10.08	6.40	7.83	12.61	12.17	7.49		8.79	8.87	7.61	8.85	13.28	6.94	6.41		14.51	15.71	16.73	27.73
Total Hectares Surveyed	2,026	131	4,373	313	2,307	7,632	3,857		3,815	5,606	267	6,361	2,576	2,547	1,334		3,788	12,415	6,643	12,480
Geographical Charactaristics																				
Subregion	1	1	3	3	3	4	4	4	4	4	4	4	8	5	5	2	6	6	7	7
Types of Terrain	F, A	F, A	F, A	F, A	F	F, W	F - R	F	F - R	F, A	?	F - R	S - SS	S, R	S, R	SS	F - SS	F - R	F, W	F - S
Alternative Development 1985-93																				
First Year Participated	1985	1986	1986	1990	1985	1991	1988	1985	1987	1985	1992	1989	1991	1985	1985	1987	1986	1985	1990	1990
Training																				
In-country	X	X	X	X	X	X	X	X	X	X	?	X	X	X	X	X	X	X	X	X
Out-of-country	X		X		X		X	X	X	X		X		X	X	X		X	X	
Promoters	X	X	X	X	X	X	X	X	X	X	?	X	X	X	X	X	X	X	X	X
Nurseries	X		X		X	X	X	X	X	X	?	X		X	X	X	X	X	X	X
Level of Participation:																				
Central	X		X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Sindicate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Individual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
UPD's	X	X	X	?	X	X	X	X	X	X	?	X	X	X	X	X	X	X	X	X
Immediate Impact			X		X	X	X	X	X	X	?	X				X		X	X	
Coca Law 1008 Seminar	X		X				X	X	X	X		X		X	X	X	X	X	X	X
Regional Ag Fair	X		X		X		X	X	X	X		X		X	X	X	X	X	X	X
Microregional Ag Fair	X		X	X	X		X	X	X	X	X	X			X	X		X	X	X

* Less demograhic information was collected during the first survey effort.

** In some areas, it is common for affiliates to own more than one lot.

9/93

A = Alluvial Plain F = Flat R = Rugged S = Sloping SS = Semi-sloping W = Low Wetland

C. Statistical Extension of the Data

The high level of participation achieved in most of the *centrales* surveyed makes it largely unnecessary to resort to statistical methods to extend the results of the farms surveyed to the rest of the *central*. Please refer to Table 2 on the following page and to Appendix B for figures on coverage levels achieved within the *centrales* surveyed. Central Chimoré was the only *central* from which so few surveys were collected from so few syndicates that it is not possible to extend those surveys to the entire *central*. Only half of *central* Ivirgarzama was surveyed due to its extreme size and to time constraints. However, the 827 farms surveyed from this *central*, from 33 out of 59 syndicates, are considered a representative sample of the entire *central*.

In addition to the 17 *centrales* surveyed, 3 other *centrales* that were not admitted to the project - Gran Chaco, German Busch and Paraíso Todos Santos - were allowed to collect surveys from a handful of affiliates for their own purposes. From Gran Chaco, one entire syndicate of 35 farmers, Limoncitos, participated. Central Gran Chaco is an example of a *central* that is relatively new and that has not had a history of participation in alternative development. From German Busch samples of 10 were taken from 4 of the syndicates. From Paraíso Todos Santos a sample of 15 was taken from the syndicate Eduardo Abaroa. German Busch is an example of a very productive citrus area, and Paraíso of a very productive banana area.

Because these *centrales* were outside the surveyed areas, the basic demographic information for these three *centrales* was not collected. Additionally, these *centrales* were allowed to pick lots to be surveyed with criteria unknown to the project, although purportedly they were sampled randomly. Thus, their data is not extended to their *centrales* in this report. Nevertheless, the information revealed about these areas from what little data is present is very interesting and is used in the report in order to demonstrate certain points.

In general, there was a high level of enthusiasm for the survey. Nevertheless, there was a small minority that did not participate or that provided incomplete data. The principal reasons for this were:

- The farmer was not available for the survey during the time the surveyors visited his or her plot.
- Some *centrales* were unable to complete their surveys in the time allotted by the project.
- Some farmers were reluctant to provide information on various items for fear that it might be used to levy taxes or confiscate his or her land if it was not in use for crop or animal production.
- Some farmers had planted new coca and were afraid that this information would be made known to DIRECO.
- In many of these cases, the reason for non-participation was unrelated to CORDEP and reflected a general distrust of all outside institutions.

Table 2. Number of Affiliates and Surveys from Centrales Surveyed

Central	Affiliates	Surveys	Central	Affiliates	Surveys
22 de Mayo	502	399	Independiente	744	631
A. La Union	589	318	Isiboro	288	200
Bolivar	348	442	Isinuta	791	716
Bulo Bulo	370	385	Ivirgarzama	1621	827
Chimoré	469	185	Jatun Pampa	273	212
Espíritu Santo	357	376	Mariposas	340	271
Eteramazama	506	521	Paraíso T.S.	N/A	15
German Busch	N/A	40	San Gabriel	841	677
Gran Chaco	N/A	35	San Miguel	326	319
Ibuelo	735	690	Villa Nueva	230	212

It is also possible to extend the data collected to the entire Chapare or to specific *centrales* not surveyed by the project. Extending the data was not required under this phase of the project. However, the data was collected in such a manner that it is now possible to do so with the following methodology.

Through *a priori* knowledge of the Chapare, it was hypothesized that the first three characteristics discussed in the previous section, i.e. geographic location, agrobio climate and soils and participation in alternative development, would influence the types and quantities of crops grown. The *centrales* picked to participate in the survey represent almost every combination of those variables. With the data now collected, these variables can be tested and their correlations determined.

Once this model is validated, the data can be extended to any *central* given that the same information - location, climate/soil and participation, in addition to population figures, is known. As described in the *CORDEP/IMIS Project Field Report*, knowing the population of the Chapare or for any given syndicate or *central* is often difficult. Until reliable data is somehow obtained, its lack provides a serious barrier to statistically estimating production in the Chapare using any methodology and deriving sound results.

The data collected in the survey represents 25 percent of the *centrales*, between 20 and 25 percent of the farms and all of the subregions of the Chapare. Nevertheless, it must be stressed that multiplying survey results by an estimation of the total population yields a statistically invalid number - although it may be in the general ballpark - because the Chapare is in no way homogenous. Again, the data would need to be normalized along the variables of population, climate/soil and project participation. However, for the purpose of making some crude comparisons with previously made estimates, results of the IMIS survey are multiplied by four in the following sections. These numbers should **not be considered valid estimates and were made for the purpose of discussion only.**

D. Success Rate of the Survey

It is very difficult to determine the exact percentage of each *central* surveyed, although the success rate for most *centrales* was high. This is for a number of reasons. First, because of fluctuations in the population, a number of community leaders did not know

how many affiliates they had. In fact, the survey in a number of areas helped the leaders determine who was present in their syndicate or *central*. Even worse, it was often unknown the number and location of lots in a syndicate. The jealously guarded syndicate maps, created upon the formation of the syndicate, were hopelessly outdated after years of exchanging, dividing, abandoning and reclaiming lots. A formal cadastral system does not exist in the Chapare.

Appendix B contains a list of all *centrales* and syndicates surveyed, the number (or its approximation) of **affiliates** in each syndicate and *central*, and the number of **lots** surveyed from each syndicate and *central*. In some communities, it was not uncommon to own more than one lot. Thus some communities have more lots surveyed than affiliates. Table 2 on the previous page shows the number of affiliates in each *central* and the number of surveys collected from each *central*.

With the data available, it appears that of the seventeen *centrales* surveyed, fourteen met the sixty percent target rate set forth by the project contract. Also, it seems from the numbers in Table 2 and from the field team's knowledge of the areas surveyed that over ninety percent of six *centrales* were surveyed. These include the Centrales Bolivar, Bulo Bulo, Espíritu Santo, Eteramazama, Ibuelo and Villa Nueva. Although sixty percent of each *central* was expressed as a participation target for the project, it is important to realize that the syndicates are the more cohesive units in the Chapare, and that participation in the survey was usually decided on a syndicate basis. In eight of the seventeen *centrales* surveyed, there were entire syndicates that declined to participate in the survey, lowering that *central*'s overall participation rate.

Two of the three *centrales* that did not meet the sixty percent target were interesting cases. The first is Central Ivirgarzama, from which 827 surveys were collected from over 1600 affiliates. This *central* was so large, both in number of affiliates and geographically, that very little power and cohesion existed at the *central* level, partly because of the huge area spanned by *central*. Due to time and resource constraints, it was not possible to include this entire *central* in the survey. Consequently, of the 59 syndicates belonging to the *central*, only 33 syndicates were included in the survey, although many others expressed a desire to participate. However, as reported in Appendix B, significant numbers of surveys were collected from those syndicates that did participate. And, in absolute numbers, more surveys were collected from Central Ivirgarzama than from any other *central*.

The second *central* that failed to reach the sixty percent target was Central Chimoré, of which no more than 36 percent was surveyed. Despite the fact that this *central* has received more aid than any other Chapare community in the form of numerous projects, cooperation was very difficult to obtain, and members could not come to an agreement about participating. Of the seven syndicates, only two truly participated in the survey. It was felt by the staff that members of Central Chimoré were reluctant to demonstrate the extent to which they had or had not responded to the development projects in their communities.

Lastly, Central Agraria La Union did not meet the sixty percent target. This *central* was surveyed during the first data collection effort of the IMIS project, of which the field work took place over a four week span. As described in detail in the CORDEP/IMIS project

Interim Report 3: Preliminary Data Analysis, the time the team spent in the field was simply not sufficient for the affiliates of some syndicates belonging to this *central* to decide whether or not to participate.

As a final note, it should be reiterated that in many situations, the *central* and syndicate leaders did not have any idea of how many affiliates they actually had. This is partly due to a lack of records kept on this matter. However, the problem was largely compounded due to fluctuations in populations within the Chapare over the years. This was attributed by the farmers to changes within the coca market. Some *centrales* maintained that they had lost up to fifty percent of their affiliates over the last three years, with some syndicates disappearing altogether.

As a result, the survey played an important role in many communities, helping them to identify just how many members they had, and who they were. The number of affiliates for each syndicate listed in Appendix B are thus, in many cases, approximations made by the *dirigentes* at the end of the survey. Unfortunately, for the same reason that most *dirigentes* could not give at first their present number of affiliates, there was no way to obtain the number of affiliates present in past years, which would have provided a very interesting comparison.

E. Gender-specific Land Ownership Information

The IMIS system records gender information for each farm. It also records information regarding plot titling and ownership. Information generated by the IMIS regarding land ownership patterns is summarized below in Table 3. Most of this information for individual *centrales* was also contained above in Table 1, "Characteristics of Centrales Participating in the 1992 - 1993 IMIS Survey", on page 15.

Not all farmers surveyed answered all of the demographic questions. Table 3 represents the breakdown for the responses that were received. The system revealed that 822 of the 7,542 farmers surveyed were women. This translates to 11.3%. Only one woman promoter was observed during the field visits. IBTA maintains records on promoters, but it is not known if the data is up to date.

Table 3. Gender-specific Land Ownership Information

	TOTAL	MALE	FEMALE
Farmers owning the farm they work	6,670	5,926	744
Farmers not owning " " "	587	565	22
Unknown land ownership status	285	229	56
Total	7,542	6,720	822
Farms that are titled:	4,992	4,412	580
Farms occupied by the farmer:	6,609	5,971	638
Farmers owning another lot:	853	775	78

The IMIS system is capable of an even higher level of disaggregation for the above data. For example, the gender specific information can by further broken down to include detail on crops or animals. It also has the ability to track both abandoned and semi-abandoned lots through the Farm Problem mechanism, once the data is captured into the system.

F. Typical Farms and the Farm Enterprise Mix

The "Typical Farm for a Central" Report is an important tool in understanding the agricultural patterns within a *central*. In this report, the typical farm units are described on a *central*-by-*central* basis. The Typical Farm Report searches the farm table for all farms in a given *central*, identifies the crops and animals present in that *central* and reports a profile of the ownership, crops and animals for the typical farm for the *central*. These reports can be found in Appendix C for all *centrales* that participated in the survey.

An example of the first page of a Typical Farm Report is found in Exhibit 1 on page 26 At the head of this report for Central Eteramazama is detailed demographic and landownership information. Much of this data for all *centrales* has been summarized in Table 1 on page 15. Beneath the demographic information, the Typical Farm Report presents crop and animal information in three ways. In the far-right column of the report, titled "Surveyed", are the **total** numbers and/or hectares of plants and animals, by variety and by breed and sex, in that *central*.

To calculate a profile across a *central*, the total number of plants and animals are divided by two different numbers. In the first column, titled "Ave/Central", the total number of plants or animals in the last column have been divided by the number of farms surveyed from that *central* to derive the average number of crops and animals **per farm across the central**. In the second column, titled "Ave/Farm", the total number of plants or animals have been divided by the number of farms that reported having that crop or animal. This yields the average number of plants or animals in the *central* for **those farms which have them**.

The *central* average number of crops and the farm average number of crops provide for an interesting and important comparison. If the average number of a given crop across a *central* is similar to the average number for only those farms that have that crop, the crop is widely distributed throughout the *central* and is present on the majority of farms. An example of this can be found in Central Isiboro, where the average number of *criollo* orange trees per farm in the *central* is 133.49 and the average number per farm with *criollo* orange trees is 137.61. Thus, almost every farm in Central Isiboro cultivates this type of orange. The ratio of these two averages can also be expressed as the percentage of farms in the *central* that have that crop. For example, 133.49 divided into 137.61 equals .970, or ninety-seven percent.

Conversely, if the average number of plants for farms with that crop is high with respect to the *central* average, it means that this crop is found on only a few farms. For example, although every farm in Central Isiboro grows unimproved oranges, the improved varieties are much less common. Valencia Tardía, the most commonly found improved variety orange in the Chapare averages 1.14 tree per farm in the *central*, but averages 228.00 trees per farm in the *central* that actually cultivates Valencia Tardía. The ratio of these

two numbers reveals that only one-half of one percent of the farms in Isiboro cultivate this variety of oranges, even though ninety-seven percent cultivate the *criollo* variety.

Average Crops and Animals Per Farm

The three tables found at the end of this section on pages 27, 28 and 29 summarize the crop information from the Typical Farm Reports contained in Appendix C. Table 5, on page 27, gives the *central* average for the four major commercial crops - oranges, mandarins, bananas and pineapples - as well as for seven other alternative crops that have been actively promoted by CORDEP. Averages are also presented for rice, established pastures and for animals.

The first advantage of the data presented in this table is that it allows for comparisons between *centrales* by removing the effect of their disparate sizes. For example, Central Ibuelo counted 442,387 banana plants, while its neighbor, Central Paraíso, counted only 200,256. However, when the count for Ibuelo is divided by the 690 farms surveyed, it averages 641 plants per farm surveyed. Conversely, when the count for Central Paraíso is divided by the 15 farms sampled for this *central*, an average of **13,350** plants per farm is revealed. Consequently, when analyzing the productivity of each area, it is important to use the average number of plants and animals, in addition to the total numbers.

Accordingly, Table 5 suggests that the *centrales* found in the neighboring Subregions 1 and 3 are currently the most productive in citrus and banana. This comes as no surprise as these are some of the oldest and most developed communities in the Chapare, and traditionally have cultivated these crops. However, other *centrales* such as Ivirgarzama in Subregion 6, Isiboro in Subregion 4 and Villa Nueva in Subregion 2 have similar levels of citrus. Ivirgarzama and Isiboro also have the highest amounts of bananas outside Subregions 1 and 3, although not in the same quantities. Pineapple appears to be the cultivated in diverse locations. No other *central* surveyed can compare with Central Mariposas, where there is an average of 22,209 pineapple plants per farm. However, the *centrales* that average between one and four thousand pineapple per farm include Eteramazama in Subregion 4, German Busch in Subregion 3, 22 de Mayo and Bulo Bulo in Subregion 7 and Villa Nueva in Subregion 2.

Farm Enterprise Mix

The second use for Table 5 is that it reveals information about the typical crop mix of each *central*. For example, Central Mariposas averages 22,209 pineapple per farm, more than five times the amount per farm of the *central* with the next greatest amount of pineapple, Eteramazama. However, in almost every other crop in the table, Mariposas has the lowest average. Clearly, the farmers of Mariposas are cultivating almost exclusively pineapple. Likewise, Central Bulo Bulo easily outdoes every other *central* in both hectares of pasture and numbers of cows, averaging 7.32 hectares of pasture per farm and 6.70 cows per farm. The only other crops currently of importance in this area are rice (1.33 hectares per farm) and pineapples (3680.0 per farm).

However, upon examination of Table 5, it is apparent that most of the other *centrales* have a diverse crop mix. Although many of the older, more established communities tend towards specialization in a few specific crops, such as citrus and bananas, the newer areas

appear to be trying their hands at a huge variety of crops. This could be for a number of reasons. First, it may be difficult to compete in a single crop against other areas with a long history of cultivating that crop. Secondly, many of these *centrales* are in the former Red Zone and are just beginning to cultivate other crops. A farmer who is reducing coca and planting orange trees cannot afford to wait the four to eight years for his trees to begin producing without also finding more immediate sources of income. Lastly, many in these newer areas have been working closely with project extensionists, who have been actively promoting new crops, in addition to improved varieties of more traditional crops.

The following events have had an impact over the years that the project has been in operation, contributing to the changes farmers have made in their farm enterprise mix. These changes include coca reduction, increases in areas planted, adoption of improved varieties and raising of animals for consumption and sale.

- Seminars on the Coca Law 1008 Fourteen of the seventeen *centrales* surveyed have hosted seminars on the Coca Law 1008 for their members during the period of 1991 to 1992. The objective of these seminars was to orient farmers on the Coca Law 1008 and the alternative development program with the desired result being that farmers would be more receptive to reduce their coca and plant alternative crops. This was the first time the law had ever been interpreted to the farmers. The planting of alternative crops and coca reduction in several of these *centrales* did increase after the seminars. That farmers were now aware of the fact that planting new coca was illegal and of the opportunities presented by the alternative development program may have influenced the farmer to plant more alternative crops.

- Fluctuations in coca prices With coca experiencing constant fluctuations in prices, the farmers have lost confidence in the economic benefits of coca production and looked towards alternative cash crops for income.

- High labor costs With high coca prices, labor was available and the farmers were able to plant coca plots in excess of one hectare. When coca prices dropped, labor become unavailable and farmers found it impossible to manage large coca plantations. This brought about two changes:

    1. The farmer reduced his coca to a small enough area that could be adequately managed by his family.

    2. The farmer adopted crops that were less labor intensive but that also had income-generating potential.

- Desire to diversify Farmers participating in the IMIS survey stated that they had planted alternative crops out of curiosity and the hope that they could turn out to be cash crops.

- Introduction of new crops and improved traditional varieties The introduction of new crops gave the farmer a larger selection of crops to plant than what had been available before the program began.

- Availability of technical assistance for farmers The fact that farmers knew that technical assistance and training courses were available for planting alternative crops may have been the incentive needed for changing the farm enterprise mix. Over the years, IBTA has given training courses on alternative crops and animal production to more than 10,000 farmers.

- Credit Credit was made available for the planting of alternative crops.

- Roads Once roads were improved, the farmers tended to plant new crops because of the possibility of transporting them to market.

- Larger markets A larger consumer market has opened up in recent years and this has motivated farmers to plant alternative crops.

- Future Infrastructure and Markets Many farmers noted that their farm strategies were based on the impression that future markets would be developed by the donor agencies. Some farmers expressed disappointment in the project's failure to deliver infrastructure improvements, which resulted in crops being lost due to the inability to transport them to market.

Quantities of Crops and Animals per Central

Tables 6 and 7 on pages 28 and 29 summarize the quantities of major commercial crops and of other alternative crops and animals respectively that can be found in each *central.* While Table 5 allowed a comparison across *centrales* that discounted the size of each *central,* Tables 6 and 7 provide a comparison based on sheer number of crops. Furthermore, Table 6 converts the numbers of the four major crops - oranges, mandarins, bananas and pineapple - into their **equivalent** hectares. These numbers were calculated with the following rationale.

Although most project personnel prefer to think of the amount of crops in the Chapare in terms of hectares, it is not possible to simply survey crops in the Chapare on a surface area basis. Furthermore, small differences in plant spacings will cause significant differences in the number of plants contained in a hectare for some crops. It is a well-known fact that Chapare farmers often do not plant their crops in regular areas in evenly-spaced rows. This is due to both difficult terrain and poor farming practices. For this very reason, the survey methodology called for counting individual plants. However, many farmers do plant their crops regularly when possible, and this information was gathered by the survey, as well. All known plant spacings for each orange tree, mandarin tree and pineapple plants were averaged and then multiplied by the total number of plants to yield the equivalent number of hectares had they been planted regularly. It was not necessary to average the planting spaces for bananas, due to the uniformity of the banana plantings. The calculated number of hectares is more accurate than any number of hectares found through a survey of areas under cultivation. The plant spacings used to calculate hectares of crops and their standard deviations are found on the following page in Table 4.

Note that although the standard deviations of the average area per plant is small for citrus, it is very large for pineapple. This is yet more evidence that the contents of a

Table 4. Average Crop Spacings in Meters

	Oranges	Mandarins	Banana	Pineapple
Ave. Space Between Plants	5.36	5.40	5.00	0.48
Ave. Space Between Rows	5.90	5.83	5.00	0.70
Ave. Area per Plant	31.62	31.48	25.00	0.39
Area Std. Dev.	1.79	1.80	*	0.52

* Plant spacings not calculated from the IMIS database.

hectare - particularly for pineapple - can vary greatly. The IMIS survey regularly found pineapple planted with $0.10m^2$ or less per plant, and pineapple planted with $1.00m^2$ or more per plant. Furthermore, these numbers did not improve when broken down by variety. *criollo* pineapple averaged $0.32m^2$ (std. dev. = 0.39), Cayena Lisa averaged $0.35m^2$ (std. dev. = 0.56) and Pucalpa $0.58m^2$ (std. dev. = 0.69). Apparently, there is some confusion regarding the proper spacing of pineapple.

Few surprises are contained in Tables 5, 6 and 7, although there are a number of interesting points to note. Subregions 1 and 3 are the self-proclaimed center of citrus production in the Chapare. As previously discussed, this area is typified by very fertile, alluvial soil and was one of the first areas to be colonized in the Chapare over thirty years ago. Table 5 shows the highest average number of orange trees (over 200) per farm in this area. However, Central Ivirgarzama in Subregion 6 has the next highest average at 156 trees. When oranges and mandarin are viewed together, Central Ivirgarzama has the second highest average number of citrus per farm of all the *centrales* surveyed. Furthermore, Table 6 shows that the total hectares of citrus is large in Ivirgarzama, more than in San Miguel and Ibuelo combined. As will be discussed in the following section, the trees in Ivirgarzama are younger than in the more established citrus areas and production is increasing at a higher rate. As a result, a second center for citrus production could be developing in that part of the Chapare.

The same area in Subregions 1 and 3 also is the major banana producing area. The fifteen farms sampled from Central Paraíso Todos Santos average over 13,000 banana plants per farm and collectively have 500 hectares of bananas. The second most productive *central* surveyed, Central Ibuelo, averages a little over 1,000 banana plants per farm and the 690 farms there collectively have 1,106 hectares of bananas. It is in this *central* that the project has recently built its second attempted banana packing facility. The first attempted facility was by Central Chimoré, which averages 487 banana plants per farm surveyed. In light of the project's difficulties encountered in exporting bananas from the Chapare, the locations of these packing plants appear questionable.

The two areas known for their pineapple production are the Centrales Mariposas and Eteramazama. However, the data shows that there are a number of *centrales* that are moving into the pineapple business, such as Centrales Bulo Bulo, 22 de Mayo and Villa

Nueva which are all in the same general area as Central Mariposas. Also, the field team observed that the many *centrales* located in Subregion 4 are taking advantage of the climatic differences between them and the above mentioned *centrales*. Because of the higher altitude and thus later pineapple season for some *centrales* in Subregion 4, the farmers there are able to command a higher price for their produce than the main pineapple producers.

The seven alternative crops which are also found in Tables 5 and 7 are crops which are present in the Chapare largely due to the efforts of the project. Annatto has traditionally been present in the Chapare, but has been encouraged by the project as a cash crop. Peach palm is also a common crop in the Chapare, but the project has been active in promoting improved varieties of this plant that ultimately can be used for hearts of palm, rather than for their fruit as the *criollo* variety is used. Black pepper, coconut and macadamia are present in the Chapare strictly because of the project. Passion fruit (maracuyá) is a crop that has been successfully marketed in regional Bolivian markets by the project. Mainly low levels of these crops have been planted to date, but it appears that there is wide-spread experimentation with all of them.

The presence of rice and domestic animals in every *central* suggest another important point about agricultural development in the Chapare. In almost every *central* the average hectares of rice and number of chicken per farm suggests that farmers are producing food on their farms to support their families. This is an important trend in that in previous years, farmers grew their coca for cash and then bought their food supplies elsewhere. Producing the family's food on the farm is considered a hallmark of becoming a serious farmer. Thus, this data reinforces the hypothesis that many individuals who originally came to the Chapare to farm coca are now becoming true farmers with diversified crops.

Exhibit 1. Report: "Typical Farms for a Central"

CORDEP IMIS Farm Report
Typical Farms for a Central - Sep/25/1993

Central: ETERAMAZAMA

Number of farms surveyed	521	
Total number of hectares surveyed	3857	
Number of male farmers	427	81.96 %
Number of female farmers	94	18.04 %
Number of farms with known area	515	98.85 %
Average area of farm in hectares	7.49	
Average number of years on farm	13.4	

	No			Yes			Unknown		
	#	[Ha]	%	#	[Ha]	%	#	[Ha]	%
Is farm titled?	33	183	6.3	477	3634	91.6	5	40	1.0
Is farmer owner?	62	485	11.9	438	3264	84.1	15	108	2.9
Farmer occupied?	63	437	12.1	444	3363	85.2	8	57	1.5
Farm another farm?	318		61.0	68		13.1	135		25.9

Crop	Variety	Ave/Central Number	Ave/Central [Ha]	Ave/Farm Number	Ave/Farm [Ha]	Surveyed Number	Surveyed [Ha]
ANNATTO	IMPROVED	.03	.00	15.00	.00	15	.0
ANNATTO	UNIMPROVED	.44	.00	13.47	.00	229	.0
ANNATTO	UNKNOWN	.01	.00	4.00	.00	4	.0
AVOCADO	MANTEQUILLA	.00	.00	1.00	.00	1	.0
AVOCADO	UNIMPROVED	6.72	.00	28.00	.00	3500	.1
AVOCADO	UNKNOWN	.23	.00	15.00	.00	120	.0
BANANA	DULCE CAJITA	.79	.00	37.27	.00	410	.0
BANANA	GROS MICHEL	.04	.00	20.00	.00	20	.0
BANANA	GUAYAQUIL	2.16	.00	375.33	.33	1126	1.0
BANANA	GUINEO	2.09	.01	68.19	.21	1091	3.3
BANANA	ISLA BLANCA	.65	.00	56.67	.11	340	.7
BANANA	ISLA MORADA	2.20	.00	76.33	.07	1145	1.0
BANANA	LACATAN	1.34	.00	350.00	.00	700	.0
BANANA	MOCATAQUI	25.79	.01	279.90	.05	13435	2.6
BANANA	UNIMPROVED	5.65	.00	133.86	.07	2945	1.5
BANANA	UNKNOWN	3.65	.00	105.78	.02	1904	.4
BEANS	CARIOCA	.00	.00	.00	.08	0	.1
BRACHIARIA	DECUMBRES	.00	.00	.00	.91	0	1.8
BRACHIARIA	UNKNOWN	.00	.01	.00	.75	0	3.0
BRAZILIAN APPLE	UNIMPROVED	.17	.00	4.94	.00	89	.0
BRAZILIAN APPLE	UNKNOWN	.01	.00	2.00	.00	4	.0
CALABASH	UNIMPROVED	.13	.00	3.88	.00	66	.0
CALABASH	UNKNOWN	.01	.00	3.00	.00	6	.0
CARPET GRASS	UNIMPROVED	.00	.00	.00	.75	0	1.5
CASSAVA/ MANIOC	AMARILLA-MBOL 4 O 7	1.54	.00	266.67	.16	800	.5
CASSAVA/ MANIOC	BLANCA ROSADA	53.30	.01	631.14	.14	27770	6.0
CASSAVA/ MANIOC	BOBORE	10.36	.00	600.00	.18	5400	1.6
CASSAVA/ MANIOC	BONET	.00	.00	.00	.50	0	.5
CASSAVA/ MANIOC	ERUCENA	3.07	.00	1600.00	.00	1600	.0
CASSAVA/ MANIOC	MORADA	3.84	.01	64.52	.21	2000	6.4
CASSAVA/ MANIOC	NOVENTON	.00	.00	.00	.27	0	.8
CASSAVA/ MANIOC	SUELAKHARA	137.24	.02	1254.39	.20	71500	11.3
CASSAVA/ MANIOC	UNIMPROVED	405.87	.04	2114.60	.23	211460	23.1
CASSAVA/ MANIOC	UNKNOWN	1.54	.00	50.00	.14	800	2.3
CHERIMOYA	ANONA DEDOS PENTADOS	.02	.00	10.00	.00	10	.0
CHERIMOYA	UNIMPROVED	2.35	.00	10.19	.00	1223	.0
CHERIMOYA	UNKNOWN	.12	.00	6.78	.00	61	.0
COCOA	UNIMPROVED	.00	.00	1.00	.00	1	.0
COCONA	UNIMPROVED	.03	.00	15.00	.00	15	.0

Table 5. "Typical Farm" Report Summary: 1992 - 1993 Average Crops and Animals per Farm by Central

	Subregion	Oranges	Mandarins	Banana	Pineapple	Annatto	Black Pepper	Coconut	Macadamia	Passion Fruit	Peach Palm	Soursop	Rice	Pasture ***	Cows	Pigs	Chickens
		Average Number of Plants											Hectares		Animals		
San Miguel	1	266.9	90.9	1,057.9	33.5	1.76	0.00	1.66	1.62	0.33	1.80	2.57	0.14	0.01	0.16	1.08	10.65
Paraiso *	1	203.0	54.7	13,350.4	0.0	0.00	0.00	0.00	0.00	0.00	3.07	0.00	0.64	0.00	0.00	0.00	0.00
Ibuelo	3	101.7	32.6	641.1	152.4	2.09	0.00	0.20	0.06	1.23	4.95	0.10	0.30	0.01	0.17	0.54	12.99
German Busch *	3	291.0	53.4	48.4	3,718.0	24.68	0.00	0.03	0.00	0.08	6.86	0.00	0.44	0.08	0.44	0.80	11.01
Chimoré **	3	122.2	60.9	486.6	798.6	3.80	0.00	0.00	0.01	0.00	2.62	0.00	0.91	0.48	1.06	1.20	9.99
Independiente	4	19.9	18.9	24.0	60.0	2.08	0.00	0.01	0.00	0.16	0.52	0.00	0.27	0.00	0.00	0.06	3.10
Eteramazama	4	68.5	24.4	44.4	4,072.0	0.48	0.00	0.07	1.80	4.80	7.19	0.37	0.34	0.01	0.51	1.47	17.37
Agraria La Union	4	42.1	31.2	57.4	284.9	2.09	3.07	1.79	0.23	0.61	30.01	0.69	0.00	0.00	0.01	0.21	5.69
Bolivar	4	75.7	34.1	87.2	472.5	1.07	0.01	0.50	0.05	0.44	4.34	0.00	0.48	0.00	0.05	0.42	9.31
San Gabriel	4	43.3	44.1	104.2	743.6	5.18	1.00	0.12	0.06	0.49	1.56	0.01	0.48	0.00	0.01	0.38	9.05
Gran Chaco *	4	18.0	12.0	25.0	500.7	0.60	0.00	0.00	0.00	0.00	0.60	0.00	0.22	0.00	0.00	0.00	0.00
Isinuta	4	53.2	34.1	56.1	601.9	2.96	0.08	0.02	0.23	0.91	3.25	0.11	0.35	0.00	0.04	0.55	14.35
Isiboro	8	138.2	65.0	232.1	587.7	20.44	0.00	0.13	0.00	0.00	2.95	0.36	0.46	0.00	0.20	0.96	21.63
Espiritu Santo	5	33.3	78.0	65.4	218.7	2.87	0.01	0.19	0.49	0.01	12.13	0.00	0.04	0.00	0.01	0.12	5.08
Jatun Pampa	5	19.6	48.5	117.7	290.0	5.99	0.32	2.41	0.81	0.13	17.70	0.57	0.10	0.00	0.00	0.11	5.14
Villa Nueva	2	107.4	60.8	18.0	1,627.3	5.69	2.37	5.01	2.13	0.00	10.93	0.49	0.32	0.17	1.25	0.33	10.61
Mariposas	6	14.2	19.0	26.3	22,209.0	0.86	0.00	0.00	0.00	7.26	0.29	0.00	0.56	0.09	0.22	0.84	15.10
Ivirgarzama **	6	155.9	122.2	173.5	609.8	3.17	0.01	0.71	0.31	16.43	1.45	0.12	0.98	0.81	1.30	0.67	11.80
22 de Mayo	7	59.0	42.6	19.4	2,077.9	0.08	0.00	0.10	0.00	0.00	3.37	0.00	1.06	1.28	2.62	0.48	15.00
Bulo Bulo	7	43.3	44.7	31.2	3,680.0	1.10	0.00	0.00	0.00	0.06	3.25	0.00	1.33	7.32	6.70	0.96	11.57

* Only samples collected (see report). Numbers do not reflect true central average.

** Less than 60% of central participation (see report). Numbers do not reflect true central average.

*** Established pasture using both native grasses and improved forages.

9/93

Table 6. "Typical Farm" Report Summary: 1992 - 1993 Quantities of Commercial Crops by Central and Equivalent Hectares***

		Oranges		Mandarins		Banana		Pineapple	
	Subregion	Total Trees	Equiv. Hectares	Total Trees	Equiv. Hectares	Total Trees	Equiv. Hectares	Total Plants	Equiv. Hectares
San Miguel	1	85,948	264.7	29,279	89.0	340,628	851.6	10,790	0.4
Paraiso *	1	3,045	9.4	821	2.5	200,256	500.6	0	0.0
Ibuelo	3	70,194	216.2	22,515	68.4	442,387	1,106.0	105,177	4.1
German Busch *	3	11,639	35.8	2,135	6.5	1,938	4.8	148,720	5.8
Chimoré **	3	22,613	69.6	11,268	34.3	90,015	225.0	147,743	5.8
Independiente	4	12,544	38.6	11,920	36.2	15,125	37.8	37,860	1.5
Eteramazama	4	35,699	110.0	12,707	38.6	23,112	57.8	2,121,533	82.7
Agraria La Union	4	13,427	41.4	9,940	30.2	18,301	45.8	90,896	3.5
Bolivar	4	33,678	103.7	15,157	46.1	38,782	97.0	210,254	8.2
San Gabriel	4	28,045	86.4	28,551	86.8	67,528	168.8	481,872	18.8
Gran Chaco *	4	630	1.9	421	1.3	875	2.2	17,524	0.7
Isinuta	4	38,790	119.5	24,852	75.5	40,860	102.2	438,785	17.1
Isiboro	8	27,642	85.1	12,996	39.5	46,426	116.1	117,530	4.6
Espiritu Santo	5	12,513	38.5	29,309	89.1	24,575	61.4	82,220	3.2
Jatun Pampa	5	4,153	12.8	10,290	31.3	24,957	62.4	61,484	2.4
Villa Nueva	2	22,758	70.1	12,881	39.2	3,816	9.5	344,985	13.5
Mariposas	6	3,817	11.8	5,119	15.6	7,085	17.7	5,974,210	233.0
Ivirgarzama **	6	127,822	393.7	100,204	304.6	142,278	355.7	499,995	19.5
22 de Mayo	7	23,525	72.5	17,001	51.7	7,729	19.3	829,094	32.3
Bulo Bulo	7	19,749	60.8	20,392	62.0	14,214	35.5	1,678,094	65.4

* Only samples collected (see report). Numbers do not reflect true central values.

** Less than 60% of central participation (see report). Numbers do not reflect true central values.

*** Calculated with the following average plant spacings: Oranges = 30.8 m2 Mandarins = 30.4 m2 Banana = 25.0 m2 Pineapple = 0.39 m2

9/93

Table 7. "Typical Farm" Report Summary: 1992 - 1993 Quantities of Alternative Crops and Animals by Central

	Subregion	Annatto	Black Pepper	Coconut	Macadamia	Passion Fruit	Peach Palm	Soursop	Rice	Pasture ***	Cows	Pigs	Chickens
		Number of Plants							Number of Hectares		Number of Animals		
San Miguel	1	567	0	535	522	106	580	828	45.1	3.2	52	348	3,429
Paraiso *	1	0	0	0	0	0	46	0	9.6	0.0	0	0	0
Ibuelo	3	1,442	0	138	41	849	3,416	69	207.0	6.9	117	373	8,963
German Busch *	3	987	0	1	0	3	274	0	17.6	3.2	18	32	440
Chimoré **	3	703	0	0	2	0	485	0	168.4	88.8	196	222	1,848
Independiente	4	1,312	0	6	0	101	328	0	170.4	0.0	0	38	1,956
Eteramazama	4	250	0	36	938	2,501	3,746	193	177.1	5.2	266	766	9,050
Agraria La Union	4	667	979	571	73	195	9,573	220	0.0	0.0	3	64	1,815
Bolivar	4	476	4	223	22	196	1,931	0	213.6	0.0	22	187	0
San Gabriel	4	3,357	648	78	39	318	1,011	6	311.0	0.0	6	246	5,864
Gran Chaco *	4	21	0	0	0	0	21	0	7.7	0.0	0	0	0
Isinuta	4	2,158	58	7	168	663	2,369	80	255.2	0.0	29	401	10,461
Isiboro	8	4,088	0	26	0	0	590	72	92.0	0.0	40	192	4,326
Espiritu Santo	5	1,079	4	71	184	4	4,561	0	7.5	0.0	4	45	1,910
Jatun Pampa	5	1,270	68	511	172	28	3,752	121	21.2	0.0	0	23	1,090
Villa Nueva	2	1,206	502	1,062	452	0	2,317	104	67.8	36.0	265	70	2,249
Mariposas	6	231	0	0	0	1,953	78	0	150.6	24.2	59	226	4,062
Ivirgarzama **	6	2,599	8	582	254	13,473	1,189	98	803.6	664.2	1,066	549	9,676
22 de Mayo	7	32	0	40	0	0	1,345	0	422.9	510.7	1,045	192	5,985
Bulo Bulo	7	502	0	0	0	27	1,482	0	606.5	3,337.9	3,055	438	5,276

* Only samples collected (see report). Numbers do not reflect true central values.

** Less than 60% of central participation (see report). Numbers do not reflect true central values.

*** Established pasture using both *native grasses and improved forages.*

9/93

G. Historical Plantings and Forecasted Yields of Alternative Crops

When a crop is surveyed for the IMIS system, the actual number of plants by age is recorded, along with the date that the survey was taken. To calculate the historical planting of a crop, the system merely looks at the age of the plant and at the date on which it was surveyed and calculates the date on which the crop was planted. The system relies strictly on the ages of *existing* plants to report historical plantings. This methodology has a limited historical viewpoint when used with crops with a short productive life span, such as pineapple or annual crops. However, it is excellent for crops with a long life span, as most of the major Chapare crops are. The only other means of obtaining historical planting data in the Chapare is from farmers' memories, who do not keep written records of their farm's activities. Unfortunately, experience has proven this data to be highly unreliable.

The history of crop planting in the Chapare is significant in that it can reveal clues to the possible effects that the CORDEP project has had on the agriculture of this region since its initiation in 1983. Of course, the mere existence of alternative crops does not establish cause and effect with the project. However, one function of the project has been the introduction and distribution of improved varieties and new crops by IBTA. One can assume in the cases where improved varieties and new crops appear that the project has had *some positive impact*. Conversely, some historical data, particularly for citrus which has a long life span, may demonstrate some planting trends and introduction of new crops and varieties prior to 1983, suggesting that not *all* of the developments in agricultural production in the Chapare are due to the CORDEP project.

From the ages of the plants surveyed, production estimates are also calculated. Using a twelve year horizon which begins with the year in which the plants were first planted, the IMIS stores the average yield and standard deviation of a crop at each age. These twelve data points form the yield curve that is used to estimate future production. Estimation of metric ton equivalents is then accomplished using conversion factors supplied by IBTA, which are found in Table 10 on page 43. This data was obtained from IBTA's technicians and from reports published by various consultants who have worked on the project in recent years.

It is important to point out that the user can change the value of any yield estimate or its standard deviation *at any time* and that it is possible to create a separate curve for any given syndicate in the system. This allows for the possibility of adjusting for variances in climate or soil conditions throughout the Chapare. In the same way, it is possible to change the metric ton equivalents at any time. Once the assumptions have been modified, all that needs to be done to obtain new projections is to run the reports. The reports produce the expected yields expressed in the unit of measure appropriate for each crop and also in metric tons. The standard deviations are also presented for these two figures.

The IMIS system then uses a "zero-syndicate" methodology to calculate production curves. It is possible to enter a yield curve for any variety of any crop for any syndicate. However, for each variety of each crop, there also exists a "zero-syndicate" curve that is not associated with any syndicate. This is the default curve for each crop and variety, and can be considered a yield curve generalized to the entire Chapare. When the system

is asked to run a crop's yield curve for a farm, syndicate or *central*, it first looks to see in what syndicates the crop is found. The system then finds the yield curves for that crop and for those syndicates. For any syndicate that does not have a specific yield curve associated with it, the system then uses the default "zero-syndicate" curve.

At the time that crop data was collected for the system, the only crop yield information that ARD/Cochabamba could supply to TMG was for 30 of the 119 crops identified in the IMIS system. Furthermore, this data was expressed in general ranges. For example, according to this data the Valencia Tardía variety of oranges produce between 500 and 1500 units, begin production between 3 to 4 years of age, and then produce for 20 to 30 years. This data is too vague and is essentially useless to the IMIS. Consequently, for the purpose of this report, the IMIS system used the yield curves found in Table 10 as the "zero_syndicate" curves for the four major crops that provide an average yield plus standard deviation for the first 12 years of the crop's life. These curves were provided by the team's agronomist based on eight years of field experience in the Chapare.

The IMIS system can forecast future production for a farm, syndicate or *central* using four different assumptions:

1. No new plants The calculation assumes that no new plantings will take place in the future and that production will come entirely from plants currently in the ground.

2. Minimal plantings The calculation assumes that new plants will be added to the farms at the *minimum* non-zero rate that was observed during the last 12 years for the designated farm, syndicate or *central.*

3. Medium level plantings The calculation assumes that new plants will be added to the farms at the *average* non-zero rate that was observed during the last 12 years for the designated farm, syndicate or *central.*

4. Maximum plantings The calculation assumes that new plants will be added to the farms at the *maximum* non-zero rate that was observed during the last 12 years for the designated farm, syndicate or *central.*

Production was forecasted for the four major crops and an example of a production report can be found in Exhibit 2 on page 44. Exhibit 3 on the following page shows an example of a historical plantings report. Tables 11, 12 13 and 14 summarize the production information for the years 1993 through 1996 on pages 46 through 50. For citrus and bananas, the first assumption of "No New Plants" was used. However, because of the short production life of the pineapple, a planting level had to be assumed in order to be able to forecast through the year 1996. The last option, "Maximum Plantings" was used, because this most closely approximates the true planting rate of pineapple in the Chapare, which has been increasing with each year.

In the following sections, citrus, pineapples and bananas in the Chapare are examined. Their historical plantings and their forecasted production are discussed in relation to each other, as the latter is a direct result of the former.

Citrus

Due to their long life span and to their wide spread cultivation, citrus are particularly useful in portraying historical plantings in the Chapare. A summarization of expected citrus production by *central* for *criollo* and improved variety oranges is contained in Tables 11 and 12, found on pages 46 and 47. The following graphs for oranges, which are found at the end of this section starting with page 51, demonstrate types of planting patterns commonly seen in the Chapare for many crops. Graph 1 shows the planting history of *criollo* and improved varieties in San Miguel, an old and established citrus producing *central* colonized over thirty years ago. As can be seen, a full fifty percent of the orange trees present in San Miguel were planted prior to 1981. Since 1986, the number of new trees planted each year has enjoyed a slow but steady increase, with the ratio of *criollo* to improved variety oranges shifting in favor of the improved varieties. This is smart strategy to follow, as the improved varieties not only begin producing oranges in half the time of *criollo* trees (four versus eight years), but the produce commands a higher price in the market. The large **number of trees** in this *central* combined with a slowly increasing **rate of new trees planted** ensures that this *central* will continue to be a major producer of oranges. This is reflected in Graph 2, which shows orange production for Central San Miguel.

Graph 3 shows the planting history of *criollo* and improved varieties in Central Ivirgarzama. The planting profile of this *central* is very different. This is another area that has been colonized for a relatively long period of time. One sees that almost 20,000 of the trees existing today in Ivirgarzama were planted prior to 1981. However, the farmers in this area have been aggressively planting new trees since that time, many of which have not yet begun to produce. The trees planted prior to 1981 represent only fifteen percent of the trees existing at the time of the survey. The fact that this *central* has both a very large number of trees and a **very high** rate of new trees planted each years means that this *central* will be contributing an increasing percentage of the overall orange production in the Chapare.

This is evident in a comparison of Graph 4 showing production of oranges for Ivirgarzama and of Graph 2 for San Miguel. The curves of these graphs are very different. Graph 5 shows the planting history of improved variety oranges by variety for the same *central*, Ivirgarzama. This graph is significant in that it shows the presence of improved varieties of oranges in the Chapare prior to the initiation of the project, and reinforces the idea that this *central* has historically been active in citrus. This is also evidence that the presence of improved varieties in the Chapare today can not be attributed entirely to the project. However, there is no doubt that the adoption and proliferation of these varieties was encouraged by the project.

Central Bolivar is an example of the many newly colonized and developing areas. Graph 6 shows that this *central*, as have many *centrales*, has steadily planted a small number of orange trees each year over time. This planting pattern will ensure a steady but meager contribution to the orange market because of the small number of trees and little increase in the number of new trees planted each year. Graph 7 of Bolivar's production shows that the large number of trees planted in 1987 will have an effect on production between the period of 1993 and 1996 as those trees reach their maximum production. Note that almost none of the trees in this area are of the improved varieties. Areas such as San

Gabriel are not only isolated by their very poor infrastructure, but their poverty also denies them access to the necessary genetic materials. This is a common problem for many communities that lie far from the main roads.

Central Bulo Bulo is a *central* that is not traditionally an orange producing area, since their flat farms are located in areas with more open grassland give them an advantage in cattle and rice. However, as Graph 8 clearly demonstrates, this *central* is representative of those areas that have been actively trying to enter the orange market. Their increase in new plantings is high, ensuring an ever larger amount of production. However, Graph 9 shows that although a comparable number of plants are now being planted each year in Bulo Bulo as in San Miguel and Ivirgarzama, the fact that this area does not have older plants currently in production means that it will be a while before this *central* is making significant contributions to the orange market. However, it is clearly only a matter of time before it, and many other *centrales* like it, do.

The trends that describe oranges are also appropriate to mandarins, although mandarins appear to be a crop that is more evenly distributed than any other crop, as the Typical Farm Report demonstrates. As such, only one example is given here, demonstrated in Graph 10 which is again located at the end of this section. Of the *centrales* surveyed, Central Espíritu Santo is one of the larger producers of mandarin, although not of oranges. Graph 10, with the historical plantings in Espíritu Santo, shows that much of this *central*'s success portrayed in Graph 11, is due to a relatively large number of mature trees planted prior to 1981. However, little use is being made of improved varieties, for the same reasons of isolation and lack of funds preventing farmers from obtaining the needed genetic material.

Thus, two factors determine the amount of citrus that the *centrales* surveyed are producing now and will produce in the future. First, is the number of trees that currently exist in the ground. Centrales San Miguel and Ivirgarzama are both *centrales* with large numbers of trees. Secondly, the rate at which a *central* is planting new trees has a significant influence not so much on current production, but on future production. The Centrales Ivirgarzama and Bulo Bulo were examples of *centrales* that have been planting new trees at a very high rate.

As can be seen in Tables 11 and 12, pages 46 and 47, production from the trees which currently exist will be increasing at a high rate over the next decade. This is largely due to the long length of time it takes for these trees to reach their maximum production rate - eight to ten years. While the average rate of increased production in Tables 11 and 12 seem to be in the neighborhood of eleven percent per year, the actual rates of increase are much more varied. First, citrus production is increasing much more rapidly in the newly colonized areas of the Chapare, averaging a 36.8% increase from 1993 to 1994, compared to the more established areas in Subregions 1 and 3, which average an increase of 4.5% in the same year. Also, the overall increase in production of improved variety citrus averaged 78% for 1994.

There have been a number of estimates made over the years of the numbers of hectares of citrus planted and the metric tons of fruit that is being produced. TMG had access to the data currently being used by IBTA, and to data published in 1990 and 1991. The CORDEP implementing contractor, Development Alternatives, Inc. (DAI), has also been

Table 8. Estimated Citrus Yields, Area and Production from Other Sources

Crop	Year	Ha.	Yield	Production
Oranges	1987[1]	2,878	12 MT/Ha.	34,400 MT
	1990[1]	5,250	25 MT/Ha.	131,250 MT
	? [2]	5,000	2 - 300,000 fr/HA 500 - 1500 fr/tree	1 - 1.5 billion fruit
	1995[2]	6,000	2 - 300,000 fr/HA 500 - 1500 fr/tree	1.2 - 1.8 billion fruit
Mandarins	1990[1]	1,750	1,750 MT/Ha.	36,750 MT
	? [2]	3,000	500 - 7,000 fr/tree	0.3 - 5.7 billion fruit
	1995[2]	3,000	500 - 7,000 fr/tree	0.3 - 5.7 billion fruit

collecting data over the last two years, but that data was not available to TMG. Table 8 summarizes estimates of total hectares of oranges and mandarins from these sources. Although the results of the 20 *centrales* in the IMIS survey cannot be directly compared with these Chapare-wide estimations, a number of very interesting and pertinent conclusions can be drawn through an indirect comparison.

A fundamental problem with the data above is that each item is an estimate based on a series of other estimates. The raw data from which these estimates were derived is unknown. However, it is apparent that estimations of the number of hectares of citrus and their yields were based on observations of actual hectares of citrus planted in the Chapare. As previously explained, the number of actual hectares planted is a relatively meaningless number when farmers plant their trees in such disparate manners. It is important to stress that the hectares of citrus reported in Table 5 are *equivalent* hectares, based on the number of trees present and the average plant spacings, representing how many hectares there would be if Chapare farmers planted their crops in a regular fashion. Secondly, few Chapare farmers have an entire hectare of citrus of the same variety and same age, factors which have a *significant* effect on production. For example, according to IBTA material, some mandarin varieties produce between 500 and 1500 fruit per year, while the Cleopatra variety reportedly produces between 3000 and 7000 fruit. Also, a young tree in production provides less fruit than a mature tree. Therefore, any hectare of citrus observed in the field is most likely composed of more than one variety and more than one age. Problems associated with these assumptions are expressed in project documents:

> "The citrus sector of the Chapare has been extensively studied over the last decade and a number of estimates exist as to current yields and production. Unfortunately, these data are frequently contradictory, even in some cases when derived from the same source. Yield estimates vary between 12 and 25 MT/Ha.

[1] *Bolivia Agroindustrial Marketing Systems Study*, Aidan Gulliver and Miguel Jimenez, University of Idaho, October 1990 for USAID Agricultural Marketing Improvement Strategies Project, pages 22 - 25. Also in *Consultancy Report on "Crop Profile, Chapare Region of Bolivia"*, Merritt J. Taylor, July 16 - August 22, 1991 for USAID CORDEP, pages 8 - 13.

[2] From the current IBTA data base, original date unknown.

and areas in production between 2,500 and 5,250 Hectares. The result is a range of total production estimates extending from 34,000 Mt to over 130,000 Mt. annually..."[1]

However, the IMIS data has great explanatory power in interpreting the above estimations. What the historical planting data shows is that, throughout the history of the CORDEP project, citrus have been continuously planted over the years. Thus, the orange trees in a farmer's hectare that produced 16 metric tons in 1987 will be three years older in 1990. Some trees will be producing more in 1990 than they did in 1987. Some trees that had not begun to produce in 1987 will be producing in 1990. Few citrus trees in the Chapare are so old that they would be reaching the end of their thirty-year life span by 1990. Thus, it is quite conceivable that this farmer's hectare that produced 16 metric tons of fruit in 1987 will be producing 25 metric tons in 1990.

Additionally, the fact that the hectares under cultivation are *continuously increasing* is completely missing from the older documentation. The IMIS data shows that for all farms surveyed, 691 hectares of citrus had been planted prior to 1987, and 1,411 hectares by 1990, a 104 percent increase in hectares under cultivation. The different hectare estimations between the IBTA 1987 study and 1990 study which were the source of confusion in the project documents show a similar, although slightly lower, increase of 82 percent.

The current IBTA data reflects this reality, although it appears that the rate of increase has been underestimated. IBTA reported approximately 5,000 hectares of citrus planted (presumably around 1990) and estimated 6,000 hectares by the year 1995, an increase of 20 percent over five years, or less than four percent per year. Table 9 on the following page presents the historical planting of *criollo* and improved variety oranges for the 7535 farms surveyed during the IMIS project. This table shows that since 1985, an average of 112 new hectares of orange trees have been planted each year. By way of crude comparison, one can assume that the 7535 farms surveyed represent one-quarter of the Chapare; this implies an approximate 450 new hectares of oranges each year, Chapare-wide. The IBTA estimate implies an increase of 200 new hectares a year, Chapare-wide. In addition to this, Table 9 shows that an increasing percentage of the oranges being planted are improved varieties - thirty-five percent in 1992. Because these trees begin to produce in half the time as the *criollo* variety and when mature produce more, the rate of increase in production will be even greater than the rate of increase in cultivated area.

A similar scenario exists for mandarins. The IBTA estimates of hectares under cultivation range from a minimum of 1,750 hectares in 1990 to a maximum 3,000 hectares in 1995. However, the sum of the equivalent hectares of mandarins surveyed in the IMIS project alone that were planted prior to 1993, is 1,148 hectares. Given that mandarins are the one crop most universally cultivated and evenly distributed in the Chapare, it appears safe to say that the total number of hectares in the Chapare implied by the IMIS survey exceeds all previous estimates. Again, for the purpose of providing a rough comparison, multiplying the 1,148 hectares by four yields a possible 4,592 hectares. And,

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[1] 1990, University of Idaho report. Also in the 1991 Taylor report.

Table 9. Equivalent Hectares* of Oranges Planted Each Year by Surveyed Farms

Year	*Criollo* Trees	Improved Trees	*Criollo* Hectares	Improved Hectares	Total Hectares	Percent Improved
1992	22,511	12,314	69.33	37.93	107.26	35.4%
1991	28,067	5,914	86.45	18.22	104.66	17.4%
1990	53,713	8,117	165.44	25.00	190.44	13.1%
1989	32,848	859	101.17	2.65	103.82	2.6%
1988	31,189	523	96.06	1.61	97.67	1.7%
1987	26,536	733	81.73	2.26	83.99	2.7%
1986	39,343	636	121.18	1.96	123.14	1.6%
1985	55,306	246	170.34	0.76	171.10	0.4%
1984	18,744	25	57.73	0.08	57.81	0.1%
1983	79,976	264	246.33	0.81	247.14	0.3%
1982	14,338	13	44.16	0.04	44.20	0.1%
1981	15,025	427	46.28	1.32	47.59	2.8%
<1981	140,910	261	434.00	0.80	434.81	0.2%
????	5,403	617	16.64	1.90	18.54	10.3%
	TOTALS		**1,737**	**95**	**1,832**	**5.2%**

* Hectares calculated from the number of trees and average plant spacing of 30.8 m^2.

as Table 12 implies, the rate of increase in production over the next four years for mandarins is even greater than it is for oranges.

In summary, although the estimates for citrus production quoted in this report from project material appeared to be plagued with problems, the trends in these estimates appear to be *supported and further explained* by the data collected for the IMIS. These include, firstly, that an average Chapare hectare of citrus is becoming increasingly productive as the composition of those trees move from young, *criollo* trees to mature *criollo* and young improved varieties. Furthermore, it can be expected that citrus will be increasingly dominated by the improved varieties over time. Secondly, the total number of hectares cultivated with citrus is not only increasing yearly, but at a rate higher than previously suspected, particularly for improved variety citrus. It appears that in this respect, the project has been more successful than it knew.

Lastly, it must be emphasized that the yearly increase in production is large, and that production will continue to increase for many years into the future. The tables and figures included in this report were created based only on the trees *that existed at the time of the survey*, whereas in truth farmers are continuing to plant new trees. Therefore the fact that improved variety citrus begin to produce with four years of age means that all production estimates from 1996 on are underestimated - perhaps greatly underestimated if improved variety citrus continue to be planted at recent levels.

Pineapples

Due to the short productive life of the pineapple plant (two to three years if done properly), no graphs of historical data have been provided for this crop. It must be said however, that the field team found through observation that this is one crop that is

without a doubt being planted in increasing amounts all over the Chapare. This has brought as a result the much complained-about effect of falling prices. However, the effect of lower prices to date has been to increase the regional markets for pineapple within Bolivia as the fruit becomes more affordable. While consumers have benefitted from this, as have some farmers, it has created problems for other farmers caught off-guard, particularly in a *central* such as Mariposas where many farmers only cultivate pineapple. This is a standard problem associated with monocropping. Another problem associated with pineapple in the Chapare is the spread of disease. Although the extent of this threat is yet unknown, it was noted that in the data collected by this survey that some pineapple nurseries are losing large quantities of suckers to disease, specifically fusarium.

Graphs 12 and 13 on pages 62 and 63 show production curves for pineapple in Centrales Mariposas and Eteramazama, the main pineapple regions. Note that Mariposas cultivates almost no *criollo* variety pineapple. Because of the short production life of pineapple, all production estimates presented here were made with the reasonable assumption that the Chapare farmers will continue to plant pineapple at high rates. Graphs 14 and 15 of Centrales San Gabriel and Villa Nueva demonstrate the production curves of *centrales* trying to enter the pineapple market. The increase in production is drastically higher in these new areas, which helps explain why the price of pineapple has been falling in the Chapare over the last few years. However, note in Graph 14 that the percentage of *criollo* variety pineapple in San Gabriel is much higher. Access to improved variety genetic material is still difficult for some. Table 13 on pages 48 and 48 summarizes pineapple production figures for all of the *centrales* surveyed.

The 1990 University of Idaho report contains an estimate of Cayena Lisa pineapple in 1987 of 245 hectares and 80 hectares of Morada (Pucalpa) pineapple in 1990. However, this report and the following Taylor report in 1991 refer to drastic changes in pineapple cultivation in the Chapare, making it difficult to compare results from the IMIS survey to historical estimates. A total of 13,398,766 pineapple plants were counted during the IMIS survey of 7535 farms. When multiplied by the average pineapple plant spacing of 0.39 square meters, this is equal to 553 hectares of pineapple. Cayena Lisa account for 110 of these hectares, and Pucalpa for 349 hectares.

One finding of interest from the survey is that the pineapple planting practices often differ significantly from what IBTA considers to be correct. For example, according to the IBTA database, Cayena Lisa is to be planted with an average of 0.15 to 0.24 square meters of space between plants. Pucalpa should be planted at 0.35 square meters. However, the IMIS survey found that the average area per Cayena Lisa pineapple plant was $0.35m^2$ with a standard deviation of $\mathbf{0.39m^2}$ and for Pucalpa, the average was $0.58m^2$ with a standard deviation of $\mathbf{0.69m^2}$. The significance of these standard deviations are that plant spacings for pineapple vary wildly. The implication is that this is an area that may require the attention of the IBTA extentionists. As a result of these disparities in plant spacings, it may be difficult to compare hectares of pineapple with previous estimates if those estimates assumed the higher planting densities. For example, if the 2,666,354 Cayena Lisa plants counted in the IMIS survey were multiplied by an assumed 0.24 square meter plant spacing, this would yield 64 hectares of Cayena Lisa, only half of what was calculated above.

If this 64 hectares is multiplied by another assumption - that a representative quarter of the Chapare was surveyed - this produces a total of 256 hectares of Cayana Lisa. When the same assumptions are made for the 8,454,621 Pucalpa pineapple surveyed, (using the recommended 0.35 square meter plant spacing), 296 hectares were surveyed, for a Chapare total of 1,184 hectares of Pucalpa. It must quickly be pointed out that this method for providing an off-the-cuff estimate for the total Chapare is probably the least accurate for this specific crop, pineapple. Central Mariposas cultivates so much more pineapple than any other *central*; it is unlikely that there are another three areas not surveyed but that present the same characteristics as Central Mariposas. Therefore, the above estimated numbers for the whole Chapare are most likely overestimated.

As stated before, the documents available to TMG do not contain estimates of pineapple with which to make any meaningful comparisons. Undoubtedly, DAI has some numbers concerning pineapple that would be of interest. One other point to note about the pineapple data is that the *criollo* pineapple accounted for only 10.6% of the pineapple surveyed, suggesting that the CORDEP project has been very successful in introducing the improved varieties into the Chapare.

Banana

There seems to be less data associated with bananas from project documents than the crops discussed above, although banana is regarded in these documents as the most important crop in the Chapare. Unfortunately, there are a number of conflicts between few numbers contained in project documents and the findings of the IMIS survey, and the lack of previous information makes it difficult to explain the disparities. For example, the 1991 Merritt Taylor consultancy report works with 19,750 as the number of hectares of Cavendish (7,075 Ha.) and Guineo (12,500 Ha.) bananas alone. These numbers were taken from studies made in 1987 and 1990 by U.N.-related institutions. These numbers are also reported in the 1990 University of Idaho paper. However, the Taylor report then suggests, without saying why, that there was a total of 10,000 hectares of bananas. No mention of specific varieties were made. The IBTA data made available to TMG did not include information on bananas. It is presumed that DAI, the consulting firm implementing CORDEP's banana program, has its own data collected on bananas, but these numbers were also not available to the TMG field team.

For the 7535 farms surveyed by the IMIS project, 3877 equivalent hectares of bananas were found. Seventy percent of these bananas are in Subregions 1 and 3, the traditional banana producing area of the Chapare. Only thirty percent of the total bananas surveyed were of some improved variety, meaning that only 1163 hectares of improved variety bananas were found. The IMIS findings suggest that the estimate of a total of 10,000 hectares of bananas in the Chapare, made in the 1990 report, may have been relatively accurate. However, the IMIS data cannot in any way support the U.N. estimates for Cavendish and Guineo bananas. These numbers would be possible only if there had been some great decline in the last three years of banana plants in the Chapare. However, the TMG field team never saw evidence of this possibility.

In light of the project's problems in successfully establishing a banana packing facility and exporting bananas from the Chapare, the question naturally arises as to whether accurate

estimates of hectares and production of bananas were used during the planning phases. Table 14 on page 50 shows the estimated production of bananas in the surveyed *centrales* for the years 1993 to 1996. These numbers remain constant over the years because bananas begin producing at a constant rate after one year, and no new plantings with minimum attrition was assumed. Note also that production estimates are broken down between *criollo* and improved varieties.

Of the *centrales* surveyed from Subregions 1 and 3, the second attempted banana packing facility has been placed in Central Ibuelo. Graphs 16 and 17 on pages 66 and 67 show the planting history and estimated production, respectively, of bananas in this *central*. Ibuelo averages 641 banana plants per farm; 23.8% of these plants are of improved varieties. Compare this with Central Paraíso, which averages 13,350 banana plants per farm, 13.7% of which are improved, and with Central San Miguel, which averages 1,058 plants per farm, 47.1% of which are improved.

An example of another type of banana production can be found in Central Isiboro, located in Isiboro National Park, which is surprisingly productive. Graphs 18 and 19 show historical planting and estimated production of bananas in this *central*. Central Isiboro is an example of a newly developing *central* which is rapidly increasing its quantities of bananas. However, this *central* is unique in a number of respects. First, this *central* is located in Subregion 8 in the Isiboro National Park and is incredibly isolated due to a complete lack of infrastructure in its vicinity and that it is located at the far end of the former "Red Zone", the road through which is also of poor quality. Despite this, Isiboro is not only rapidly increasing its stands of bananas, but is the only *central* to have more improved varieties than *criollo*, with the incredible ratio of 2.2 to 1, that they have been cultivating since 1984. Graphs 20 and 21 show the historical planting of improved varieties in Ibuelo and Isiboro, demonstrating the marked difference in planting strategies.

It is important to note that the predominant variety of banana in Isiboro is the Manzano Amarillo variety, which is currently in great demand in Santa Cruz and which fetches a higher price than many other varieties of bananas. The Manzano Amarillo is also produced in Subregions 1 and 3, the more traditional banana producing areas. However, these areas are unfortunately becoming infested with Panama disease, which strikes particularly at this variety. Although Isiboro's isolation has been a particular burden in the past, it could now become a boon in preventing this disease and others from spreading to Isiboro.

Other Alternative Crops

Graphs 22 through 27, starting on page 72, show the planting history of the six of the seven alternative crops discussed in the previous section. It is clear from these graphs that for most of these crops, the farmers are in an experimental stage. There are few plantings prior to 1988, demonstrating their relative novelty in the Chapare, with the exception of annatto. Graph 26 shows only the improved varieties of peach palm, which has been promoted by IBTA. The *criollo* variety of peach palm is traditional to the Chapare and is widely found. A graph for the planting history of passion fruit is not supplied because few plants were more than two years old. Table 7 on page 29 showed the actual quantities of each crop by *central*.

Factors inhibiting more farmers from adopting these crops include the high cost of genetic materials and lack of experience cultivating them. However, those farmers which were able to make the initial investment to obtain these crops are now beginning to recoup their investments by using their plants not for their fruits, but for producing genetic material to sell to other farmers. The graphs of the planting histories, along with the typical farm report tables show that, although these crops are present in the Chapare in small quantities, they are present in many areas, suggesting a wide spread interest in crop diversification.

Annatto: When the numbers of these crops found in the IMIS survey are compared with previously made estimates, the results are mixed. For example, although at least one annatto plant can be found on almost every farm through the Chapare, the 1990 Idaho report identifies only 1 known hectare of annatto, located at the La Jota experimental station, plus 20 hectares worth of improved genetic material for distribution. The 1991 Taylor report used an off-the-cuff estimation of about 3,000 annatto trees in the Chapare. The IBTA database estimated (presumedly in 1990) that there were 70 hectares of annatto at a 4 by 4 plant spacing for 43,750 trees in the entire Chapare. The IMIS survey counted 22,947 trees from the 7535 farms surveyed. This number leads credence to the IBTA estimate and suggests that there could be much more, if the theory that the IMIS project surveyed one-fourth of the Chapare is accepted. Of these annatto trees, 1028 were improved, presumedly distributed by IBTA. Four hundred were in Ivirgarzama and six hundred in Villa Nueva. Nevertheless, the two *centrales* that averaged far more trees per farm than any other area were German Busch and Isiboro.

Black Pepper: Unlike annatto, the numbers found by the IMIS survey for black pepper do not appear to support project estimates. The 1990 Idaho report found 4 hectares of black pepper between the experimental station at La Jota and local growers, with available genetic material for 28 hectares more. The 1991 Taylor report noted that by June, 1991, 13.3 hectares of plants were distributed, and that there were plans to distribute 10,000 cuttings more at a cost of $17,800, so that by the year 1994 there would be a total of 23 hectares. Assuming the IBTA recommended plant spacings of 2.5 meters by 2.5, this is an equivalent of 21,280 plants in 1991 and 36,800 plants in 1994. The IBTA database estimates 35 hectares of black pepper (56,000 plants) and 45 hectares in 1995 (72,000 plants).

In stark contrast to these numbers, the IMIS survey found a total of 2,271 black pepper plants amongst the 7535 farms surveyed. It is always conceivable that the black pepper cultivated in the Chapare is concentrated in only a few areas that were consequently missed by the survey. However, the TMG field team, which was well acquainted with Chapare agriculture, was unaware of any such areas. Therefore, the question must be asked whether the genetic material reportedly distributed was in fact distributed, if the transfer of materials to the farmers was not successful or if after the farmers received the genetic material it was not successfully cultivated.

Coconut: The IMIS findings for coconut appear to be in line with the one estimate made available for this crop. The 1991 Taylor report found that a total of 65.3 hectares worth of coconut had been distributed between the years of 1987 and 1991. Assuming an average plant spacing of 7 by 7 meters, this translates into 13,327 trees. The IMIS survey counted 3,887 trees. Assuming that a rough comparison can be made by multiplying the

IMIS number by four, these two numbers are within a reasonable distance from each other, and thus it can be concluded that most of the genetic material distributed has been successfully used.

Macadamia: This is another crop for which the numbers resulting from the IMIS survey support project estimates. Taylor reports that, as of June 1991, 62 hectares worth of macadamia had been distributed. At the IBTA recommended plant spacings (10 by 10 meters), this equals 6,200 plants. The IBTA database reports 72 hectares of macadamia (7,200 plants) and estimates 110 hectares by 1995 (11,000 plants). The IMIS survey found 2,867 plants on the 7535 farms surveyed. Multiplying this number by four yields 11,468 plants, supporting the IBTA estimates.

Passion Fruit: According to Taylor, there were 63 hectares of passion fruit in the Chapare as of 1991, although no more than 3 hectares of these plants were distributed by IBTA. The 1990 Idaho reports seems to support these numbers. With an assumed plant spacing of 3 by 3 meters, 63 hectares equal 70,000 plants. The IBTA database reports 11 hectares at the time the data was entered (possibly 1990) and estimates 120 hectares by the year 1995 (133,333 plants). The 11 hectares reported by IBTA may look out of place, but it is conceivable that this is merely a typographical error, a common problem in the IBTA data. The IMIS survey found 20,417 plants. Multiplying this number by four yields a number within the project estimates.

Peach Palm: It is difficult to compare the results of the IMIS survey with the project data for this crop. The *criollo* variety of peach palm is commonly cultivated in the Chapare, and the fruit is harvested from the trees over many years. The CORDEP project has been trying to introduce improved varieties of peach palm to be harvested after two years for the heart of palm. The project data is unclear whether it is referring to improved varieties only or to all peach palm. Taylor reports that 52.1 hectares of material was distributed between 1985 and 1991 (208,400 plants), and that there was material available for 50 hectares more. The IBTA database records 9 hectares (36,000 plants) in 1990, presumedly, but estimates 600 hectares (2,400,000 plants) by the year 1995. Because of the large distances between these numbers, it is difficult to know what would be a reasonable expectation for the current year.

The IMIS found a total of 39,094 peach palm from the 7535 farms surveyed; 6,084 were of an improved variety and 16,327 were listed as unknown. However, because the field team noted that, in the case of peach palm, farmers usually knew when they had an improved variety, but not what that specific variety was, it can be assumed that these "unknowns" were also some improved variety, for a total of 22,411 improved variety plants and 16,683 *criollo* plants. Using the factor of four for the purposes of comparison, these become 89,644 improved variety peach palms and 66,732 *criollo* variety peach palms. These numbers fall within the range of numbers in the IBTA database. However, if it is true that over 200,000 plants were distributed from IBTA, it does not appear that the distribution was completely successful. Fortunately, these plants are relatively inexpensive.

Soursop: The 1990 Idaho report found 1 hectare of soursop in the Chapare, specifically in the experimental station of La Jota. This would be the equivalent of 333 plants, assuming a plant spacing of 5 by 6 meters. However, this report did not attempt to

estimate amount of soursop cultivated by farmers, and the other documents available to the IMIS project do not comment on soursop. The IMIS survey found 1,791 plants (5.4 hectares), which suggests a Chapare total of 7,164 plants, or 21.5 hectares.

In summary, most of the crops examined above appeared to be with project estimates of what is being cultivated in the Chapare. The most notable exception was for black pepper, where it seems unlikely that the genetic material reportedly distributed is accounted for by the number of actual plants counted in the IMIS survey. It is unknown whether this is a result of problems with distribution by the project or problems with cultivation of the genetic material by the farmers. However, it seems that the project is unaware that a problem exists, because the estimates used by the project assume that all of the material was used. Another crop in which the number of existing plants do not agree with the amount of genetic material distributed in peach palm. For the other five crops, the quantities found by the IMIS survey appear to agree with or exceed project estimates.

Table 10. Yield Curves Used for Principal Crops for "Zero-Syndicate" Methodology

	Bananas		Manderines - Criollo		Manderines - Improved		Oranges - Criollo		Oranges - Improved		Pineapple	
Unit	Chipa		Each		Each		Each		Each		Each	
Units/MT	10.416		8000.0		8000.0		6000.0		5000.0		500.0	
Year	Yield	SD	Yield	SD	Yield	SD	Yield	SD	Yield	SD	Yield	SD
1	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0	0	0	1	0
3	1	0	0	0	0	0	0	0	0	0	1	0
4	1	0	0	0	50	25	0	0	50	25	0	0
5	1	0	0	0	125	62	0	0	125	62	0	0
6	1	0	0	0	400	200	0	0	400	200	0	0
7	1	0	100	50	600	300	75	37	600	300	0	0
8	1	0	250	125	650	325	200	100	650	325	0	0
9	1	0	500	250	650	325	600	300	650	325	0	0
10	1	0	800	400	650	325	750	375	650	325	0	0
11	1	0	800	400	650	325	750	375	650	325	0	0
12	1	0	800	400	650	325	750	375	650	325	0	0
>12	1	0	800	400	650	325	750	375	650	325	0	0

Exhibit 2. Report: "Crop Yields for a Central - No New Plantings"

CORDEP IMIS Farm Report
Expected Crop Yields For Central - Sep/16/1993

Central: IVIRGARZAMA

Crop: ORANGES
Variety: VALENCIA TARDIA

Year	Units	Sd [Units]	MT	Sd [MT]
1985	16,575	8,266	3.31	1.65
1986	37,450	18,725	7.49	3.74
1987	52,625	26,278	10.52	5.26
1988	73,750	36,875	14.75	7.37
1989	87,550	43,775	17.51	8.75
1990	96,000	48,000	19.20	9.60
1991	103,500	51,700	20.70	10.34
1992	133,500	66,750	26.70	13.35
1993	248,500	124,225	49.70	24.84
1994	480,125	239,150	96.02	47.83
1995	1,185,500	591,990	237.10	118.40
1996	2,090,250	1,044,330	418.05	208.87
1997	2,922,750	1,461,375	584.55	292.27
1998	3,316,750	1,658,375	663.35	331.67
1999	3,396,250	1,698,125	679.25	339.62
2000	3,396,250	1,698,125	679.25	339.62

No Age: 0

Exhibit 3. Report: "Crop Ages for a Central"

CORDEP IMIS Farm Report
Crop Ages for Central - Sep/17/1993

Central: IVIRGARZAMA

Crop	Variety	Unit	
ORANGES	VALENCIA TARDIA	ea	
Year Planted	Age (years)	Units	Hectares
1992	1	1590	1.00
1991	2	1520	0.00
1990	3	1825	2.00
1989	4	50	0.00
1988	5	0	0.00
1987	6	100	0.00
1986	7	0	0.00
1985	8	0	0.00
1984	9	0	0.00
1983	10	69	0.00
1982	11	0	0.00
1981	12	43	0.00
Pre-1981	> 12	28	0.00
No Age		0	0.00

Table 11. Estimated 1993 - 1996 Production of Oranges in Metric Tons, No New Plantings Assumed

	Subregion	1993 Criollo	1993 Improved	1993 Total	1994 Criollo	1994 Improved	1994 Total	1995 Criollo	1995 Improved	1995 Total	1996 Criollo	1996 Improved	1996 Total
San Miguel	1	7,221.8	133.0	7,354.8	7,394.9	207.9	7,602.8	7,591.7	428.9	8,020.6	7,885.5	699.2	8,584.7
Paraiso *	1	82.2	3.6	85.8	84.3	11.4	95.7	96.7	17.0	113.7	129.2	18.5	147.7
Ibuelo	3	5,499.7	123.0	5,622.7	5,626.5	196.6	5,823.1	5,735.0	380.2	6,115.2	5,948.4	593.6	6,541.9
German Busch *	3	1,055.0	3.3	1,058.2	1,058.5	3.3	1,061.8	1,061.8	3.3	1,065.1	1,064.3	3.4	1,067.6
Chimoré **	3	1,779.7	38.7	1,818.4	1,825.3	57.8	1,883.1	1,900.2	97.2	1,997.4	2,013.3	118.7	2,131.9
Independiente	4	365.9	0.7	366.6	571.1	0.8	571.9	756.8	1.2	758.0	911.8	1.6	913.4
Eteramazama	4	3,687.6	13.5	3,701.2	3,801.1	15.4	3,816.5	3,873.5	18.3	3,891.8	3,920.9	25.6	3,946.5
Agraria La Union	4	418.9	2.6	421.5	535.4	5.3	540.7	671.4	8.0	679.4	866.1	16.4	882.5
Bolivar	4	2,201.4	3.9	2,205.3	2,639.4	4.0	2,643.4	3,349.2	4.3	3,353.5	3,667.3	5.0	3,672.3
San Gabriel	4	1,680.8	36.4	1,717.2	2,140.7	40.7	2,181.3	2,394.7	42.3	2,437.0	2,635.4	45.5	2,680.9
Gran Chaco *	4	12.5	0.0	12.5	31.0	0.0	31.0	53.3	0.0	53.3	66.5	0.0	66.5
Isinuta	4	2,591.3	14.5	2,605.8	2,945.0	18.1	2,963.0	3,201.6	38.6	3,240.2	3,495.3	71.8	3,567.1
Isiboro	4	2,261.0	0.0	2,261.0	2,551.8	0.0	2,551.8	2,788.2	2.3	2,790.5	2,973.6	5.7	2,979.3
Espiritu Santo	5	1,216.0	15.2	1,231.2	1,248.8	23.4	1,272.2	1,470.2	50.5	1,520.7	1,304.5	70.4	1,374.9
Jatun Pampa	5	295.0	22.4	317.4	324.4	23.5	347.9	375.6	25.7	401.3	411.6	27.8	439.4
Villa Nueva	2	1,753.0	23.9	1,777.0	1,865.6	37.6	1,903.2	1,939.0	63.1	2,002.1	1,985.5	103.4	2,088.9
Mariposas	6	200.4	0.0	200.4	253.9	0.1	253.9	294.2	0.2	294.5	327.7	0.4	328.0
Ivirgarzama **	6	7,939.6	58.8	7,998.4	10,034.7	105.2	10,139.9	10,917.5	248.8	11,166.3	11,815.2	433.7	12,248.9
22 de Mayo	6	123.4	9.2	132.6	211.6	23.9	235.5	408.6	73.4	481.9	837.4	111.1	948.5
Bulo Bulo	6	188.8	0.5	189.2	362.8	3.0	365.7	597.9	9.7	607.6	1,006.4	24.7	1,031.0

* Only samples collected (see report). Numbers do not reflect true central values.

** Less than 60% of central participation (see report). Numbers do not reflect true central values.

9/93

Table 12. Estimated 1993 - 1996 Production of Mandarins in Metric Tons, No New Plantings Assumed

	Subregion	1993 Criollo	1993 Improved	1993 Total	1994 Criollo	1994 Improved	1994 Total	1995 Criollo	1995 Improved	1995 Total	1996 Criollo	1996 Improved	1996 Total
San Miguel	1	1,460.6	24.0	1,484.5	1,570.5	52.5	1,623.0	1,720.5	110.5	1,831.0	1,894.9	149.8	2,044.7
Paraiso *	1	8.1	0.0	8.1	10.8	0.0	10.8	15.2	0.0	15.2	22.8	0.0	22.8
Ibuelo	3	1,149.3	27.0	1,176.2	1,234.6	45.1	1,279.7	1,307.7	73.3	1,381.0	1,411.5	103.4	1,514.9
German Busch *	3	196.5	0.0	196.5	199.4	0.0	199.4	201.6	0.1	201.7	204.1	0.3	204.4
Chimoré **	3	559.8	13.0	572.8	600.4	14.1	614.4	642.5	15.7	658.2	681.0	21.5	702.5
Independiente	4	275.1	1.3	276.3	450.5	1.8	452.3	596.1	2.5	598.6	734.2	3.8	738.0
Eteramazama	4	728.8	2.2	731.0	809.4	2.2	811.6	858.0	5.6	863.6	898.8	10.8	909.6
Agraria La Union	4	219.7	2.8	222.4	294.9	7.2	302.1	383.2	13.0	396.2	492.4	30.7	523.1
Bolivar	4	748.7	36.0	784.7	910.1	47.2	957.3	1,025.2	64.5	1,089.6	1,119.5	81.5	1,201.0
San Gabriel	4	993.0	2.0	994.9	1,416.8	2.0	1,418.8	1,696.9	6.2	1,703.1	1,921.3	12.6	1,933.8
Gran Chaco *	4	6.4	0.0	6.4	13.8	0.0	13.8	23.7	0.0	23.7	30.3	0.0	30.3
Isinuta	4	875.3	9.2	884.5	1,131.2	10.3	1,141.5	1,295.7	17.6	1,313.3	1,493.8	30.1	1,523.9
Isiboro	8	825.6	0.8	826.4	1,045.1	1.1	1,046.3	1,098.1	1.3	1,099.5	1,158.8	1.4	1,160.2
Espiritu Santo	5	1,771.9	34.0	1,806.0	1,834.6	37.9	1,872.5	1,892.2	53.6	1,945.8	1,971.1	309.2	2,280.3
Jatun Pampa	5	610.8	5.9	616.7	706.4	9.7	716.0	740.3	14.3	754.6	782.0	19.1	801.1
Villa Nueva	2	575.9	42.2	618.0	614.4	49.4	663.8	657.1	58.2	715.3	694.1	77.2	771.3
Mariposas	6	77.5	0.1	77.6	111.4	0.2	111.6	169.9	0.8	170.7	239.6	1.1	240.7
Ivirgarzama **	6	3,531.8	48.1	3,579.8	5,177.7	73.4	5,251.1	6,143.4	163.2	6,306.6	6,736.3	254.0	6,990.4
22 de Mayo	7	119.6	16.3	135.9	227.9	43.4	271.3	386.1	96.6	482.8	590.7	134.3	724.9
Bulo Bulo	7	206.8	15.6	222.4	381.5	36.5	418.0	552.7	81.9	634.6	740.4	120.3	860.7

* Only samples collected (see report). Numbers do not reflect true central values.

** Less than 60% of central participation (see report). Numbers do not reflect true central values.

9/93

Table 13. Estimated 1993 - 1996 Production of Pineapple in Metric Tons, Maximum Planting Rate Assumed

	Subregion	Criollo	Brasilera	Cayena Lisa	Pulcalpa	Rosita	Other***	Total	Criollo	Brasilera	Cayena Lisa	Pulcalpa	Rosita	Other***	Total
		1993							1994						
San Miguel	1	8.0	0.0	0.0	0.3	0.0	0.1	8.42	20.8	0.0	0.0	0.3	0.0	0.2	21.32
Paraiso *	1	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Ibuelo	3	12.1	0.5	12.6	112.0	21.8	0.0	158.90	14.5	0.7	12.6	112.0	21.8	1.2	162.72
German Busch *	3	21.9	0.0	7.2	159.3	0.0	0.0	188.36	43.8	0.0	66.2	159.4	0.0	0.0	269.40
Chimoré **	3	61.5	13.3	2.1	163.7	1.5	4.3	246.32	98.0	24.0	3.2	210.3	3.0	8.6	347.16
Independiente	4	10.2	1.8	0.7	23.3	1.1	4.7	41.81	10.2	1.8	1.4	33.1	1.5	10.6	58.46
Eteramazama	4	193.1	9.0	1920.1	1497.9	1.2	35.7	3,656.98	364.4	13.7	2122.1	2185.0	7.0	71.8	4,763.98
Agraria La Union	4	13.6	0.0	87.5	22.6	0.0	4.7	128.43	13.6	0.0	165.4	41.9	6.0	9.5	236.34
Bolivar	4	57.4	10.0	20.1	134.5	4.3	1.6	227.89	75.0	19.6	23.7	207.0	8.6	41.7	375.52
San Gabriel	4	345.8	2.2	73.2	256.6	0.4	0.1	678.34	606.0	2.2	130.3	264.6	0.4	0.1	1,003.58
Gran Chaco *	4	12.4	0.0	0.0	0.0	0.0	0.0	12.38	30.6	0.0	0.0	0.0	0.0	0.0	30.62
Isinuta	4	65.2	11.7	81.1	450.1	8.6	2.6	619.22	66.6	0.0	81.1	521.1	24.6	3.3	696.57
Isiboro	8	51.7	3.3	10.9	45.8	0.1	21.4	133.07	51.7	6.4	17.7	63.3	0.2	42.8	182.14
Espiritu Santo	5	16.6	2.5	75.7	47.6	0.0	2.5	144.79	16.6	4.9	75.7	64.2	0.0	0.0	161.37
Jatun Pampa	5	2.5	0.5	18.6	16.8	0.0	9.7	48.13	17.2	4.0	18.6	20.0	0.2	27.2	87.21
Villa Nueva	2	0.0	0.0	0.0	114.2	5.3	15.3	134.79	6.0	0.0	8.0	208.5	51.4	30.6	304.50
Mariposas	6	1.0	3.0	973.0	7005.0	10.2	382.1	8,374.36	36.2	5.6	1692.2	9068.3	19.4	771.8	11,593.52
Ivirgarzama **	6	201.5	1.8	8.5	229.2	32.3	28.7	502.02	201.5	12.7	8.5	229.2	32.3	82.2	566.39
22 de Mayo	7	49.2	53.7	8.7	1391.7	4.0	50.2	1,557.46	70.4	53.7	17.4	2551.7	4.0	99.5	2,796.73
Bulo Bulo	7	893.8	3.9	508.0	399.5	10.1	446.4	2,261.69	1259.8	32.6	653.8	460.9	20.0	894.3	3,321.47

* Only samples collected (see report). Numbers do not reflect true central values.

** Less than 60% of central participation (see report). Numbers do not reflect true central values.

***Other = Other improved varieties and unknown varieties

9/93

Table 13. continued... Estimated 1993 - 1996 Production of Pineapple in Metric Tons, Maximum Planting Rate Assumed

	Subregion	Criollo	Brasilera	Cayena Lisa	Pulcalpa	Rosita	Other***	Total	Criollo	Brasilera	Cayena Lisa	Pulcalpa	Rosita	Other***	Total
		1995							1996						
San Miguel	1	25.60	0.00	0.00	0.64	0.00	0.20	26.4	25.60	0.00	0.00	0.64	0.00	0.20	26.4
Paraiso *	1	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Ibuelo	3	25.24	0.74	16.08	130.92	43.32	1.20	217.5	25.24	0.74	16.08	130.92	43.32	1.20	217.5
German Busch *	3	43.8	0.0	132.0	162.0	0.0	0.0	337.85	43.8	0.0	132.0	162.0	0.0	0.0	337.85
Chimoré **	3	98.0	24.0	3.2	210.3	3.0	8.6	347.16	98.0	24.0	3.2	210.3	3.0	8.6	347.16
Independiente	4	10.2	3.0	1.6	33.1	1.5	10.6	59.92	10.2	3.0	1.6	33.1	1.5	10.6	59.92
Eteramazama	4	364.4	13.7	2122.1	2185.0	13.7	72.1	4,771.04	364.4	13.7	2122.1	2185.0	13.7	72.1	4,771.04
Agraria La Union	4	26.1	0.0	165.4	44.2	12.0	9.5	257.18	26.1	0.0	165.4	44.2	12.0	9.5	257.18
Bolivar	4	89.5	19.6	23.7	207.0	8.6	80.8	429.21	89.5	19.6	23.7	207.0	8.6	80.8	429.21
San Gabriel	4	606.0	2.9	130.3	272.9	0.6	0.2	1,012.75	606.0	2.9	130.3	272.9	0.6	0.2	1,012.75
Gran Chaco *	4	36.8	0.0	0.0	0.0	0.0	0.0	36.80	36.8	0.0	0.0	0.0	0.0	0.0	36.80
Isinuta	4	91.9	0.0	99.1	521.1	33.6	3.3	748.84	91.9	0.0	99.1	521.1	33.6	3.3	748.84
Isiboro	8	101.1	6.4	25.2	63.3	0.4	43.0	239.34	101.1	6.4	25.2	63.3	0.4	43.0	239.34
Espiritu Santo	5	32.6	4.9	132.7	64.2	0.1	0.1	234.51	32.6	4.9	132.7	64.2	0.1	0.1	234.51
Jatun Pampa	5	33.4	8.0	35.6	26.4	0.4	37.2	140.93	33.4	8.0	35.6	26.4	0.4	37.2	140.93
Villa Nueva	2	12.0	0.0	16.0	338.2	102.3	30.6	499.05	12.0	0.0	16.0	338.2	102.3	30.6	499.05
Mariposas	6	72.0	11.2	1692.2	9068.3	20.0	869.2	11,732.93	72.0	11.2	1692.2	9068.3	20.0	869.2	11,732.93
Ivirgarzama **	6	229.9	25.4	12.1	282.5	40.8	107.5	698.20	229.9	25.4	12.1	282.5	40.8	107.5	698.20
22 de Mayo	7	70.4	107.5	17.4	2551.7	8.0	99.5	2,854.46	70.4	107.5	17.4	2551.7	8.0	99.5	2,854.46
Bulo Bulo	7	1259.8	64.5	653.8	458.2	20.0	897.5	3,353.84	1259.8	64.5	653.8	458.2	20.0	897.5	3,353.84

* Only samples collected (see report). Numbers do not reflect true central values.

** Less than 60% of central participation (see report). Numbers do not reflect true central values.

***Other = Other improved varieties and unknown varieties

9/93

Table 14. Estimated 1993 - 1996 Production of Banana in Metric Tons, No New Plantings Assumed

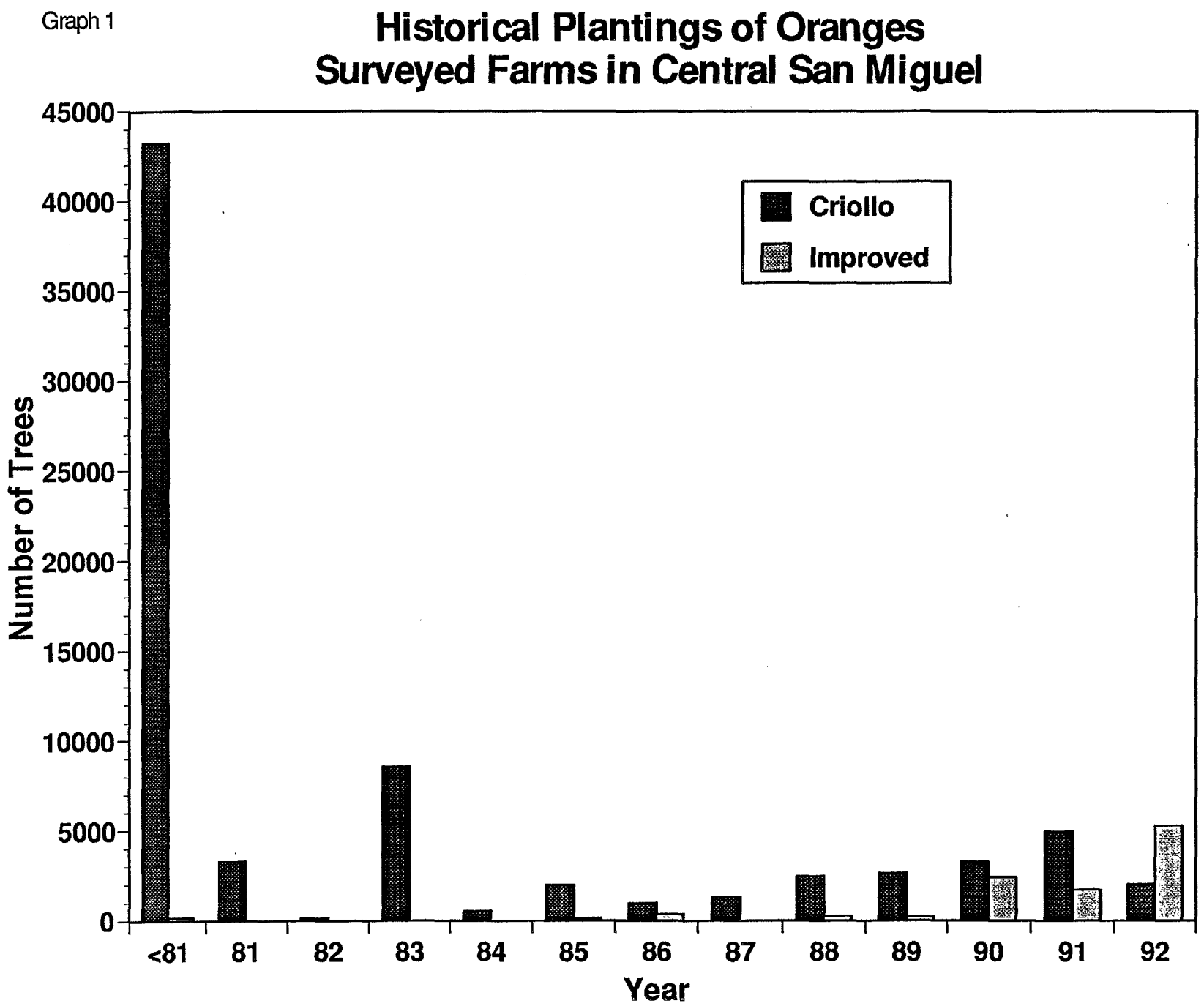
	Subregion	1993 Criollo	1993 Improved	1993 Total	1994 Criollo	1994 Improved	1994 Total	1995 Criollo	1995 Improved	1995 Total	1996 Criollo	1996 Improved	1996 Total
San Miguel	1	17,298	15,411	32,709	17,298	15,411	32,709	17,298	15,411	32,709	17,298	15,411	32,709
Paraiso *	1	16,500	2,630	19,130	16,500	2,630	19,130	16,500	2,630	19,130	16,500	2,630	19,130
Ibuelo	3	32,001	9,990	41,991	32,001	9,990	41,991	32,001	9,990	41,991	32,001	9,990	41,991
German Busch *	3	168	18	186	168	18	186	168	18	186	168	18	186
Chimoré **	3	7,757	856	8,613	7,757	856	8,613	7,757	856	8,613	7,757	856	8,613
Independiente	4	923	517	1,440	923	517	1,440	923	517	1,440	923	517	1,440
Eteramazama	4	1,460	464	1,924	1,460	464	1,924	1,460	464	1,924	1,460	464	1,924
Agraria La Union	4	1,391	29	1,420	1,391	29	1,420	1,391	29	1,420	1,391	29	1,420
Bolivar	4	2,858	828	3,686	2,858	828	3,686	2,858	828	3,686	2,858	828	3,686
San Gabriel	4	4,964	1,332	6,296	4,964	1,332	6,296	4,964	1,332	6,296	4,964	1,332	6,296
Gran Chaco *	4	56	28	84	56	28	84	56	28	84	56	28	84
Isinuta	4	2,655	1,135	3,790	2,655	1,135	3,790	2,655	1,135	3,790	2,655	1,135	3,790
Isiboro	8	1,365	3,027	4,392	1,365	3,027	4,392	1,365	3,027	4,392	1,365	3,027	4,392
Espiritu Santo	5	561	1,798	2,359	561	1,798	2,359	561	1,798	2,359	561	1,798	2,359
Jatun Pampa	5	999	1,380	2,378	999	1,380	2,378	999	1,380	2,378	999	1,380	2,378
Villa Nueva	2	103	46	149	103	46	149	103	46	149	103	46	149
Mariposas	6	509	146	655	509	146	655	509	146	655	509	146	655
Ivirgarzama **	6	10,415	2,921	13,336	10,415	2,921	13,336	10,415	2,921	13,336	10,415	2,921	13,336
22 de Mayo	7	95	647	742	95	647	742	95	647	742	95	647	742
Bulo Bulo	7	435	902	1,337	435	902	1,337	435	902	1,337	435	902	1,337

* Only samples collected (see report). Numbers do not reflect true central values.

** Less than 60% of central participation (see report). Numbers do not reflect true central values.

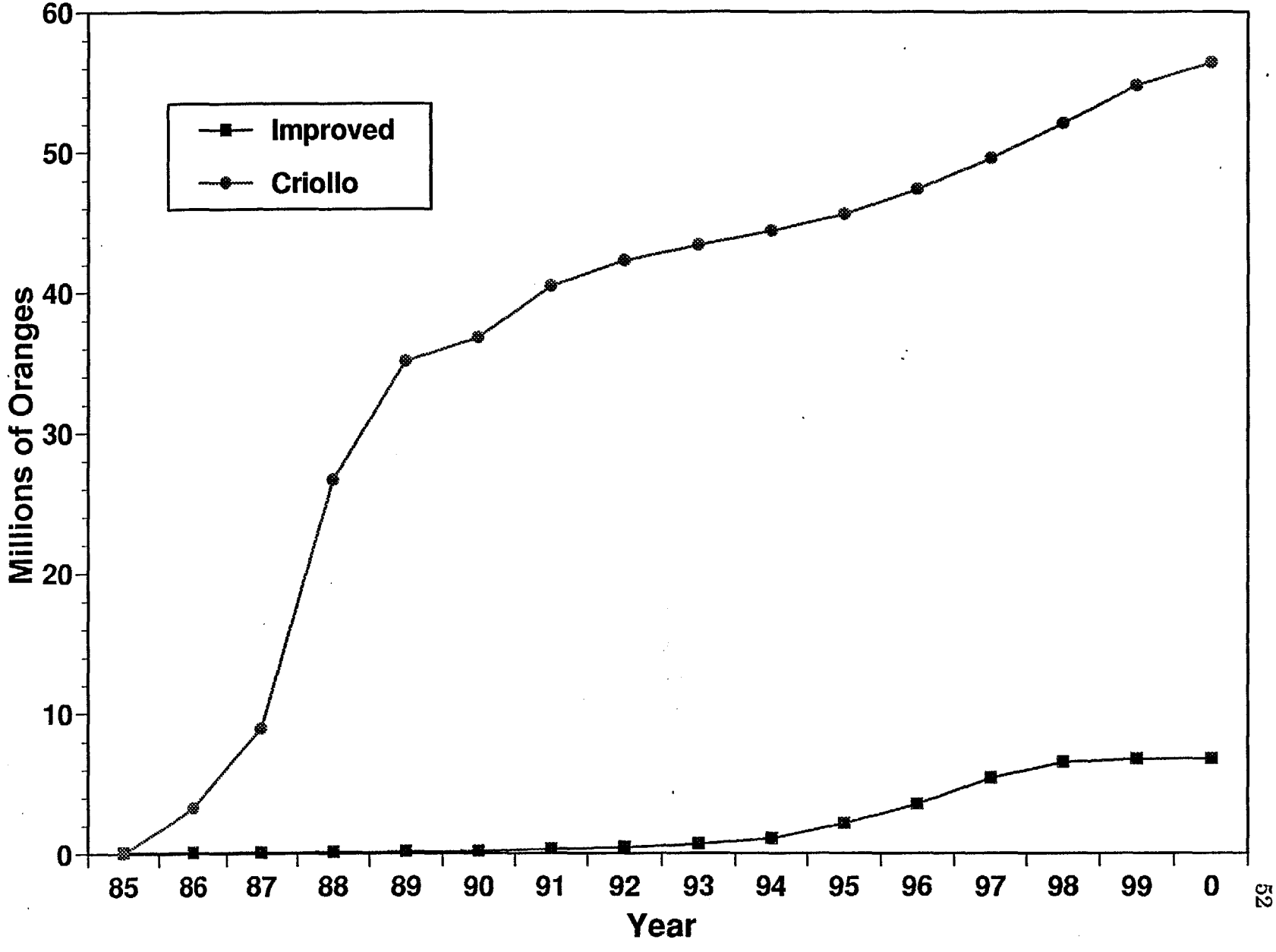
9/93

Graph 1


Historical Plantings of Oranges
Surveyed Farms in Central San Miguel
Criollo
Improved
Number of Trees
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
<81
81
82
83
84
85
86
87
88
89
90
91
92
Year

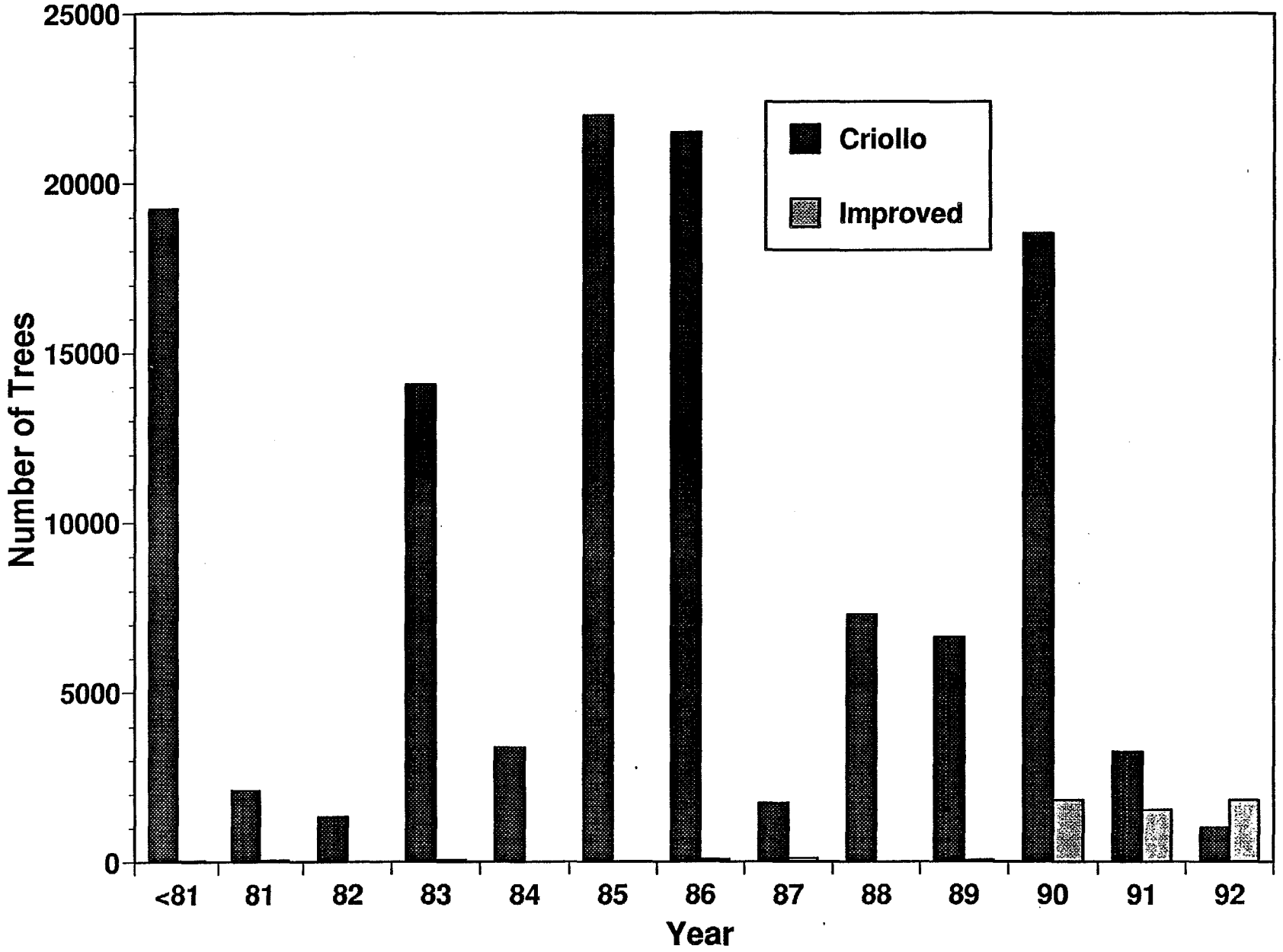
Graph 2

Estimated Historic and Projected Yields of Oranges Surveyed Farms Without New Plantings in Central San Miguel



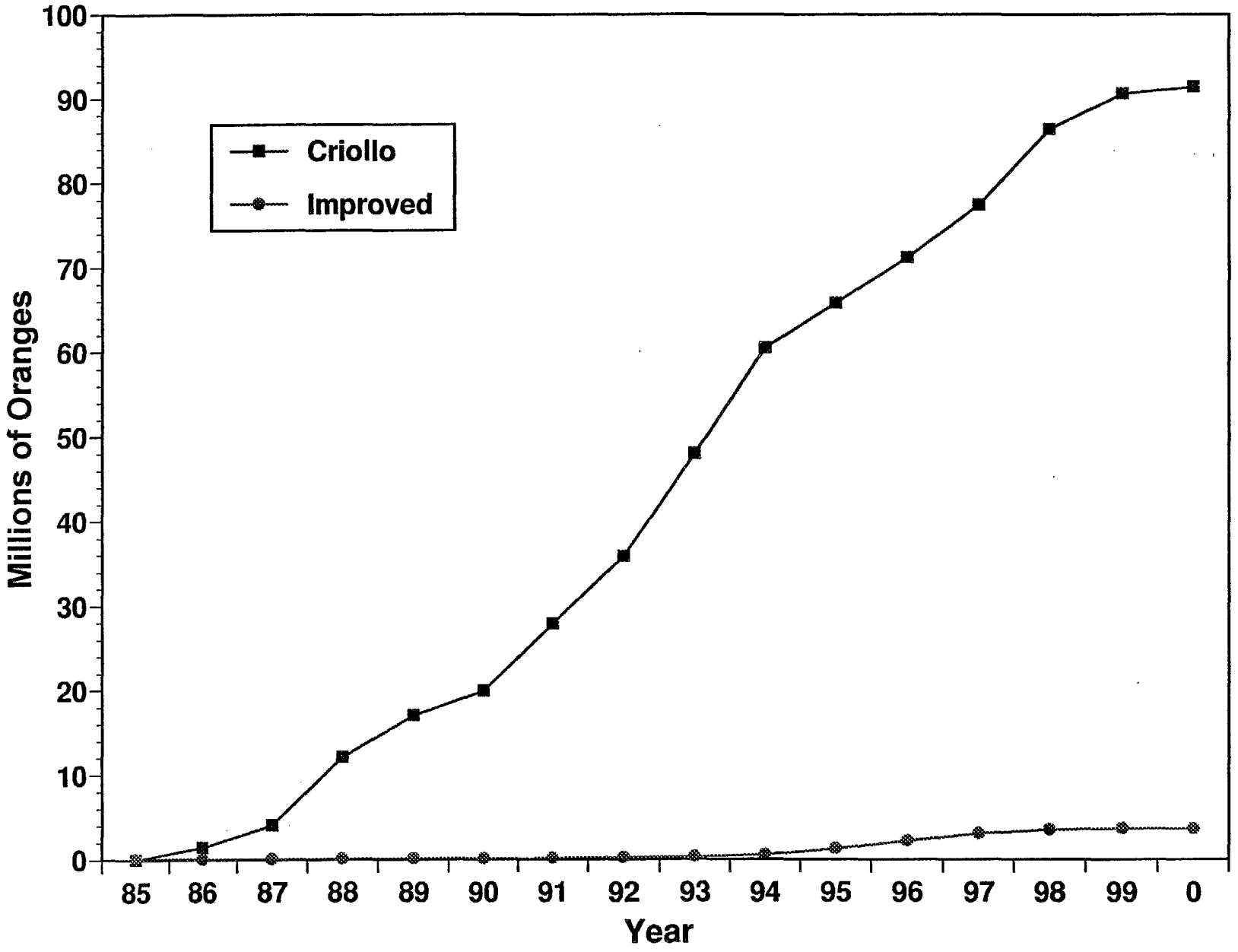
Graph 3

Historical Plantings of Oranges
Surveyed Farms in Central Ivirgarzama



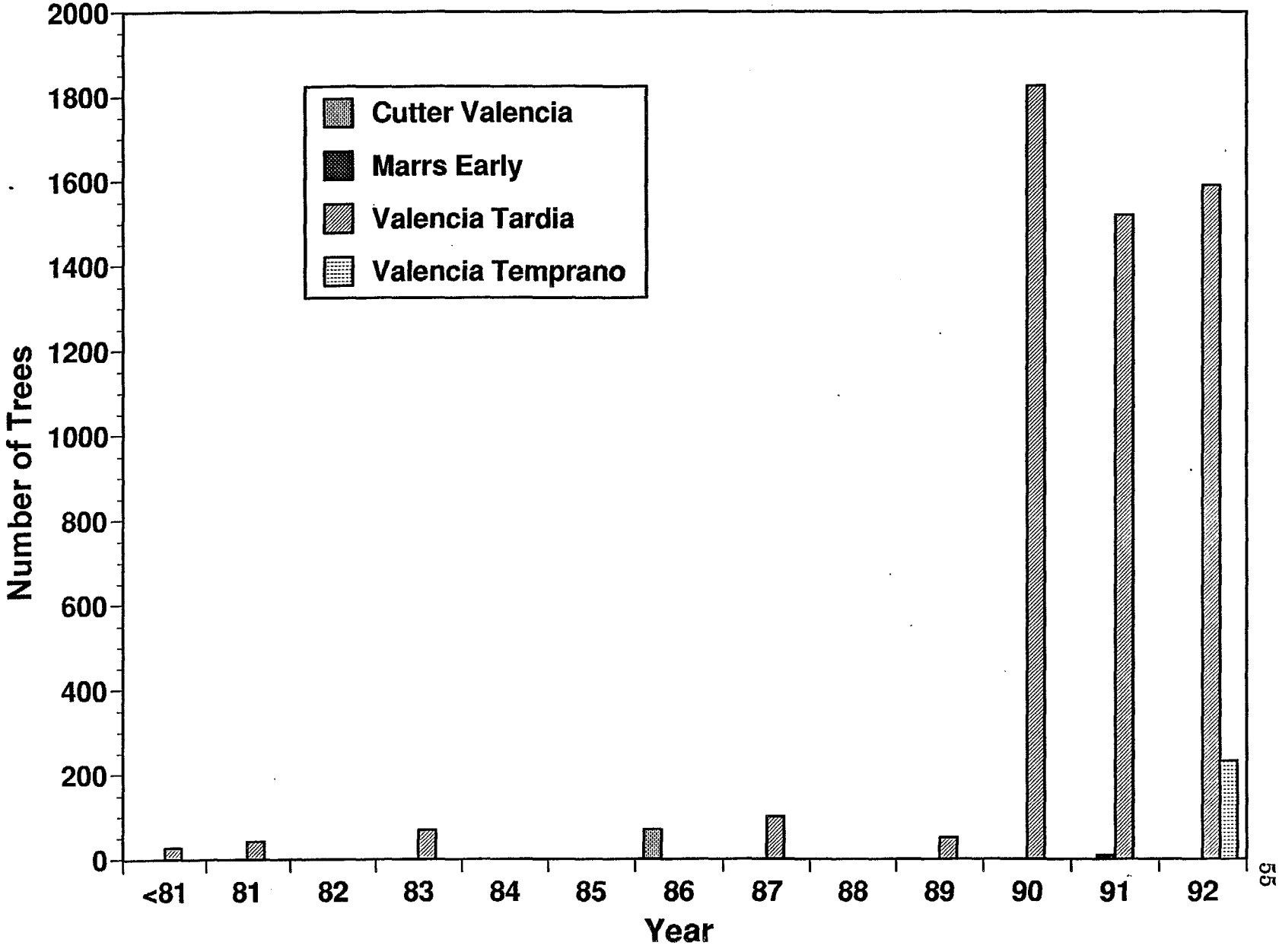
Graph 4

Estimated Historic and Projected Yields of Oranges Surveyed Farms Without New Plantings in Central Ivirgarzama

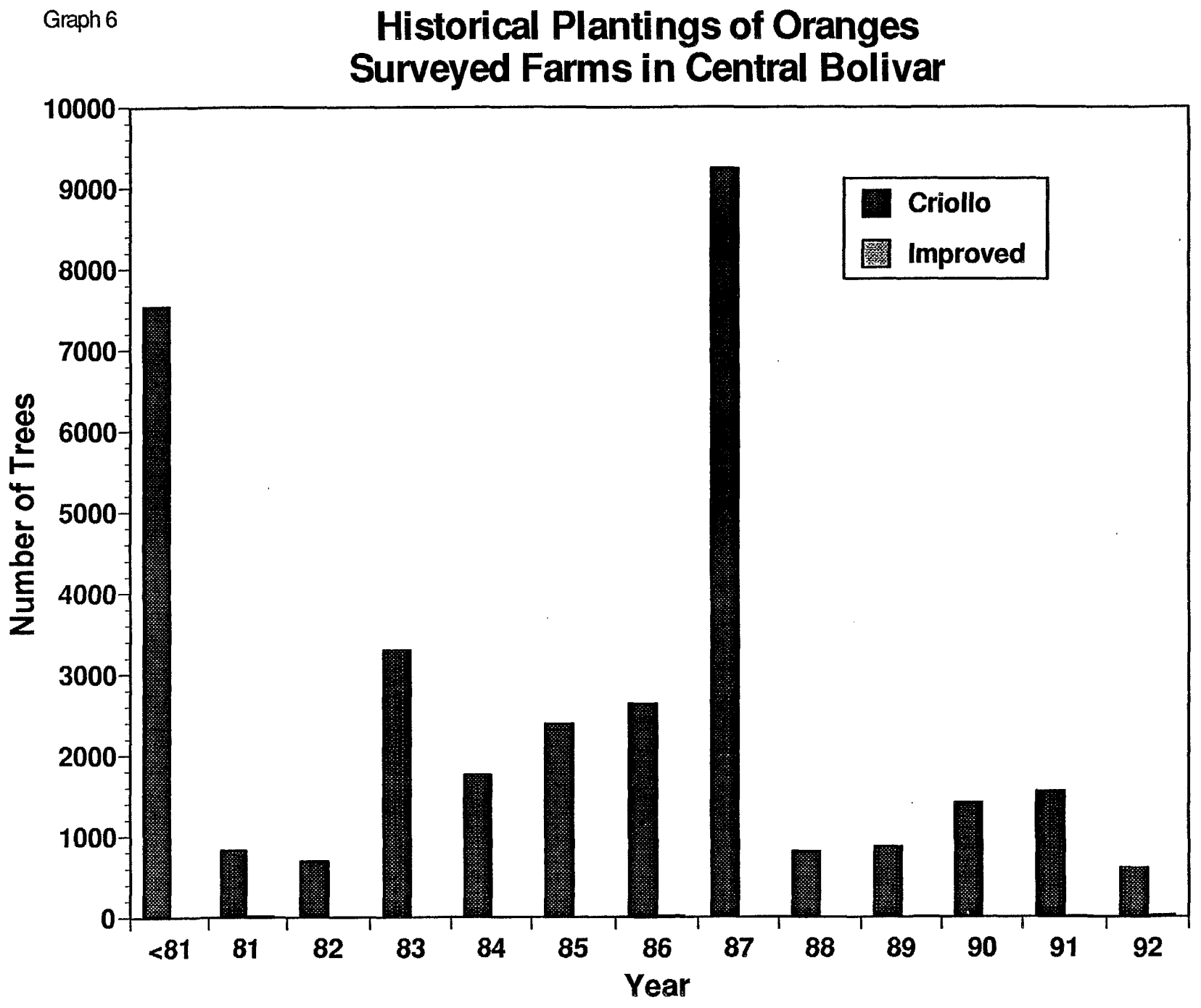


Graph 5

Historical Plantings of Improved Orange Varieties Surveyed Farms in Central Ivirgarzama

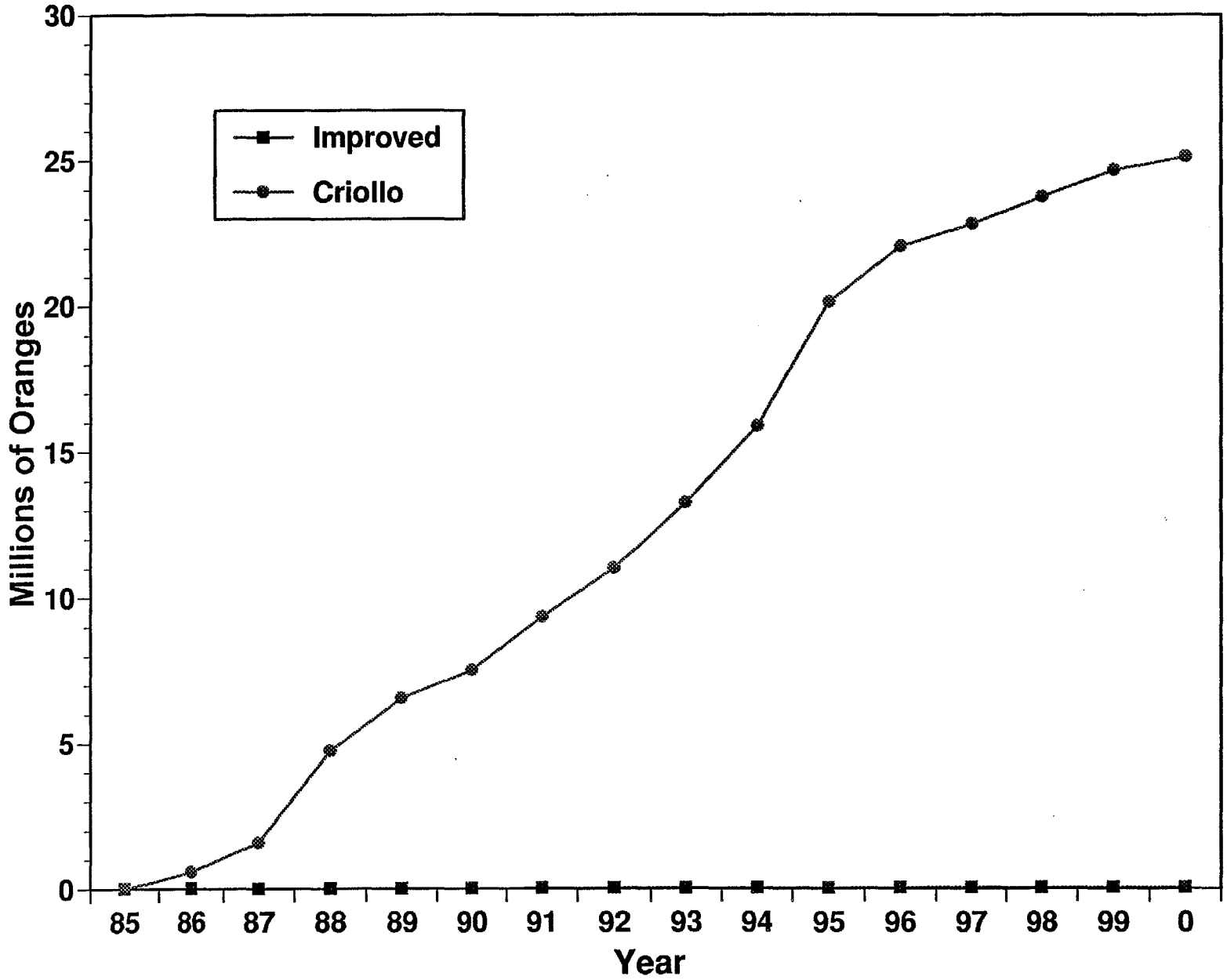


Graph 6


Historical Plantings of Oranges
Surveyed Farms in Central Bolivar
Criollo
Improved
Number of Trees
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
<81
81
82
83
84
85
86
87
88
89
90
91
92
Year

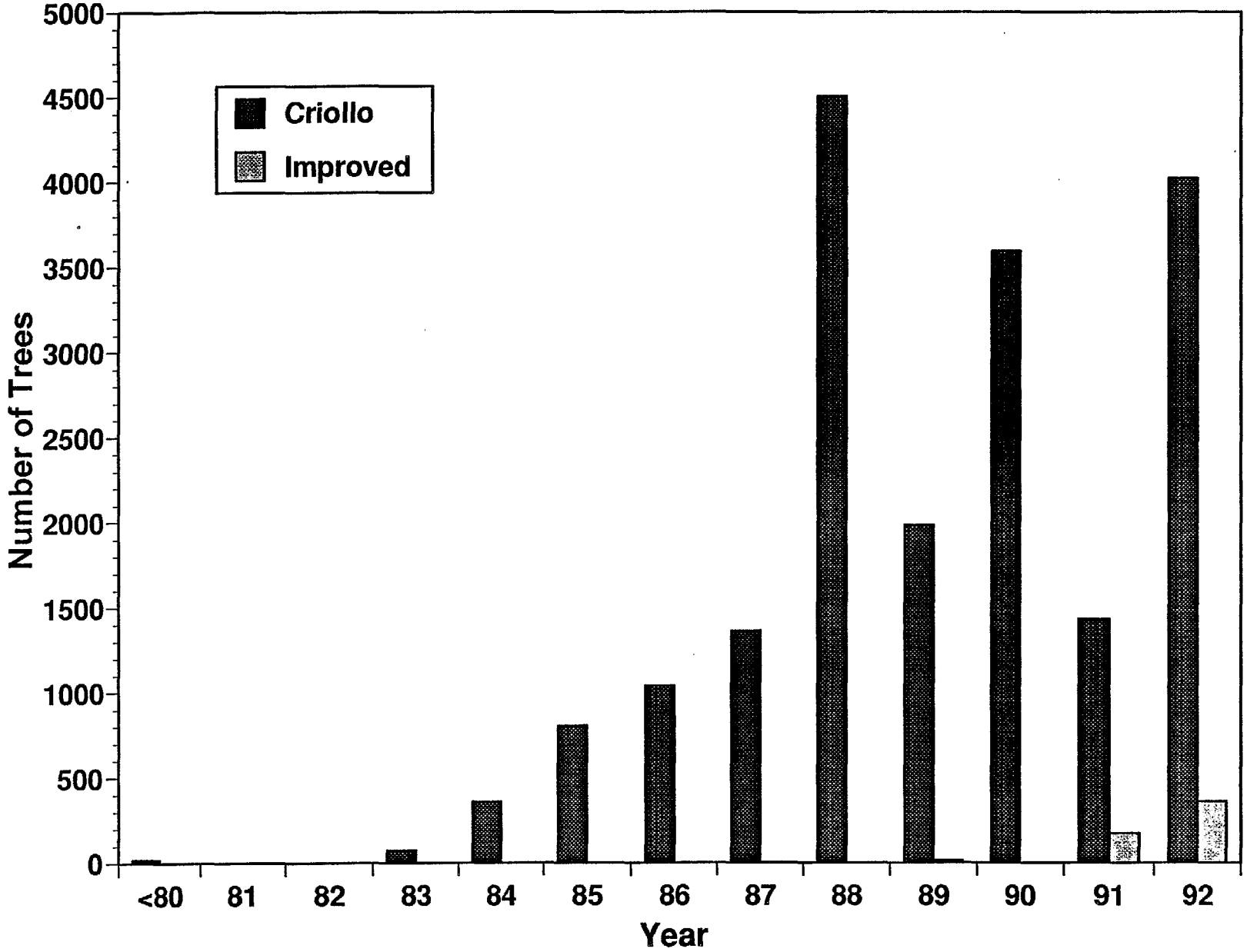
Graph 7

Estimated Historic and Projected Yields of Oranges Surveyed Farms Without New Plantings in Central Bolivar



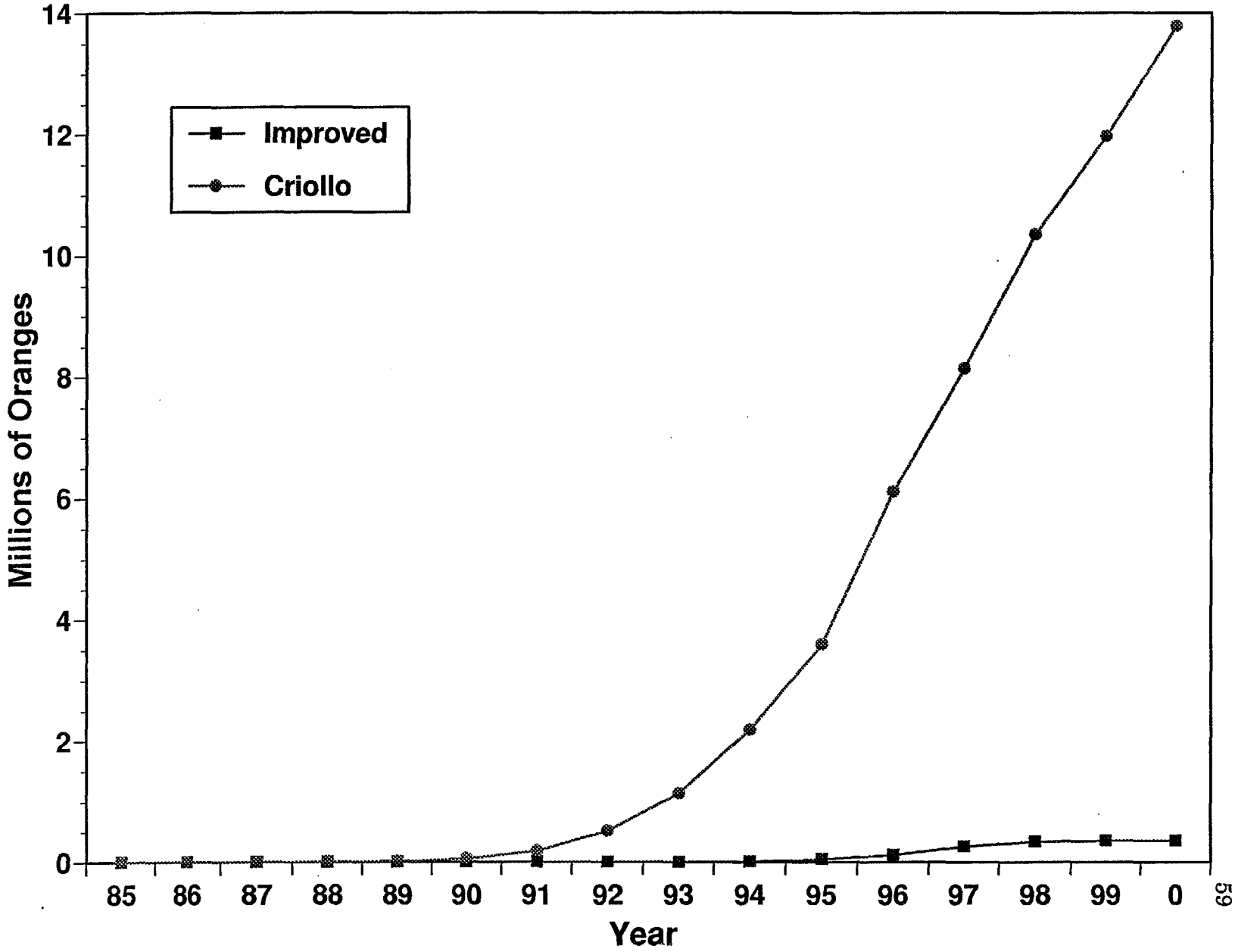
Graph 8

Historical Plantings of Oranges
Surveyed Farms in Central Bulo Bulo



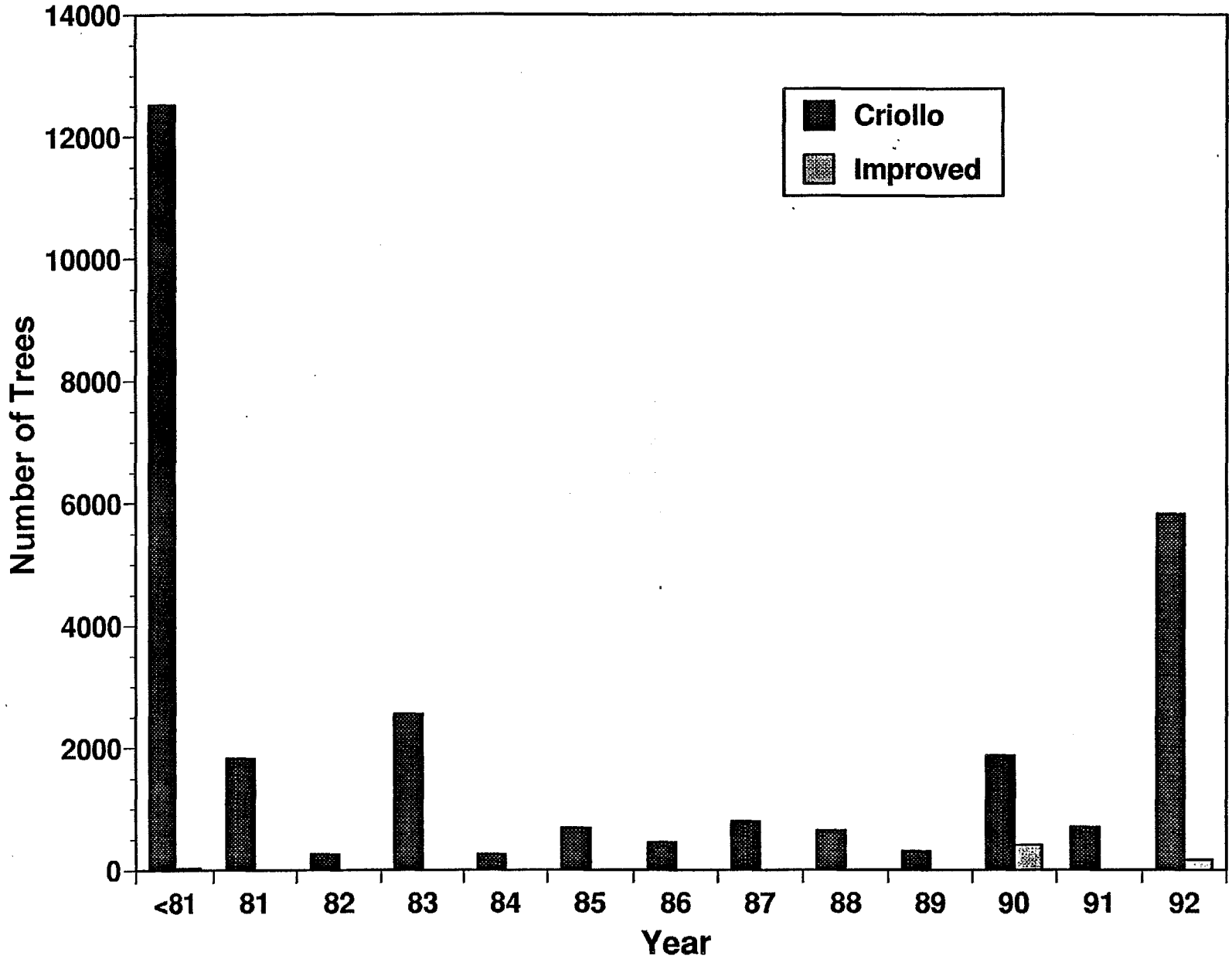
Graph 9

Estimated Historic and Projected Yields of Oranges Surveyed Farms Without New Plantings in Central Bulo Bulo



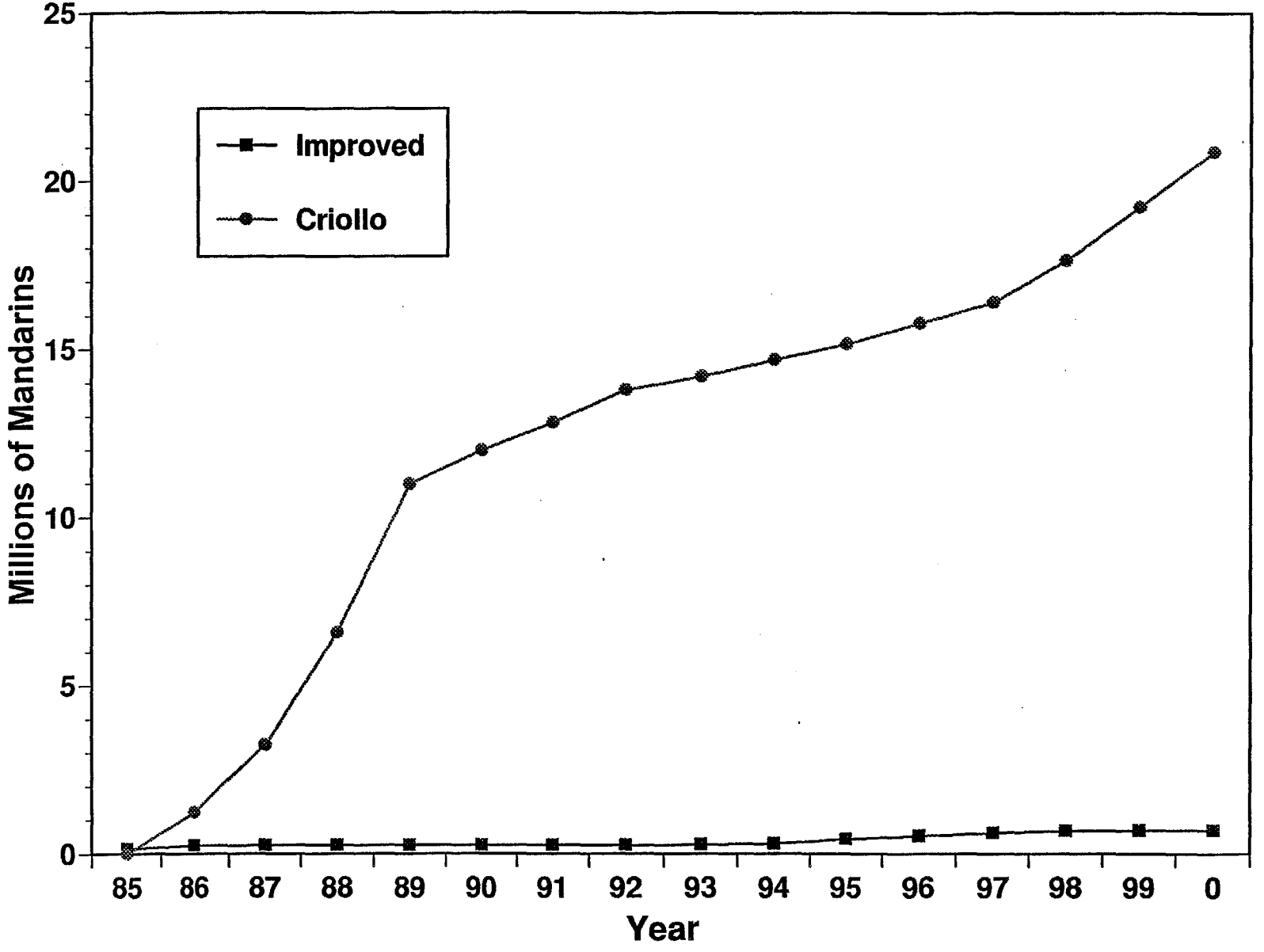
Graph 10

Historical Plantings of Mandarins
Surveyed Farms in Central Espiritu Santo



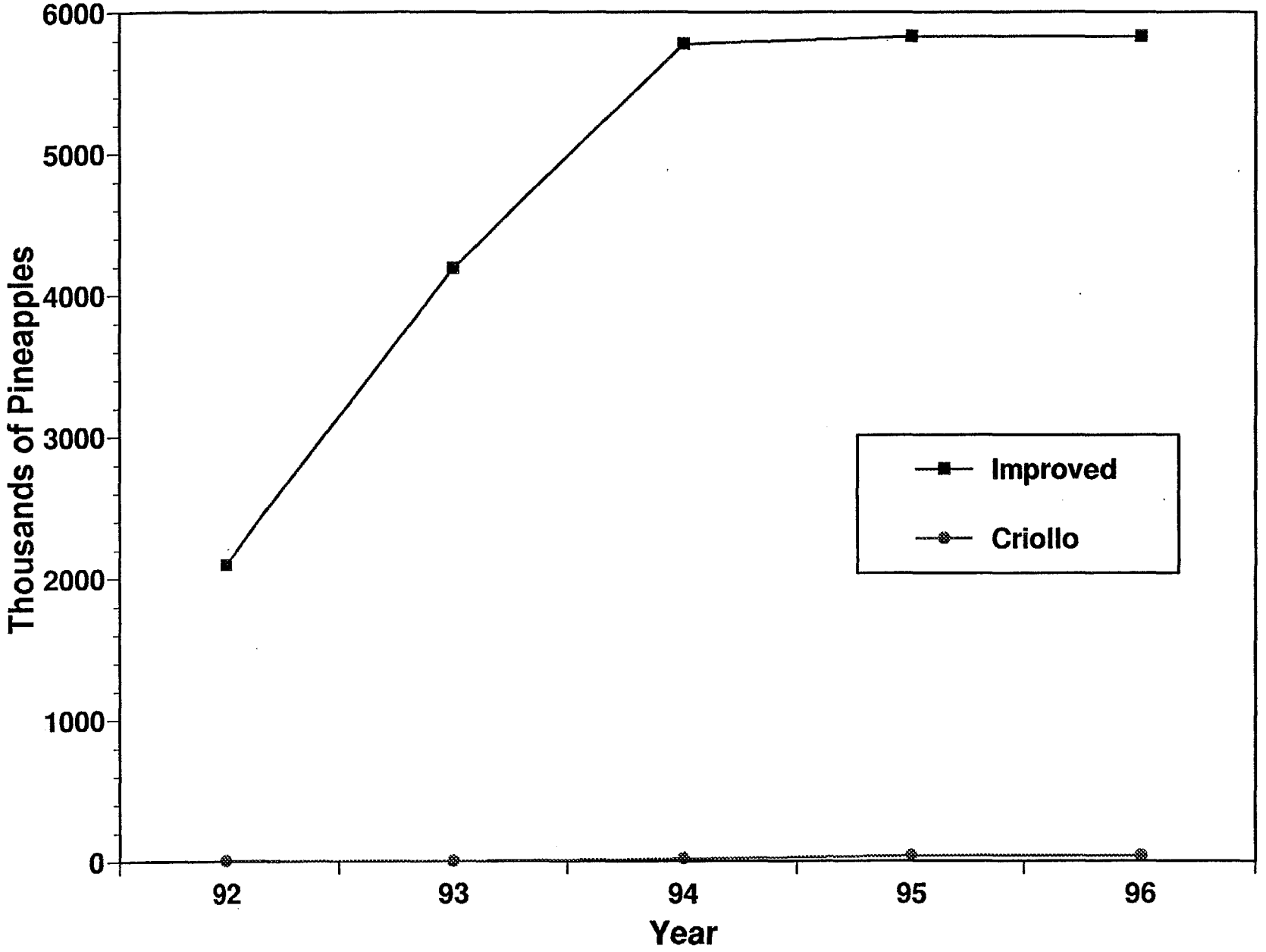
Graph 11

Estimated Historic and Projected Yields of Mandarins Farms Surveyed Without New Plantings in Central Espiritu Santo



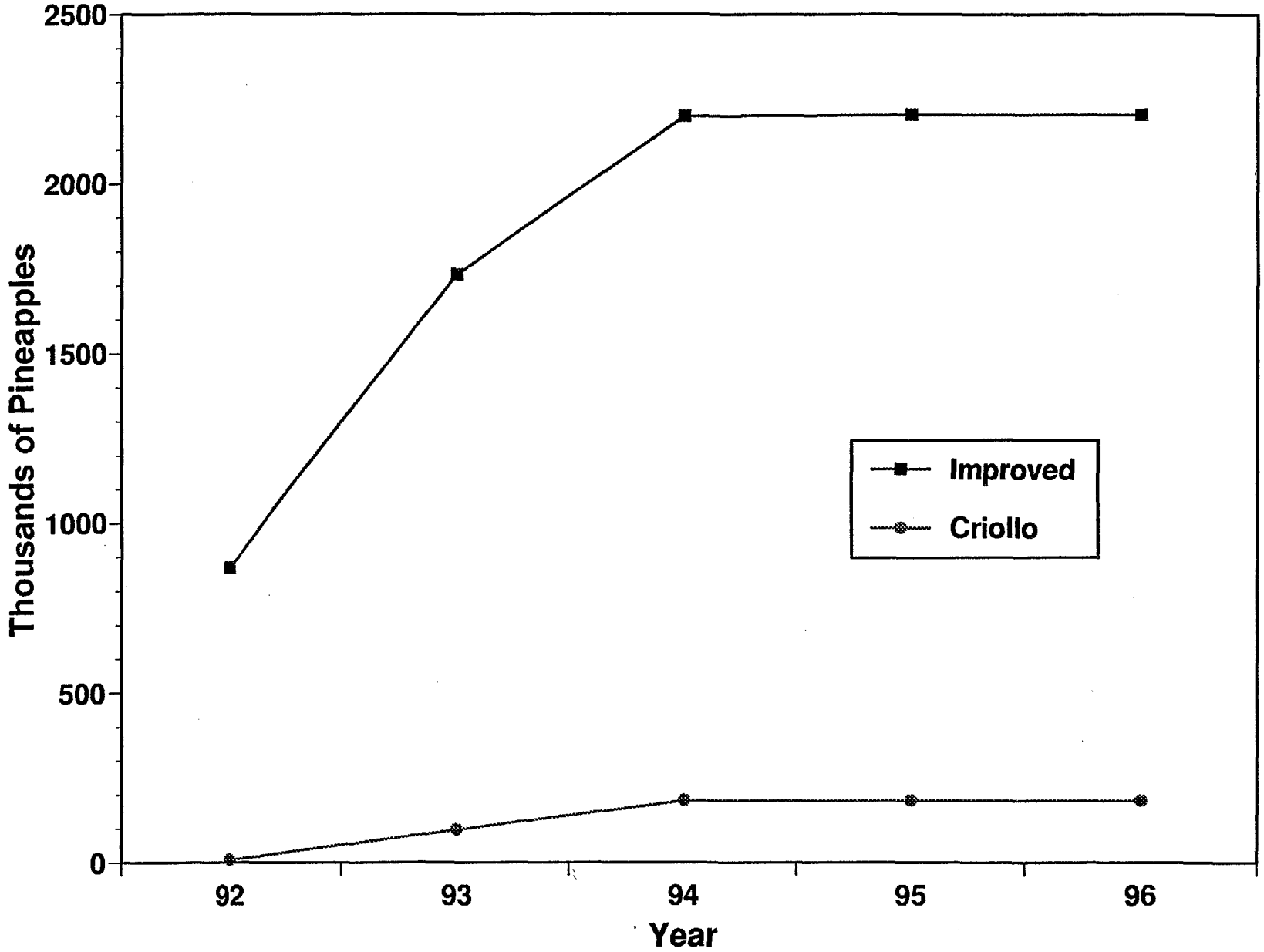
Graph 12

Estimated Historic and Projected Yields of Pineapples Surveyed Farms With Continued Plantings in Central Mariposas



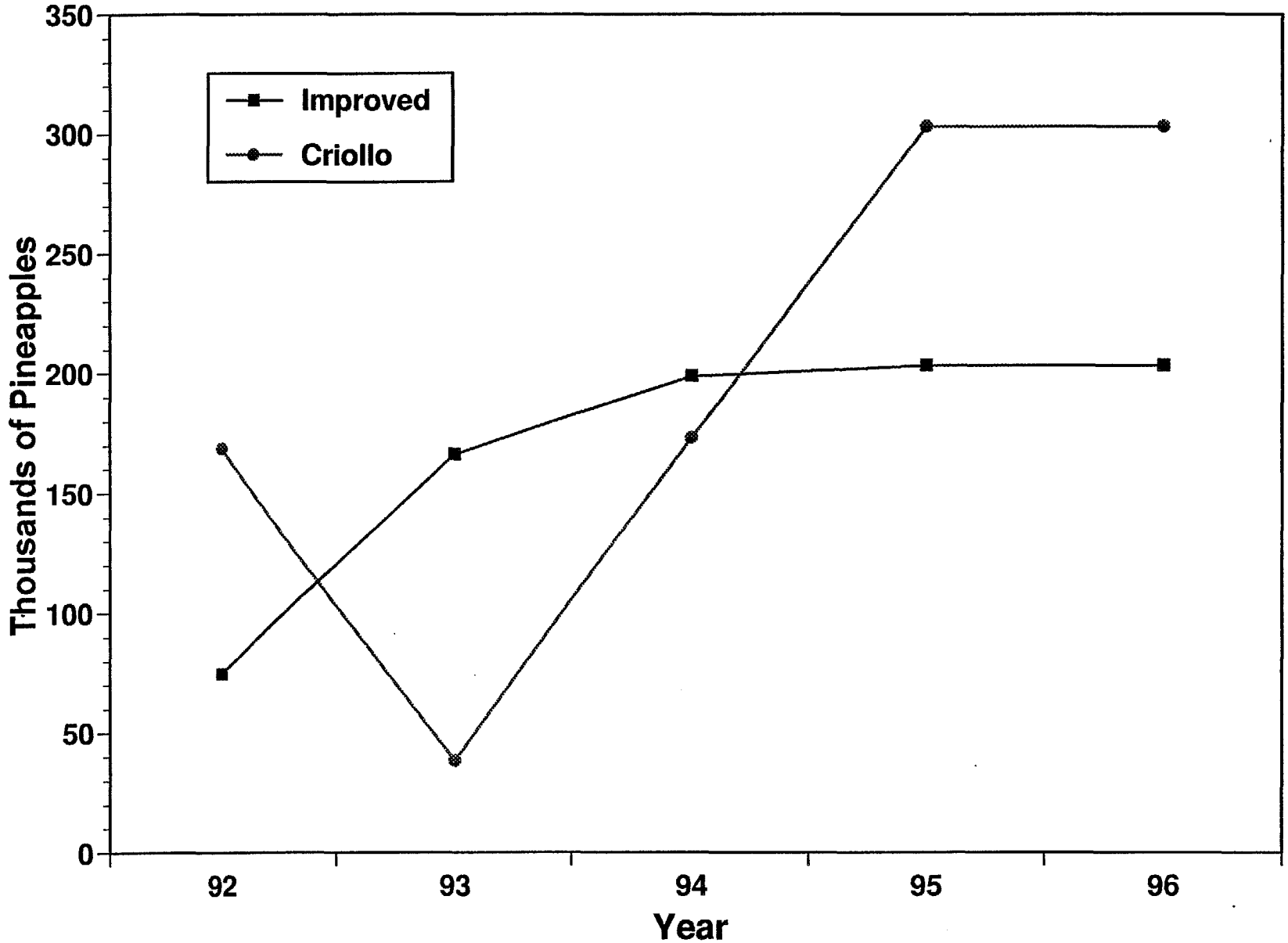
Graph 13

Estimated Historic and Projected Yields of Pineapples Surveyed Farms With Continued Plantings in Central Eteramazama



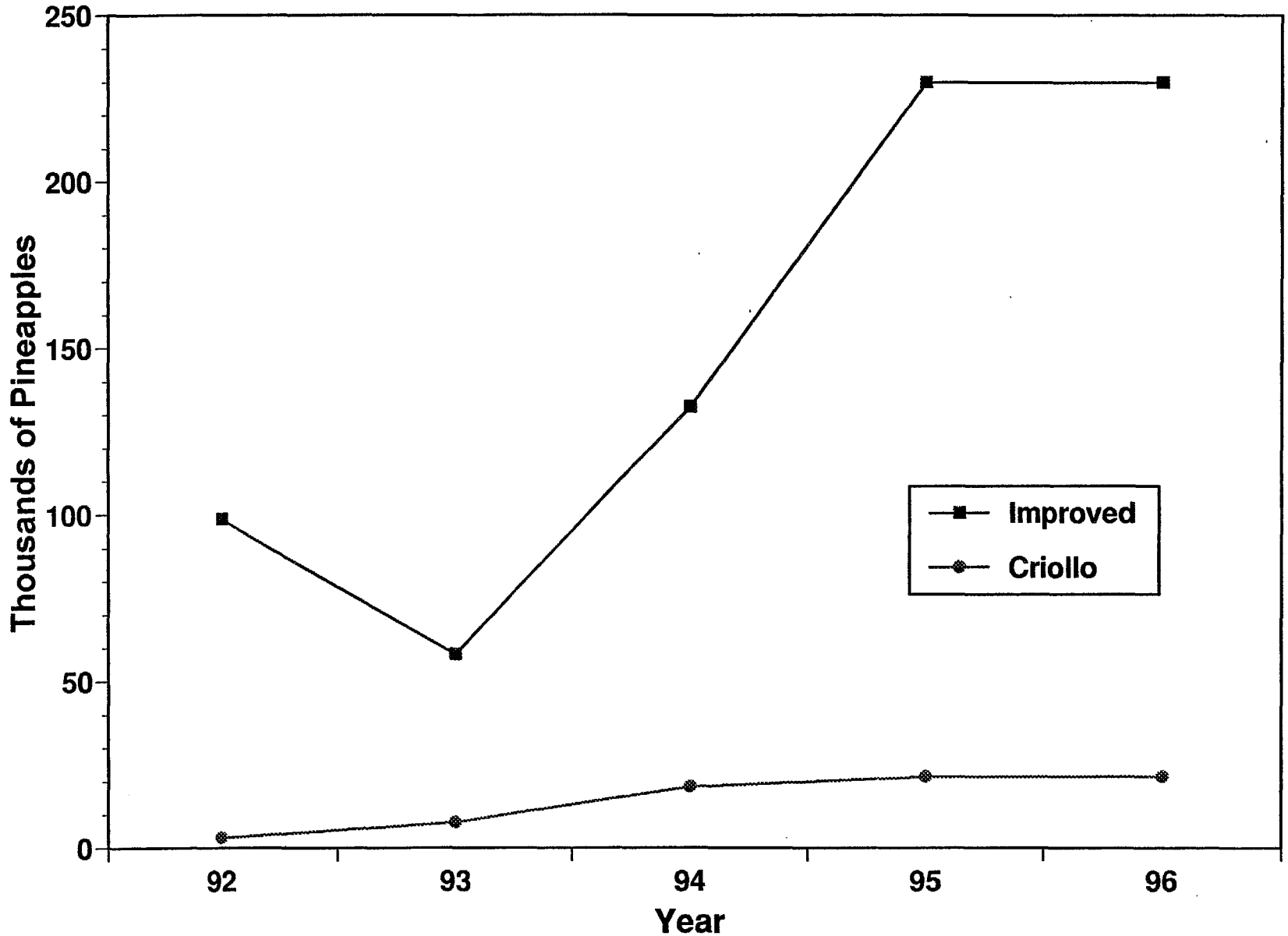
Graph 14

Estimated Historic and Projected Yields of Pineapples Surveyed Farms With Continued Plantings in Central San Gabriel



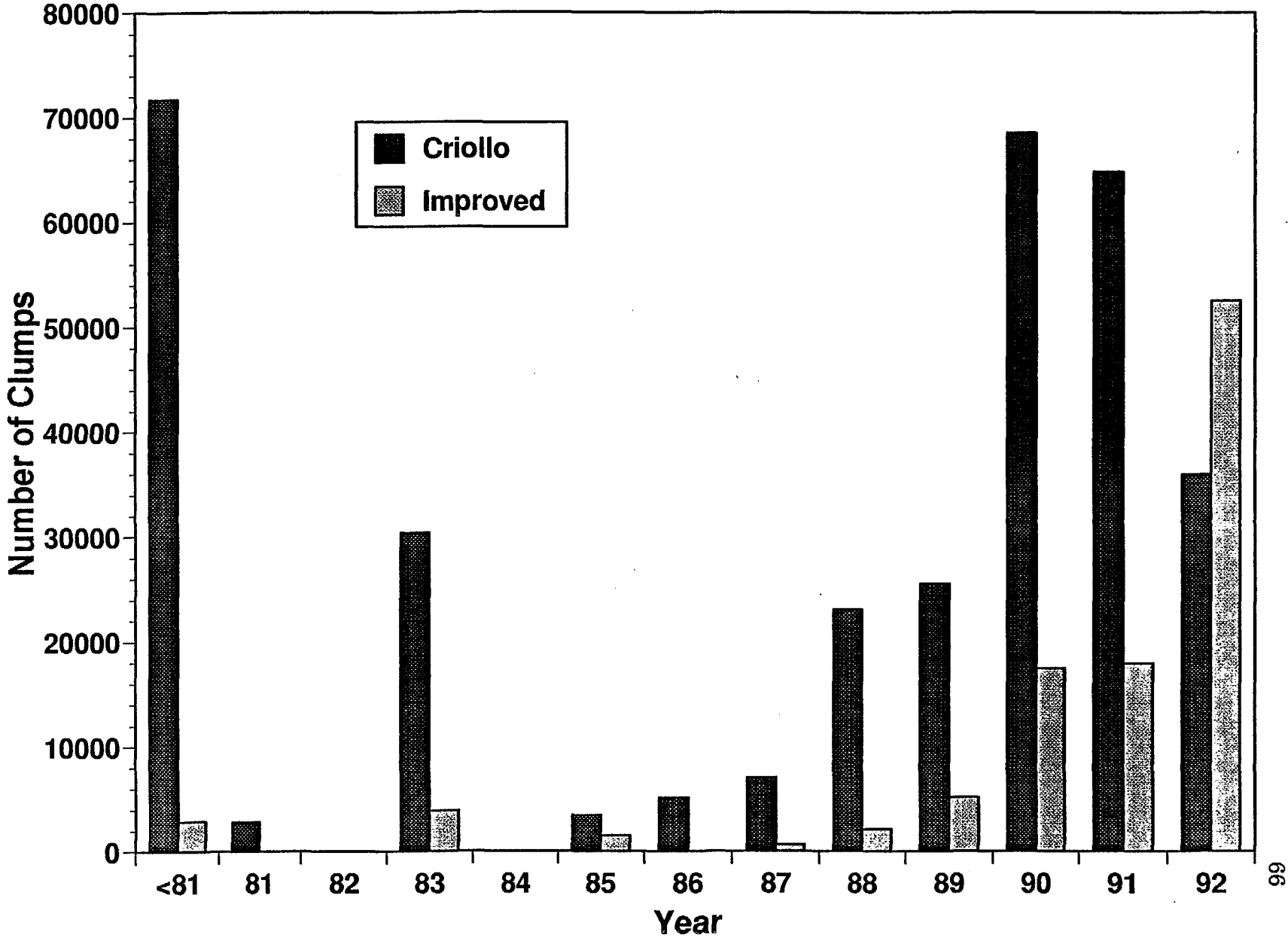
Graph 15

Estimated Historic and Projected Yields of Pineapples Surveyed Farms With Continued Plantings in Central Villa Nueva



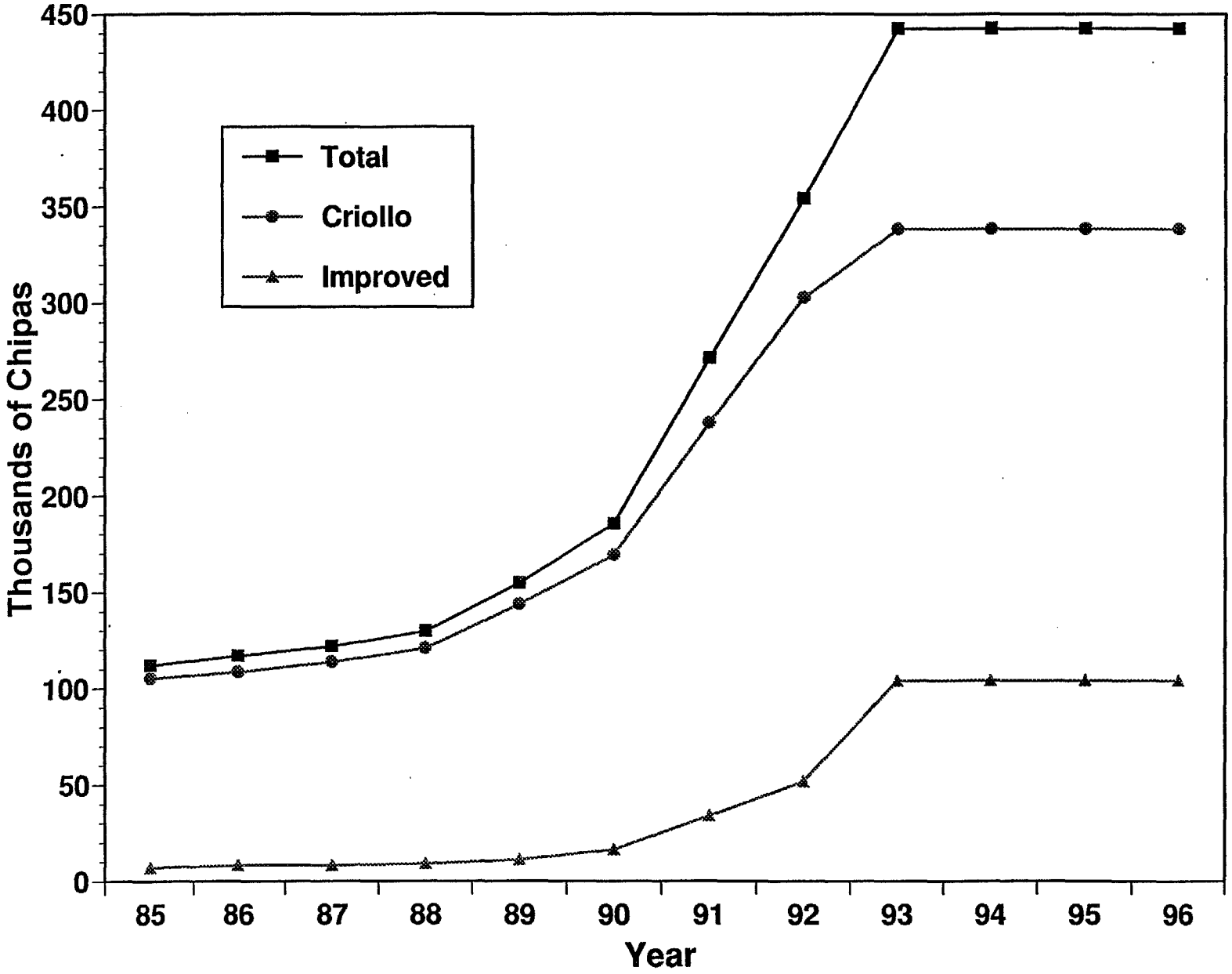
Graph 16

Historical Plantings of Bananas
Surveyed Farms in Central Ibuelo

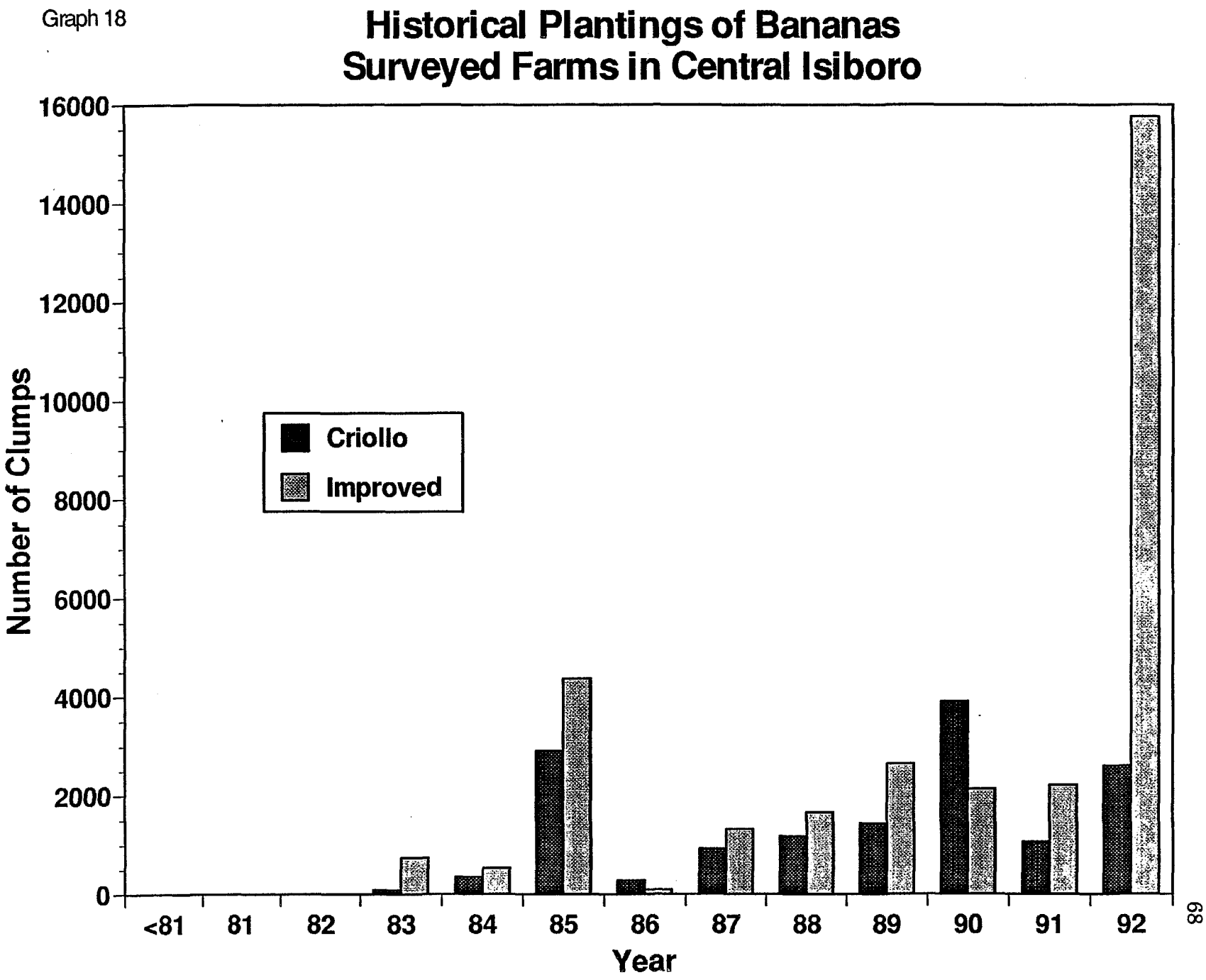


Graph 17

Estimated Historic and Projected Yields of Bananas Surveyed Farms Without New Plantings in Central Ibuelo

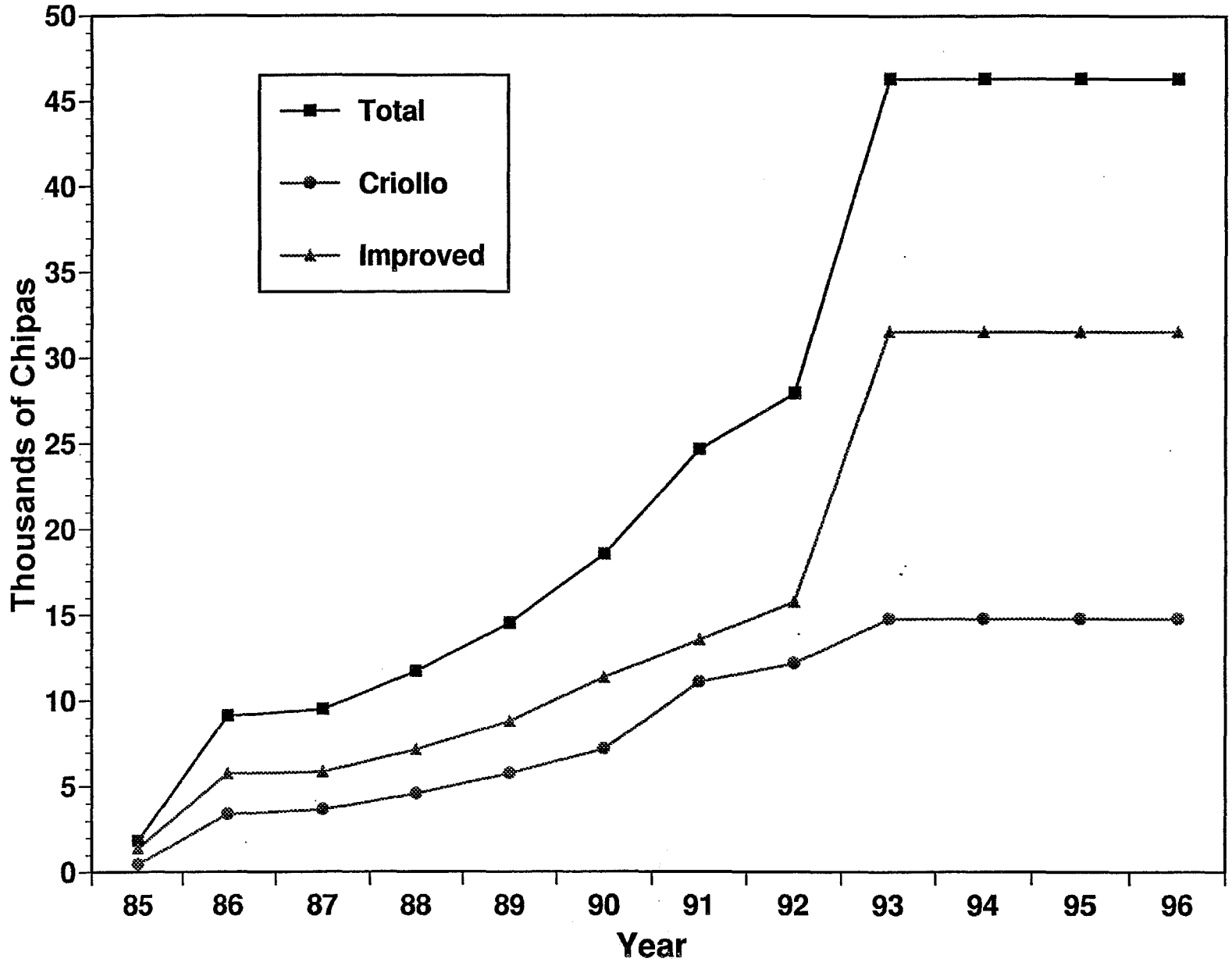


Graph 18


Historical Plantings of Bananas
Surveyed Farms in Central Isiboro
Number of Clumps
16000
14000
12000
10000
8000
6000
4000
2000
0
Criollo
Improved
<81
81
82
83
84
85
86
87
88
89
90
91
92
Year

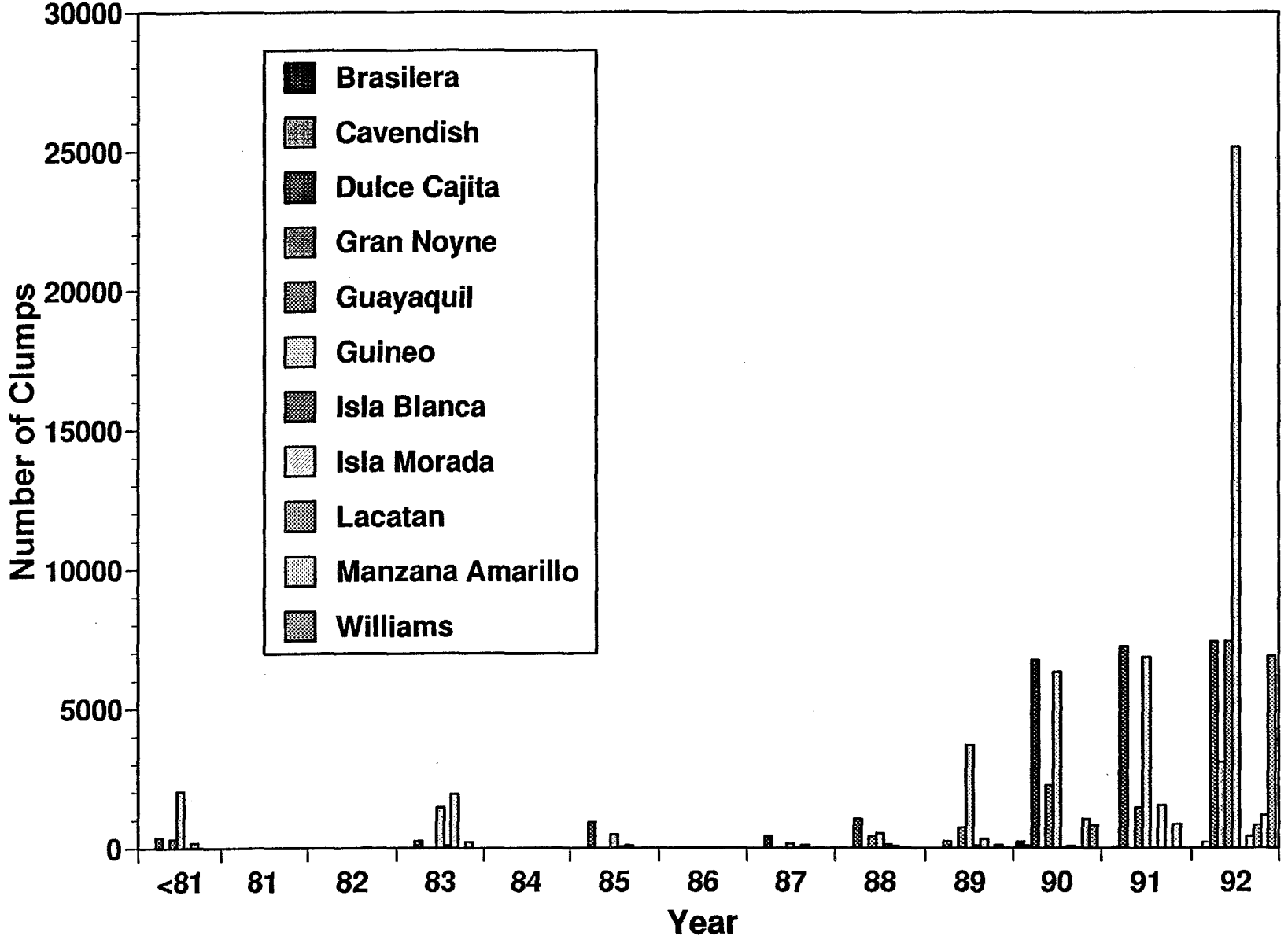
Graph 19

Estimated Historic and Projected Yields of Bananas Surveyed Farms Without New Plantings in Central Isiboro



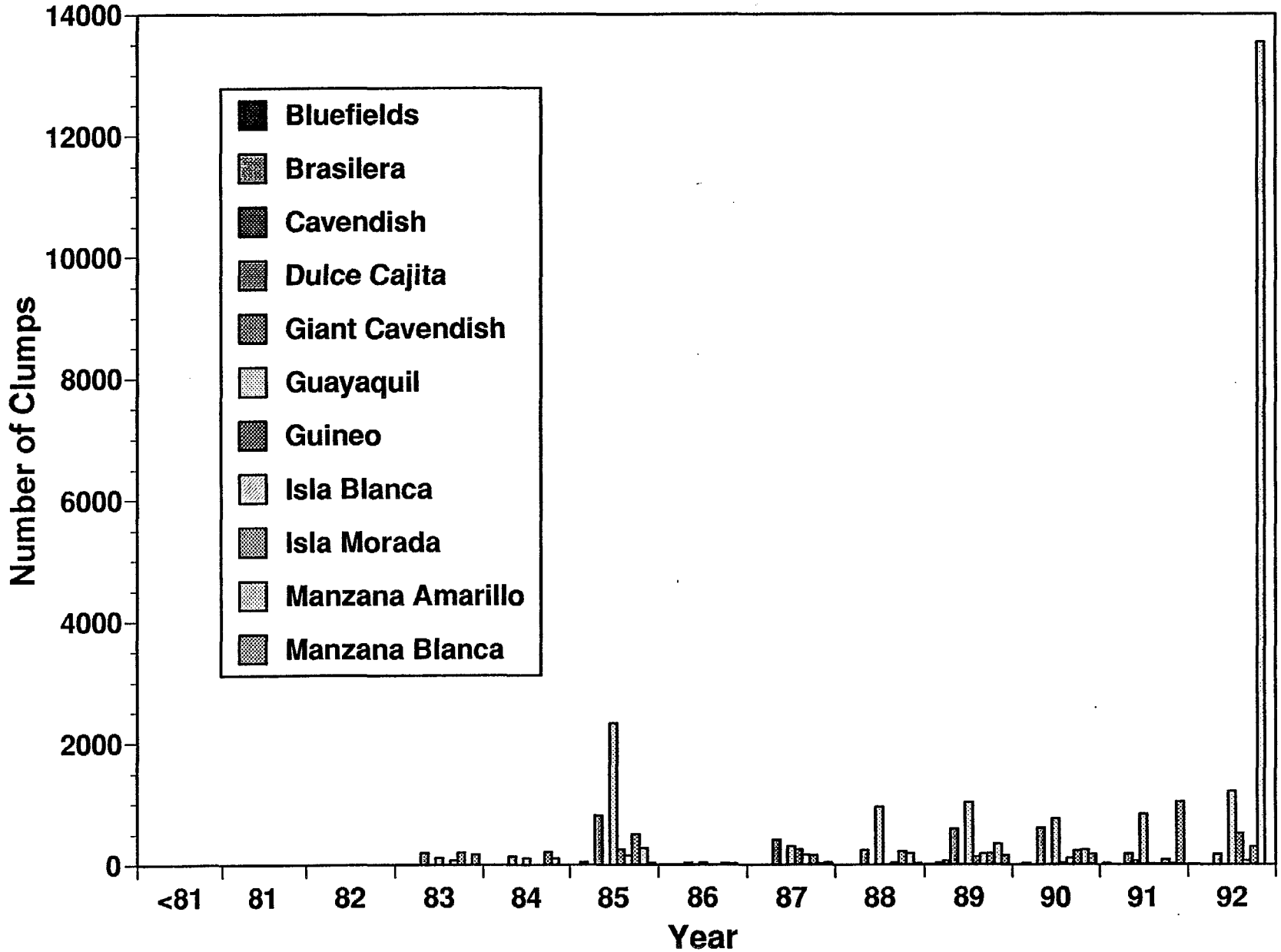
Graph 20

Historical Plantings of Improved Bananas Surveyed Farms in Central Ibuelo



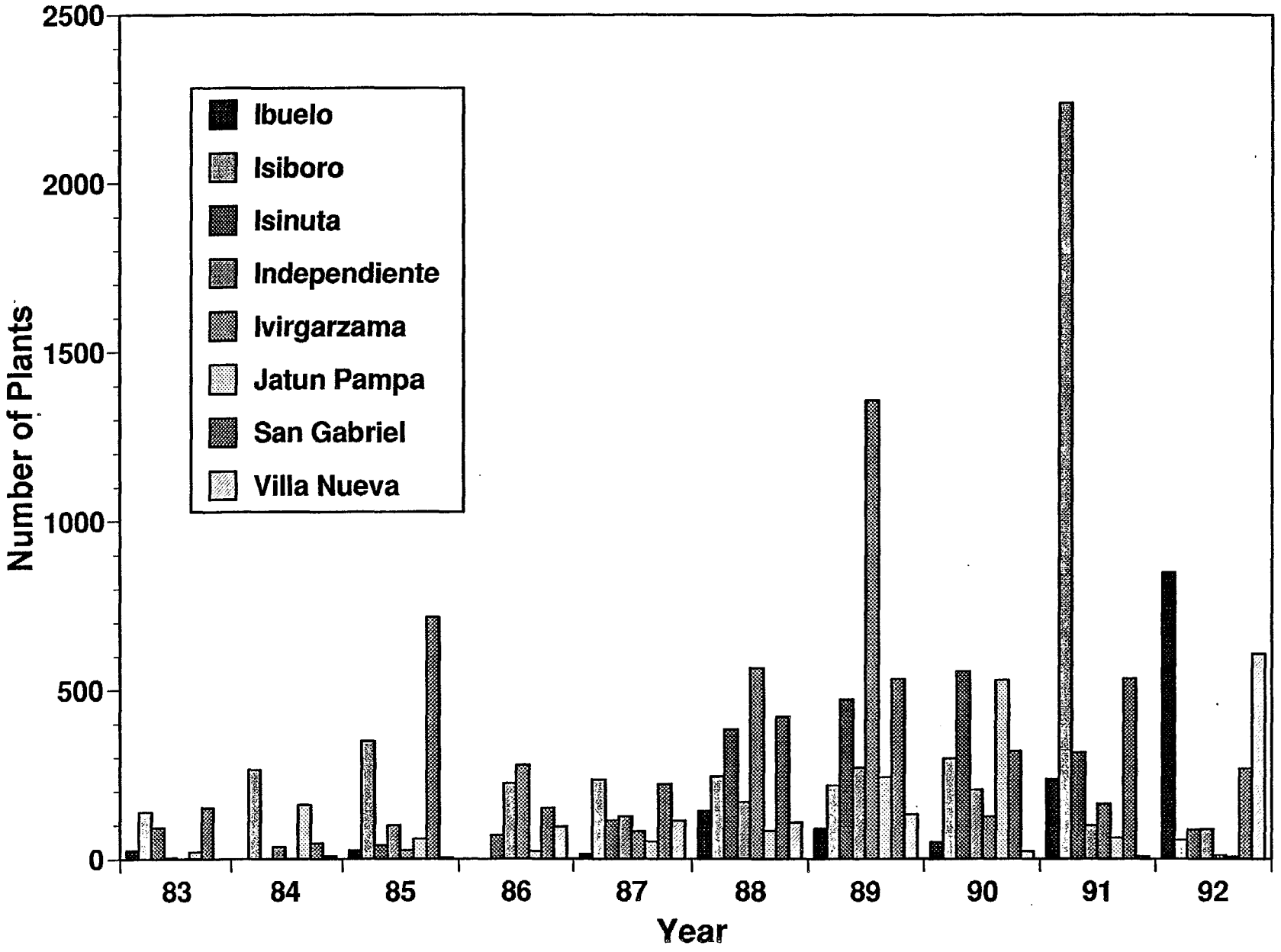
Graph 21

Historical Plantings of Improved Bananas Surveyed Farms in Central Isiboro



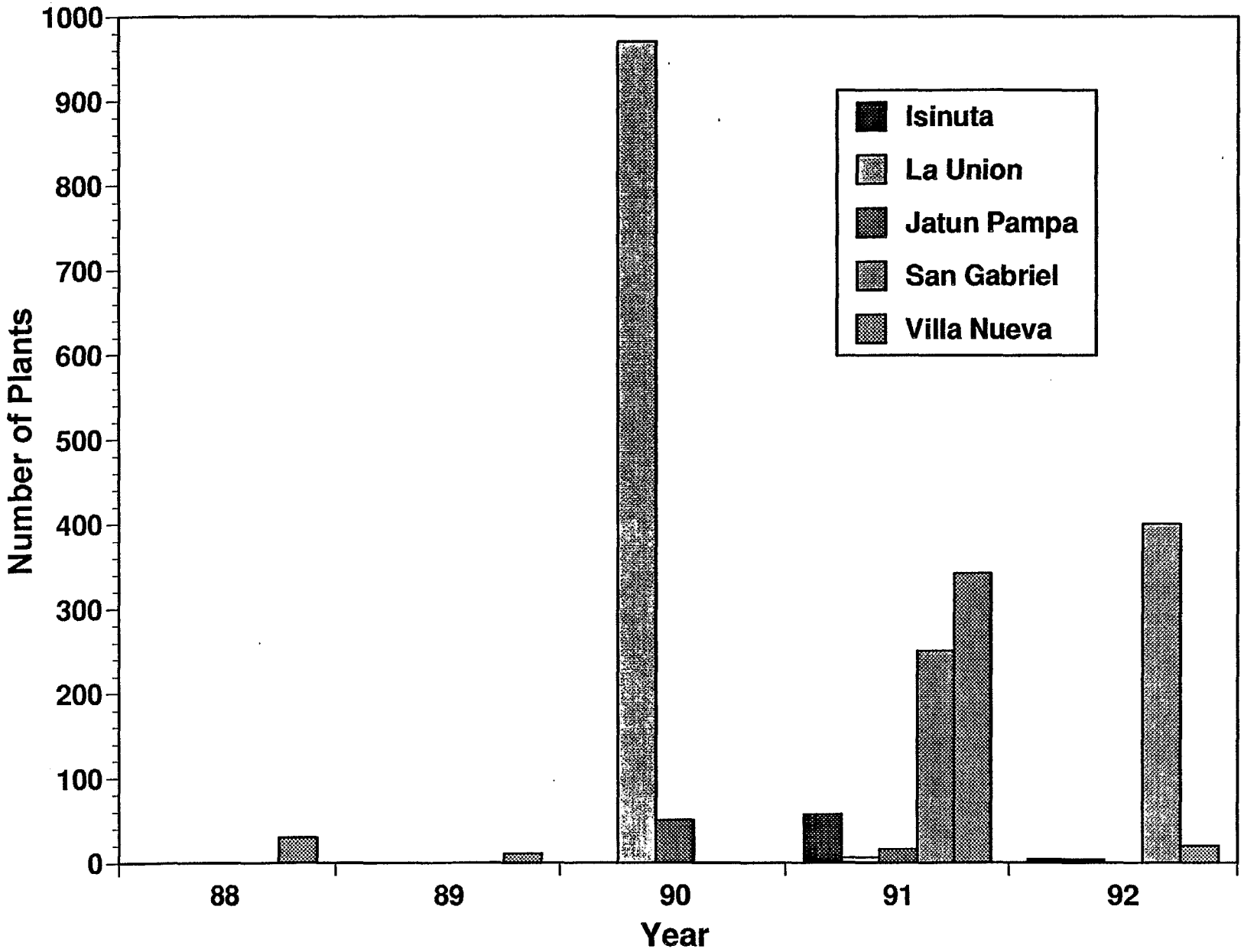
Graph 22

Historical Plantings of Annatto For Centrales With More Than 1,000 Plants



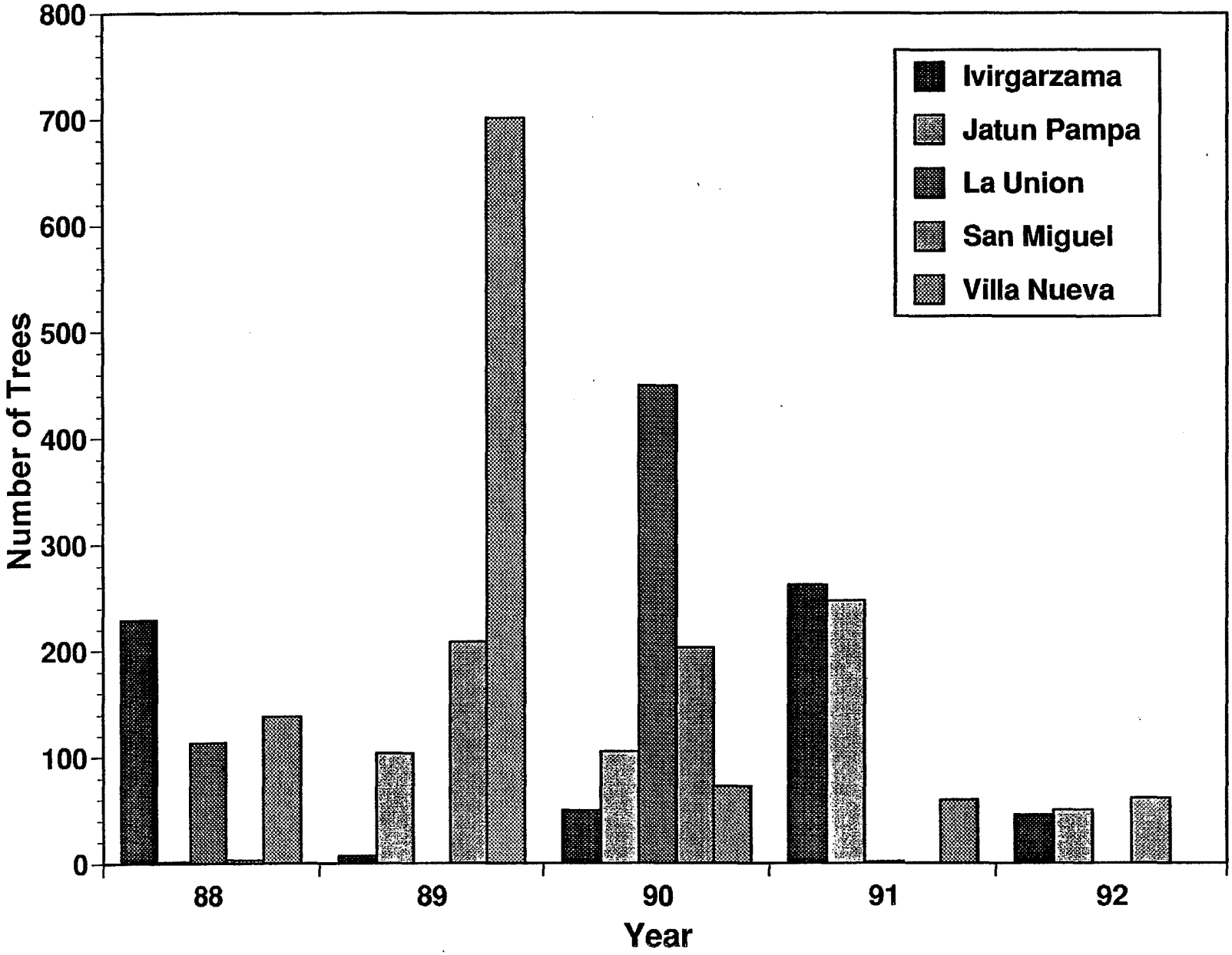
Graph 23

Historical Plantings of Black Pepper For Centrales With More Than 50 Plants



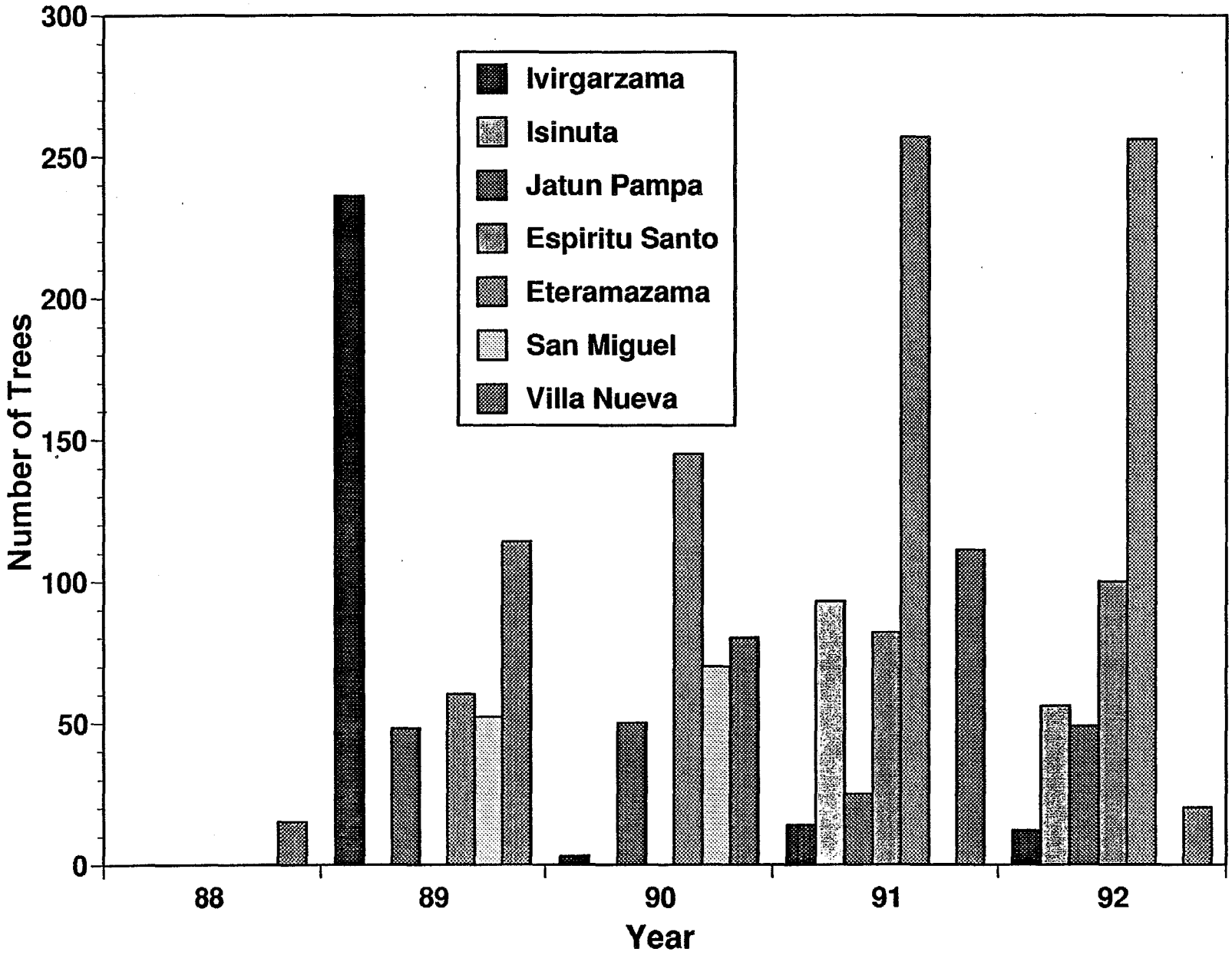
Graph 24

Historical Plantings of Coconuts For Centrales With More Than 500 Trees



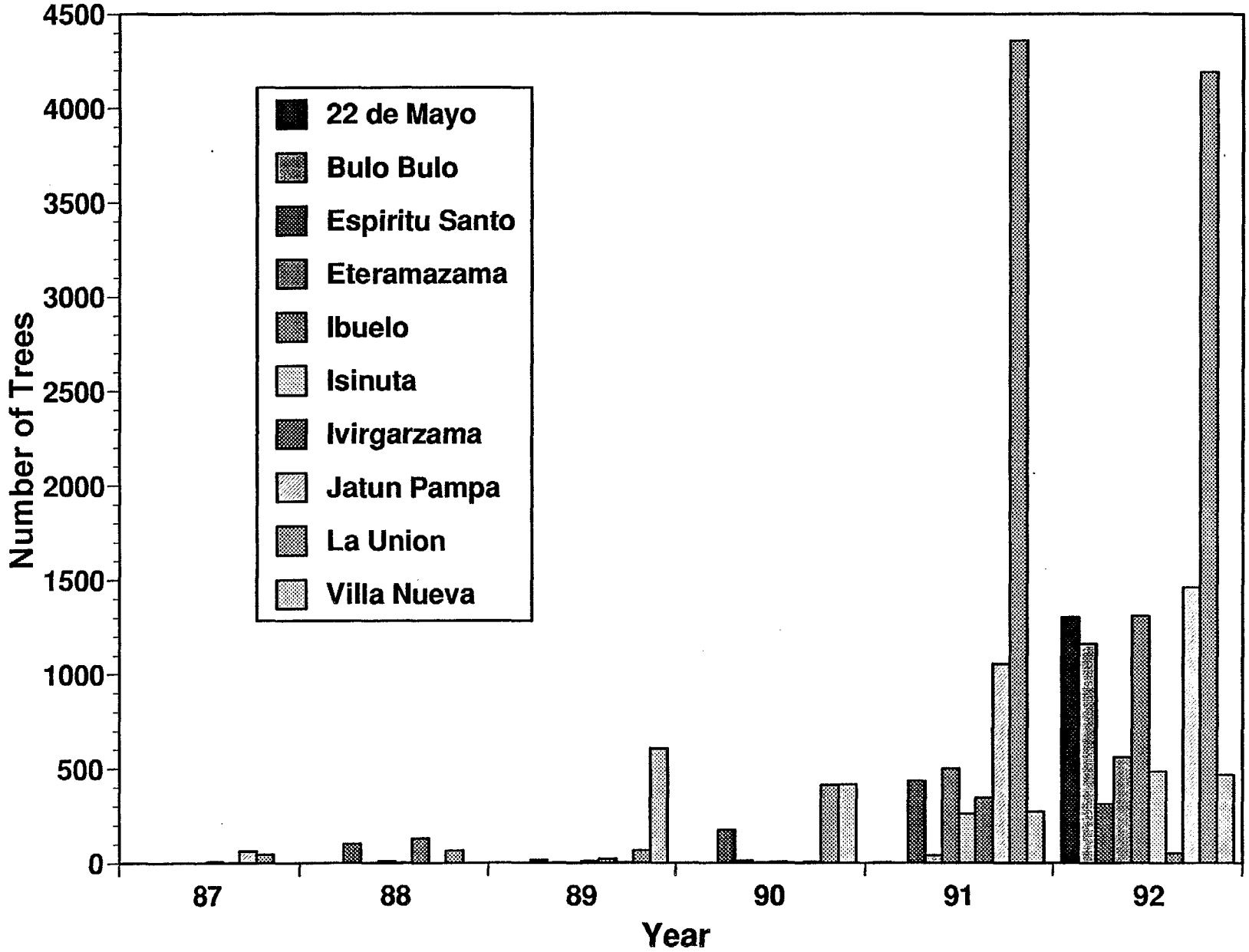
Graph 25

Historical Plantings of Macadamia For Centrales With More Than 100 Trees



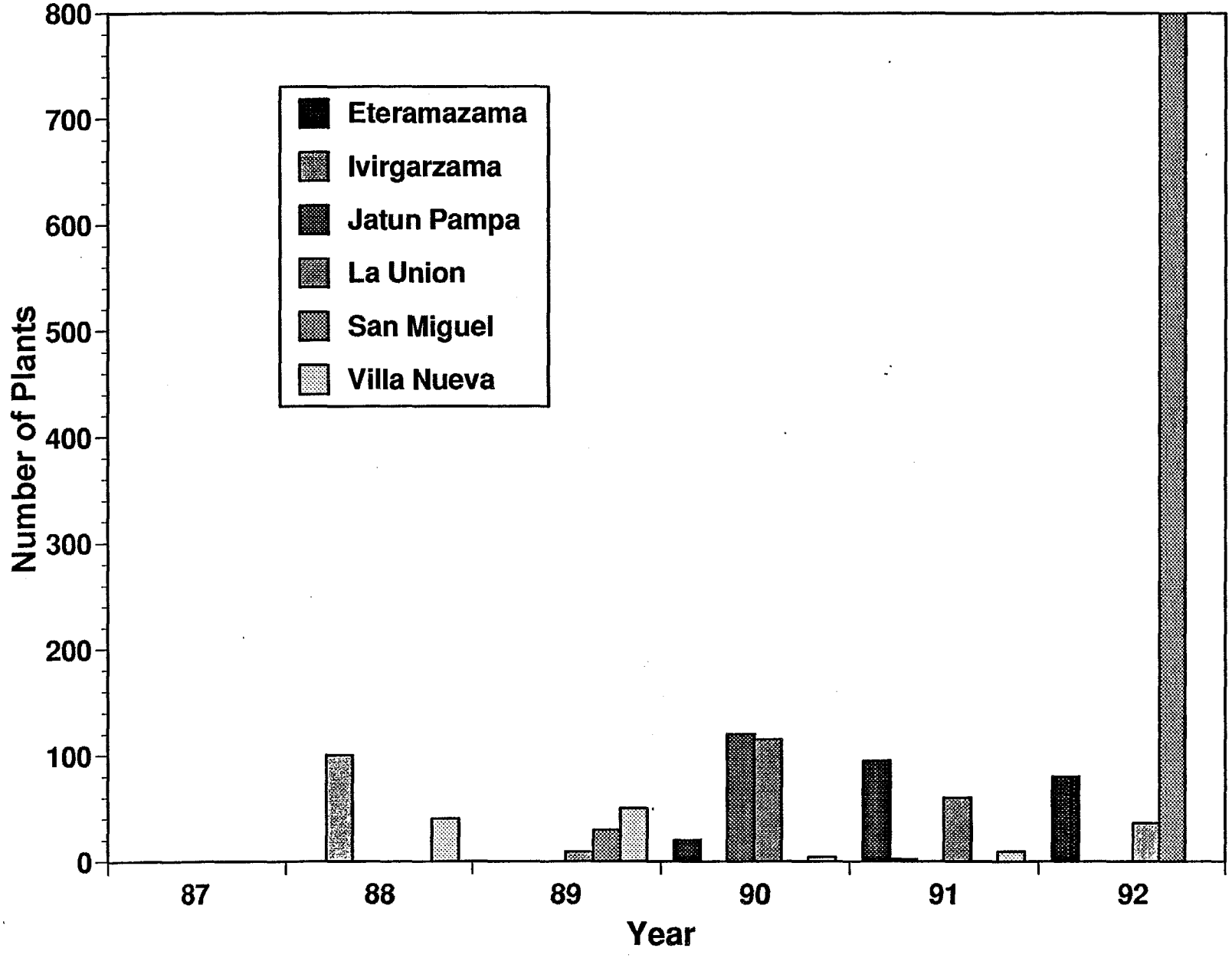
Graph 26

Historical Plantings of Improved Varieties of Peach Palms For Centrales With More Than 500 Trees



Graph 27

Historical Plantings of Soursop For Centrales With More Than 100 Plants



H. Genetic Materials

For this document, genetic material was reported by *central* by the IMIS. An example of the system-generated report in found on page 80 in Exhibit 4. Table 15 on the following page summarizes data from the genetic materials report, which is contained in Appendix S. Table 15 lists separately the amounts of genetic material surveyed from the nurseries at the two experimental stations and the amounts of genetic material surveyed from private nurseries and from cooperatively owned nurseries. This second category is further divided by subregions. It is important to note that only nurseries with **commercial** levels of genetic material were surveyed. Many farmers have their own small nurseries with which to produce material for their own farms. Consequently, the plant material represented in Table 15 is not a reflection on the amounts of new plants being sown, but rather a reflection on the potential for a different source of income for the farmers and on the extent to which the private sector is assuming a role previously filled by IBTA.

Not surprisingly, the types of crops found in nurseries in the various Subregions reflect the agriculture of that area. For example, Subregion 1 almost exclusively has citrus nurseries, whereas the contents of the nurseries in Subregion 4 reflect the wide variety of crops being explored in that area. The presence of these nurseries are also indicative of the successfulness of the project in promoting new technologies. Note, for example, that in every subregion there is at least some mandarin. Mandarin, particularly the Cleopatra variety, is used as a root stock upon which the improved varieties of oranges are grafted. Thus, Table 15 provides yet more evidence of the growing acceptance of improved variety oranges and of the growing technical knowledge that must accompany this acceptance. Furthermore, the data contained in Table 15 suggests that the private sector is beginning to replace the function of the experimental stations in terms of propagating and distributing genetic material. This is a very positive result.

There is also support here for the conclusion that many of the plants and improved varieties that IBTA has been promoting have firmly taken root in the Chapare, so to speak. Quantities of many of the crops found in nurseries equal or exceed quantities at the experimental stations. Furthermore, there are undoubtedly more nurseries in the *centrales* not surveyed, and consequently the amount of material available from non-project sources will be greater than the numbers reported in Table 15. Although the IMIS survey did not find huge amounts of improved variety peach palm (no more than 16,000 trees), the amount of peach palm found in nurseries suggest that there is much interest in cultivating this crop. The number of pineapple suckers surveyed also suggests that farmers no longer rely on IBTA as their sole source of improved variety pineapple. Unfortunately, it must be noted here that a number of the surveys of pineapple nurseries reported problems with fusarium, and that they would be forced to destroy the infected suckers.

Table 16, which is found on pages 82 through 85, was constructed for the purpose on identifying what genetic material is available when and where. Most of the information contained in Appendix S is contained in these four pages. Table 16 identifies all of the genetic material by crop, variety, age at the time it was surveyed, age as of 20 September 1993 (the date at which the genetic material report was run), the quantity surveyed and the *central* in which it is located. Also provided is a column for the quantity of genetic material intended to be sold. The data regarding the intended use of the genetic material

was not collected in either Central Villa Nueva or Agraria La Union, both of which have many nurseries, and which were the *centrales* surveyed during the first survey effort. This information was added to the survey subsequently. Nurseries which reported that none of their material was for sale did so for two reasons. In some cases, the material is for distribution or sale among cooperative members, but not the general public. In the IMIS, the quantities of material in good, regular and poor conditions were recorded. In many cases, those quantities listed as in poor condition were not intended to be used by the nursery or to be sold, but rather, were earmarked for destruction.

Exhibit 4. Report: "Nursery Crops for a Central"

CORDEP IMIS Nursery Report
Nursery Crops by Central - Sep/20/1993

Central: ETERAMAZAMA
Crop Variety
PINEAPPLE CAYENA LISA

Month	Good	Fair	Poor	Total	Own Use	Sell
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	5000	10000	5000	20000	5000	15000
10	0	0	0	0	0	0
11	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0
21	0	0	0	0	0	0
22	182796	38844	6854	228494	0	0
23	0	0	0	0	0	0
24	0	0	0	0	0	0
25	0	0	0	0	0	0
26	0	0	0	0	0	0
27	0	0	0	0	0	0
28	26366	5603	989	32958	0	0
29	0	0	0	0	0	0
30	0	0	0	0	0	0
31	0	0	0	0	0	0
32	0	0	0	0	0	0
33	0	0	0	0	0	0
34	0	0	0	0	0	0
35	0	0	0	0	0	0
36	0	0	0	0	0	0
37	0	0	0	0	0	0
38	0	0	0	0	0	0
39	0	0	0	0	0	0
40	0	0	0	0	0	0
41	0	0	0	0	0	0
42	0	0	0	0	0	0
43	0	0	0	0	0	0
44	0	0	0	0	0	0
45	0	0	0	0	0	0
46	0	0	0	0	0	0
47	0	0	0	0	0	0
48	0	0	0	0	0	0
> 48	0	0	0	0	0	0

Page 51

Table 15. Numbers of Plants by Crop Surveyed from Farmer Owned Nurseries and from the Experimental Stations

			Farmer Stock by Subregion						
	Exp. Stations	Farmer Total	1	2	3	4	5	6	7
Annatto	14,000	0	0	0	0	0	0	0	0
Banana	9,593	23,600	0	0	23,600	0	0	0	0
Black Pepper	473	927	0	0	0	927	0	0	0
Brazilian Apple	0	20	0	0	0	20	0	0	0
Cocoa	0	2,400	0	2,000	0	400	0	0	0
Coconut	0	10	0	10	0	0	0	0	0
Coffee	140,000	5,000	0	5,000	0	0	0	0	0
Grapefruit	0	2,500	2,500	0	0	0	0	0	0
Lime	3,100	700	0	0	0	700	0	0	0
Macadamia	8,900	2,200	0	2,200	0	0	0	0	0
Mandarin	165,094	65,956	3,000	39,150	6,235	9,786	1,750	530	4,905
Oranges	6,444	32,682	2,500	0	0	3,182	3,200	0	1,200
Ornamentals	0	737	0	0	0	600	0	137	0
Passion Fruit	0	5,860	0	0	0	560	0	5,300	0
Peach Palm	190,000	133,236	280	0	34,025	46,907	50,524	0	0
Pineapple	244,000	320,442	0	0	30,100	290,342	0	0	0
Rough Lemon	0	16,258	0	0	0	0	0	98	0
Soursop	8,600	1,200	0	0	0	1,200	0	0	0
Sweet Potato	5,000	0	0	0	0	0	0	0	0
Walusa	3,200	0	0	0	0	0	0	0	0
Yuca	39,996	0	0	0	0	0	0	0	0

9/93

Table 16. Surveyed Genetic Material by Crop, Variety, Age, Quantity and Location

Crop	Variety	Age in Months as surveyed	Age in Months as of 9/93	Quantity Surveyed	Quantity For Sale	Location
Banana						
	Gran Enano	1	5	6,130		Ibuelo
	Gran Enano	3	7	9,915		Ibuelo
	Gran Noyne	4	8	2,613		Ibuelo
	Gran Noyne	6	10	1,111	0	Experimental Stations
	Mocataqui	25	29	5,357	0	Experimental Stations
	Williams	3	7	4,942		Ibuelo
Citrus						
Grapefruit						
	Unknown	8	12	2,500	0	San Miguel
Lime						
	Sutil	3	7	549	549	Isinuta
	Sutil	6	10	91	91	Isinuta
	Tahiti	7	11	3,100	1,000	Experimental Stations
	Unknown	14	18	60	0	La Union
Mandarin						
	Cleopatra	4	8	1,500	0	Ibuelo
	Cleopatra	8	12	80,000	40,000	Experimental Stations
	Cleopatra	9	13	700		Villa Nueva
	Cleopatra	9	13	20,000	18,000	Experimental Stations
	Cleopatra	12	16	1,900	0	La Union
	Cleopatra	12	16	530	0	Ivirgarzama
	Cleopatra	13	17	50,000		Experimental Stations
	Cleopatra	16	20	60	0	La Union
	Cleopatra	19	23	1,250		Villa Nueva
	Cleopatra	20	24	20,000		Villa Nueva
	Cleopatra	21	25	3,000	0	San Miguel
	Cleopatra	21	25	7,000		Villa Nueva
	Cleopatra	22	26	2,700		Villa Nueva
	Cleopatra	24	28	5,320		Isinuta
	Cleopatra	25	29	1,750		Espiritu Santo
	Cleopatra	28	32	7,000		Villa Nueva
	Cleopatra	33	37	500		Villa Nueva
	Criollo	10	14	300		Villa Nueva
	Criollo	12	16	1,735	1,335	Ibuelo
	Criollo	16	20	3,000	2,000	Ibuelo
	Honey	6	10	1,976	1,976	Experimental Stations
	Honey	11	15	300		Villa Nueva
	Honey	37	41	56	0	Experimental Stations
	Kara	7	11	1,376		Experimental Stations
	Kara	37	41	56	0	Experimental Stations
	Limon	7	11	2,527	800	Bulo Bulo
	Morocoche	10	14	878	300	Bulo Bulo

Mandarins continued on the following page...

Table 16 Continued... Surveyed Genetic Material by Crop, Variety, Age, Quantity and Location

Crop	Variety	Age in Months as surveyed	Age in Months as of 9/93	Quantity Surveyed	Quantity For Sale	Location
Mandarins continued...						
	Poncan	7	11	3,750		Experimental Stations
	Poncan	10	14	1,500	350	Bulo Bulo
	Poncan	13	17	280		La Union
	Poncan	21	25	600		La Union
	Poncan	22	26	600		La Union
	Rey de Siam	3	7	890	890	Isinuta
	Rey de Siam	6	10	136	136	Isinuta
	Unknown	7	11	910		Experimental Stations
	Unknown	37	41	56	0	Experimental Stations
Oranges						
	Criollo	8	12	2,500	0	San Miguel
	Criollo	10	14	400		Villa Nueva
	Criollo	12	16	350		La Union
	Criollo	12	16	1,735	0	Ibuelo
	Criollo	16	20	3,000	0	Ibuelo
	Cutter Valencia	16	20	6,802		Experimental Stations
	Cutter Valencia	37	41	56	0	Experimental Stations
	Marrs Early	37	41	56	0	Experimental Stations
	Olinda Valencia	16	20	1,539		Experimental Stations
	Unknown	11	15	2,200	1,500	Jatun Pampa
	Unknown	16	20	1,000		Jatun Pampa
	Valencia Tardía	6	10	532	532	Isinuta
	Valencia Tardía	7	11	1,200	700	Bulo Bulo
	Valencia Tardía	7	11	3,229	3,000	Experimental Stations
	Valencia Tardía	11	15	200		Villa Nueva
	Valencia Tardía	14	18	700		La Union
	Valencia Tardía	16	20	20,000		Villa Nueva
	Valencia Tardía	21	25	1,000		La Union
	Valencia Tardía	22	26	2,000		Villa Nueva
	Valencia Tardía	22	26	600		La Union
	Valencia Tardía	37	41	1,676	0	Experimental Stations
Rough Lemon						
	Criollo	11	15	18	0	Ivirgarzama
	Criollo	15	19	500		Villa Nueva
	Criollo	16	20	200		Villa Nueva
	Criollo	17	21	1,100		Villa Nueva
	Criollo	18	22	600		Villa Nueva
	Criollo	18	22	80		Ivirgarzama
	Criollo	22	26	2,260		Villa Nueva
	Criollo	28	32	1,000		Villa Nueva
	Criollo	33	37	600		Villa Nueva
Pineapple						
	Cayena Lisa	4	8	10,000	0	Ibuelo
	Cayena Lisa	5	9	20,000	15,000	Eteramazama
	Cayena Lisa	11	15	244,000	120,000	Experimental Staions
	Cayena Lisa	18	22	228,494		Eteramazama
	Cayena Lisa	24	28	32,958		Eteramazama

Pineapple continued on the following page...

Table 16 Continued... Surveyed Genetic Material by Crop, Variety, Age, Quantity and Location

Crop	Variety	Age in Months as surveyed	Age in Months as of 9/93	Quantity Surveyed	Quantity For Sale	Location
Pineapple continued...						
	Pucalpa	4	8	20,000	0	Ibuelo
	Pucalpa	10	14	8,890	8,890	Eteramazama
	Unknown	28	32	100		Chimore
Other Alternative Crops						
Annatto						
	Improved	7	11	14,000		Experimental Staions
Black Pepper						
	Balancota	6	10	473		Experimental Staions
	Balancota	13	17	927	867	Eteramazama
Brazilian Apple						
	Criollo	17	21	20		La Union
Cocoa						
	Hybrid	6	10	400		La Union
	Hybrid	28	32	2,000		Villa Nueva
Coconut						
	Filipino Enano Verde	34	38	10		Villa Nueva
Coffee						
	Caturra	9	13	140,000		Experimental Stations
	Caturra	28	32	5,000		Villa Nueva
Macadamia						
	Integrifolia 344	3	7	200	200	Experimental Stations
	Integrifolia 508	3	7	200	200	Experimental Stations
	Integrifolia 350	28	32	2,000		Villa Nueva
	Tetraphylia	5	9	3,000		Experimental Stations
	Tetraphylia	9	13	4,700	700	Experimental Stations
	Tetraphylia	16	20	800		Experimental Stations
	Unknown	23	27	100		Villa Nueva
	Unknown	33	37	100		Villa Nueva
Ornamentals						
	Others	6	10	15	9	Ivirgarzama
	Chiflera	10	14	26	12	Ivirgarzama
	Croton	10	14	56	48	Ivirgarzama
	Marginatas	10	14	40	10	Ivirgarzama
	Others	22	26	600		La Union
Passion Fruit						
	Flavicarpa Amarilla	3	7	1,800	1,800	Ivirgarzama
	Flavicarpa Amarilla	6	10	3,500	0	Ivirgarzama
	Unknown	13	17	500		La Union
	Unknown	17	21	60		La Union

Table 16 Continued... Surveyed Genetic Material by Crop, Variety, Age, Quantity and Location

Crop	Variety	Age in Months as surveyed	Age in Months as of 9/93	Quantity Surveyed	Quantity For Sale	Location
Peach Palm						
	Imp. Smooth	0	4	1,500		Villa Nueva
	Imp. Smooth	6	10	100	0	San Miguel
	Imp. Smooth	10	14	180	0	San Miguel
	Imp. Smooth	13	17	6,554		La Union
	Improved Spiny	2	6	137		Ibuelo
	Improved Spiny	2	6	1,264		Jatun Pampa
	Improved Spiny	4	8	33,888	32,870	Ibuelo
	Improved Spiny	5	9	49,260		Jatun Pampa
	Improved Spiny	13	17	9,831		La Union
	Unknown	2	6	15,665	0	Independiente
	Unknown	3	7	751	0	Independiente
	Unknown	4	8	13,106	0	Independiente
	Unknown	11	15	19,000	17,600	Experimental Stations
	Unknown	22	26	1,000		La Union
Soursop						
	Improved	7	11	8,600		Experimental Stations
	Improved	16	20	1,200		La Union
Sweet Potato						
	Unknown	4	8	5,000	3,000	Experimental Stations
Walusa						
	Unknown	13	17	3,200	2,000	Experimental Stations
Yuca						
	Amarilla	11	15	2,856	1,428	Experimental Stations
	Blanquita	11	15	1,428	1,428	Experimental Stations
	Boboré	11	15	1,428	0	Experimental Stations
	Noventon	11	15	1,428	0	Experimental Stations
	Suelakara	11	15	1,428	0	Experimental Stations
	Unknown	11	15	30,000	18,000	Experimental Stations
	Valencia	11	15	1,428	0	Experimental Stations

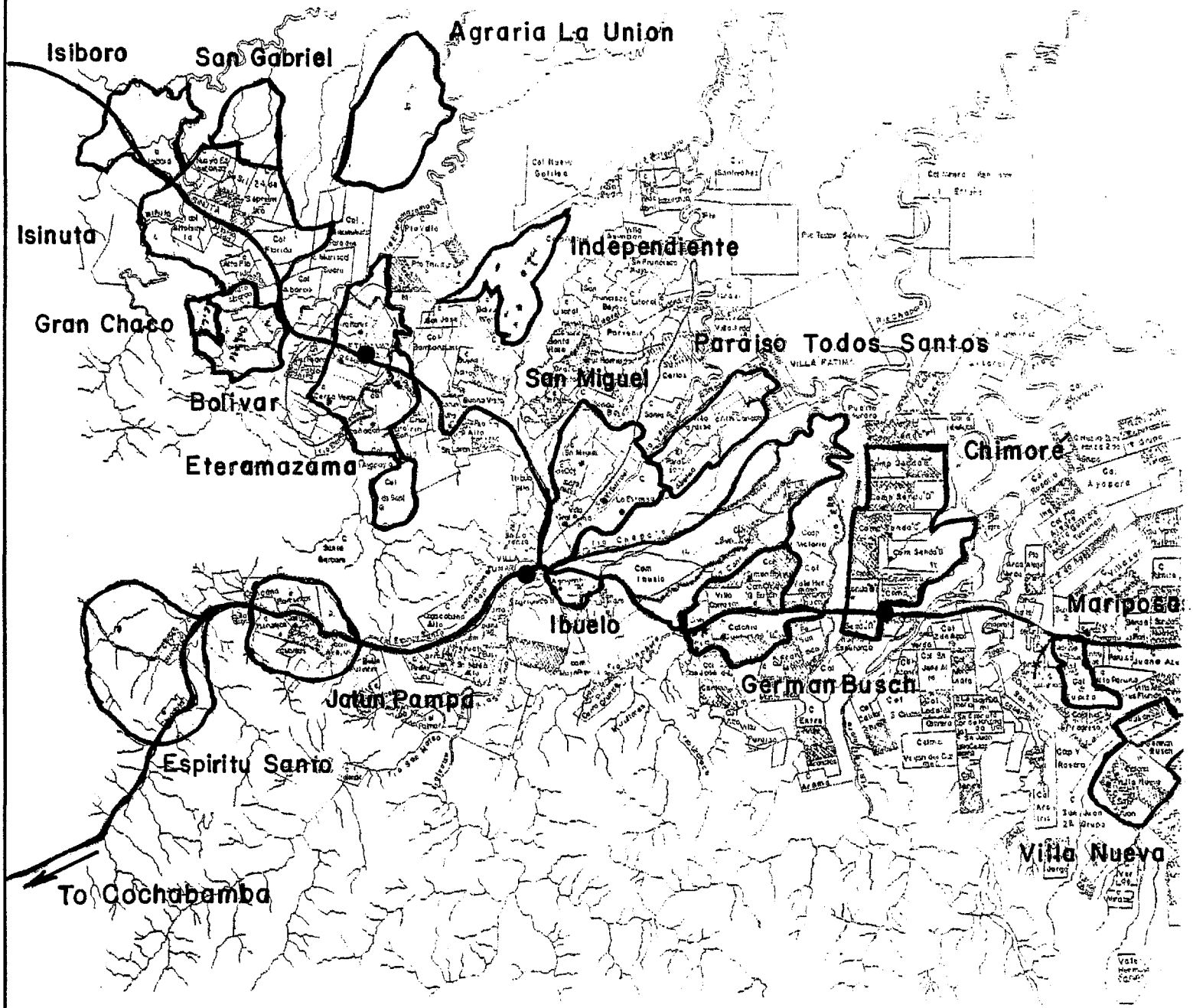
V. Final Comments

It must be concluded that in many respects alternative agriculture is definitely developing in the Chapare. Additionally, there is evidence supporting the conclusion that the CORDEP project has had a positive effect on this development. This evidence includes the increased plantings of improved varieties and new crops, the increasing quantity of production in the Chapare and the development of private nurseries propagating and distributing the crops and varieties introduced by IBTA. Of course, evidence such as the presence of some improved varieties prior to the project suggests that not all development in the Chapare can be attributed to the CORDEP project.

As emphasized at many points in this report, levels of production of all crops are increasing in the Chapare - more than previously suspected, for some. Based on observations in the field and the data collected in the IMIS survey, it appears that one thing that would have a significant impact on the farmers' ability to market their produce would be the development and/or improvement of infrastructure. This was the most common comment made by surveyed farmers from all areas. Whereas markets have a way of developing themselves when there is a ready supply, they can never develop if the produce can't leave the farm.

It is strongly recommended that the extra data collected during the IMIS survey not currently contained in the system be inputted. This data includes information that quantifies farmer participation in CORDEP-sponsored agricultural courses, farmer contact with various agencies, the problem/comment fields associated with farms, crops and animals recorded on the surveys and the marketing information, which includes quantities of crops sold in 1992, their prices and places sold. This data, which was not required in the IMIS system by contract, will be highly informative in terms of quantifying the effect of the CORDEP project on agricultural production in the Chapare and providing an equally important view of the current marketing of that production.

Finally, the Chapare communities and individuals that participated in the IMIS survey did so based on the promise that their data from the IMIS system would be returned to them. This includes reports and analyses made for each individual farm, each syndicate and each *central*. The understanding between The Mitchell Group and the Chapare farmers was that they would use their information to understand what they individually and collectively have, and to begin to plan and strategize the production and marketing of their own produce. It is the farmers' desire to take destiny into their own hands that must be cultivated by the project, for this is true development. Because the publication of this information is understandably a very large project (7535 farms, 217 syndicates and 20 *centrales*), and in gratitude to the farmers for their enthusiastic participation in the survey, The Mitchell Group has offered to ARD/Cochabamba to assist in the publishing of these documents.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San Gabriel
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Independiente
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Paraiso Todos Santos
San Miguel
Bolivar
Chimore
Eteramazama
Ibuelo
Mariposa
Jatun Pampa
German Busch
Espiritu Santo
Villa Nueva
To Cochabamba

Chapare and Neighboring Regions

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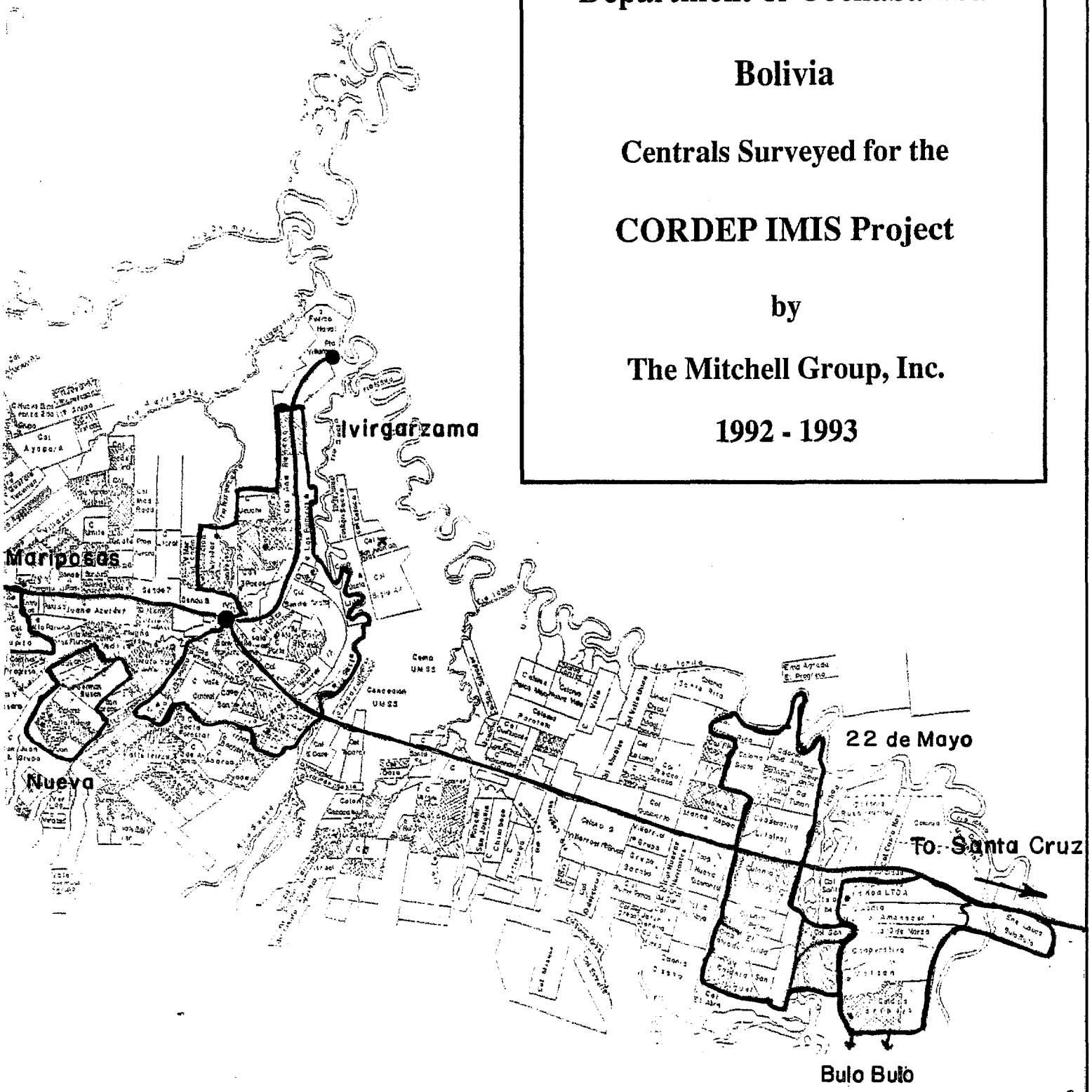

88