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9. ABSTRACT

Ex-Hacienda Toralapa is located near Tiraque in a predominantly agricultural area, the Upper Cochabamba Valley, on the main road between Cochabamba and Santa Cruz. At the 9,500 meter elevation of Toralapa, changes in the types of crops which are grown have been limited by the short growing season and the ever-present danger of frost. Despite these limitations, which are found over most of the areas in which the agrarian reform has been most important, dramatic changes have taken place in agricultural production, land ownership, distribution of wealth and income, and the acculturation and integration of Bolivian campesinos into the national society. These changes are the product of an agrarian revolution in which campesinos expelled the landowning class from the Upper Valley and adamantly and successfully opposed their return. The immediate result of the reform was to transfer ownership rights to campesinos over the land they had formerly held as usufruct plots under the colonato system. Within a year or two after the MNR took power in 1952, campesino unions, or sindicatos, were formed throughout the countryside. Sindicatos became the instruments by which the land reform process spread from one area to another. Sindicato organizations were actively involved in bringing individual agrarian reform cases to their successful conclusions with the titling of land to the campesinos by the National Agrarian Reform Service, thus consolidating and expanding on initial gains achieved during the period of agrarian revolution.

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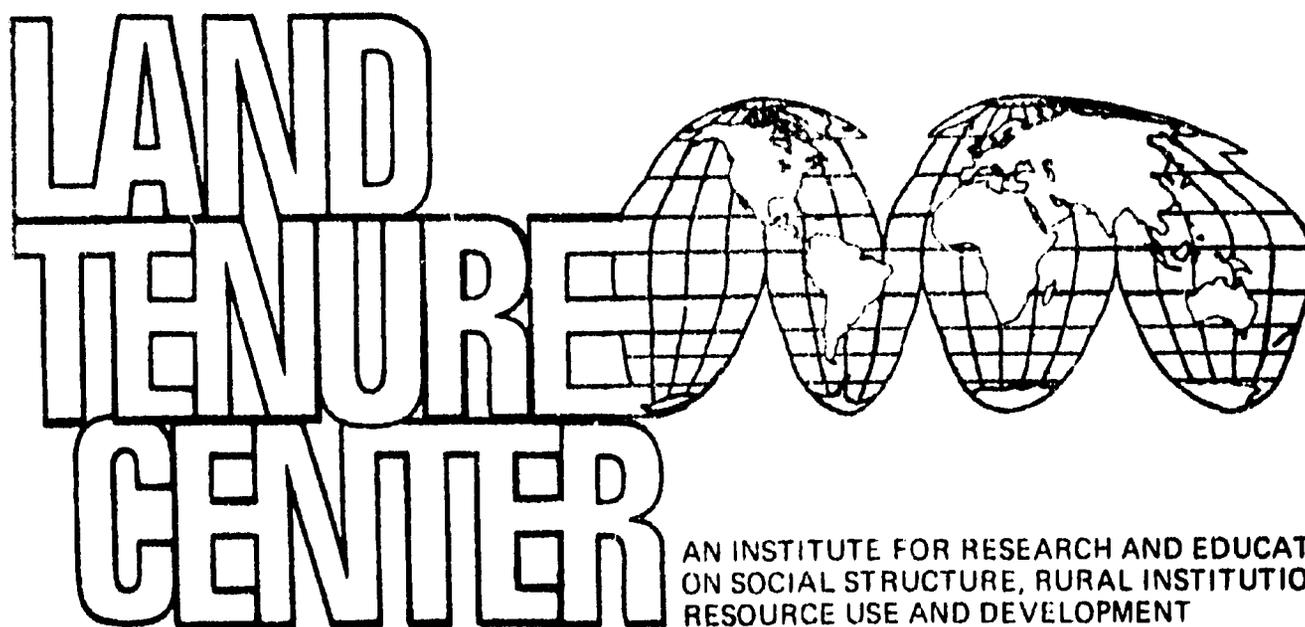
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# A RESEARCH PAPER

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A CASE STUDY OF EX-HACIENDA TORALAPA  
IN THE TIRAQUE REGION  
OF THE UPPER COCHABAMBA VALLEY

by  
JOSEPH F. DORSEY



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## PREFACE

The decision to do this case study was largely a response to statements by the research staff of the Bolivian Servicio Nacional de Reforma Agraria (SNRA) that no recent farm-level studies of the effects of the land reform on income, production, education, and the like were available. Much of the published macro-level information was inconsistent and contradictory both overtime and for the same year, with different government agencies providing widely differing estimates of any given characteristic. The case study approach had been followed by the LTC-CIDA team studying the Bolivian land reform between 1966 and 1970, under the direction of Dr. Ronald Clark. Katherine Barnes von Marschall and Luis Calderón S., head of the SNRA research section, encouraged me to restudy ex-hacienda Toralapa, located about 40 kms. up the valley from Cochabamba, high above the valley floor. At more than 3,000 meters above sea level, climatic conditions and crops grown on Toralapa are much like those found on the Altiplano, particularly in the Lake Titicaca region, with potatoes and other root crops, barley and other hardy grains, and broad beans predominating.

Background data on Toralapa, along with a wealth of tabular information, were available from work done by Dr. Marcelo Peinado\*; part of his work consisted of a household survey including data on production, income, consumption, labor, education, and traditional practices.

The panel design employed in the Lower Valley case study\*\* could not be duplicated for Toralapa since only half the original questionnaires could be found. Those available were copied (by hand!) by Paz Soto Dorsey and provided the basis for partial comparisons reported in this study. Aggregate data developed by Dr. Peinado did exist for most of the variables.

Pedro Guachalla and Roxana Castillo of the SNRA helped prepare duplicates of the 1967 questionnaires for use in the restudy. Colonel Amadeo

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\*Marcelo Peinado S., "Land Reform in Three Communities of Cochabamba, Bolivia" (Doctoral Dissertation in Agricultural Economics, University of Wisconsin-Madison, 1969).

\*\*"A Case Study of the Lower Cochabamba Valley: Ex-Haciendas Parotani and Caramarca" (Madison, Wis., November 1974). This study was done as part of the same project on comparative effects of land reform; field work on this case study immediately preceded the initiation of the Toralapa survey.

Saldías C., President of the SNRA, and Luis Calderón S. arranged for staff research worker Juan Torrico A. to accompany me to Cochabamba. There we met Hernán Torres Quiroz, the field worker who had conducted interviews for the LTC-CIDA team on all three of the ex-haciendas included in the two case studies. His agreement to rerun the same survey in effect made it possible to do both the Toralapa and the Lower Valley case studies, since the two months (July and August 1973) allotted for field work did not leave time for training a new interviewer in survey techniques. Particularly in Toralapa, where few heads of household can speak Spanish, interviews had to be conducted in Quechua, which from a methodological standpoint I thought preferable even in the Lower Valley where most campesinos speak Spanish at least well enough to get by.

Numerous friends at the Land Tenure Center provided help of various kinds while data was being analyzed and written up. Joanne Doehler did part of the coding and most of the key-punching. My advisor, Dr. William Thiesenhusen, has been extremely generous with his time in criticizing and helping me revise the manuscript. Jane Dennis typed and corrected most of the manuscript. John Padgett sacrificed a great deal of time in the rush to finish the case study.

Several present and past members of the Department of Agricultural Economics also helped with this study. Dr. Marcelo Peinado,\* whose thesis provided much of the background information, answered numerous questions about Toralapa over the phone. Dr. Stephen M. Smith, Research Associate in the Department, and Hernán Zeballos, a doctoral candidate and former director of the Instituto Nacional de Colonización, discussed numerous questions which arose and suggested changes in the manuscript. Many of these suggestions and criticisms have been incorporated into the study as it appears here, although perhaps not as many as should have been. Much of what the reader finds good in this study is because of help received from these friends; what's not should be blamed on me.

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\*Former graduate student in Agricultural Economics here; presently Professor, Department of Economics, Covell College, University of the Pacific.

I would like to extend my appreciation and thanks to the collaborating and supporting institutions: the Sindicato of Toralapa, the National Agrarian Reform Service, the World Bank (which supported field work), and the Land Tenure Center of the University of Wisconsin (which supported an extended write-up period). The opinions, conclusions, and recommendations I expressed here do not necessarily reflect those of the supporting or cooperating institutions, although I hope they will be helpful to these institutions in formulating policies that will benefit present and future campesino beneficiaries of the agrarian reform.

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## AREA: UPPER VALLEY EX-HACIENDA: TORALAPA

### I. Natural, Historical, and Economic Setting

#### A. The Natural Setting and Principal Markets

The Upper Valley rises in a generally westerly direction from Cochabamba from an altitude of less than 3,000 meters to more than 12,000 meters in less than 50 kilometers. The microclimates of individual farms in the region and even within farms is strongly dependent on altitude which, along with the availability of irrigation, is the major determinant of the crops which can be grown. An adequate system of improved gravel roads connects major market towns with Cochabamba, and the asphalt road connecting Cochabamba with Santa Cruz runs through the Upper Valley and by ex-hacienda Toralapa located about 45 km. west of Cochabamba at an altitude of 9,500 meters. An access road, passable virtually year-round, runs north from the center of population of Toralapa to the Cochabamba-Santa Cruz road, a distance of about 2 km. Tiraque, the largest town in the Province of Arani though not its capital, is located about 2 km. north of the highway.

Most marketing for ex-haciendas in the Upper Valley takes place in numerous market towns which have grown up since the reform. Pre-reform markets which were oriented to sales by landlords have declined in relative importance since the reform as a result of changes in the pattern of trade. Toralapa is perhaps slightly better off than most haciendas in the region. Punata has become the major agricultural and livestock market of the Upper Valley since the reform and is only about 20 km. distant from Toralapa. Toralapa also has ready access to other markets in the area, including fairs once a week in Tiraque and on the eastern end of the ex-hacienda itself by the main road.<sup>1</sup> Ability to market products is not a limiting factor for ex-haciendas in the Upper Valley, although market participation remains

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1. Telephone conversation (October 25, 1974) with Dr. Marcelo Peinado S. whose doctoral dissertation is the source for most of the background information included in this study and whose data collected in 1967 provides the basis for comparison with similar economic and social data Hernan Torres and I collected in 1973.

## I.2.

low on some farms, particularly those at higher elevations where it has not been possible to build access roads which trucks can negotiate at all times of the year. Most farmers from the Toralapa area market virtually nothing in Cochabamba.<sup>2</sup>

### B. Ecology and Natural Resources

According to Peinado, Hacienda Toralapa "was probably the biggest and most important farm of the entire province in terms of number of rural families, area, and volume of potato production," making it a logical choice for study. The farm itself was divided into five parts, each administered separately; the lower section, called Toralapa, containing the patrón's house and most of the irrigated land of the hacienda, was chosen for study. The other sections, Ucuchi, Canicota, Boqueron, and Sancayani, are not treated in this study because no base data are available for them. The hacienda was established in 1870 and increased in size following the War of the Pacific (1879) at the expense of the neighboring Indian community.<sup>3</sup> Its final owner in the pre-reform period expanded it by the acquisition of the neighboring hacienda. By this time, the Indian community had been completely incorporated into the hacienda.

Toralapa has a mean altitude of 9,700 meters, which is high enough to limit the growth of natural vegetation to short grass and tola (a scrub bush); a few eucalyptus trees are also found, but wood is generally scarce at this altitude. Most rain falls between December and March, with a yearly average precipitation of 400 mm. Annual average temperature is about 50° F., with a great deal of variation between day and night because of the altitude and general lack of cloud cover. Frosts are most common in winter (July and August) but in fact occasionally do occur at any time of the year. High winds and hail also constitute a threat to agricultural production.<sup>4</sup> Peinado notes that the moisture-holding capacity and loose consistency

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2. Survey data for 1973 and Peinado, Land Reform in Three Communities of Cochabamba, Bolivia (doctoral diss., Department of Agricultural Economics, University of Wisconsin-Madison), p. 201.

3. Ibid., p. 54.

4. Peinado, The Reform in Three Communities, pp. 50-51.

of the soils make the region well-suited for potato production and grazing range. The seasonality and relatively low level of rainfall make irrigation desirable; however, rivers of the region (the Millimayu and Toralapa rivers being the most important) carry very little water except during the rainy season.<sup>5</sup> Even so, campesinos make every effort to capture as much water as possible from these rivers and numerous smaller streams. Mechanical irrigation (tube wells and pumps) is unknown in this region.

By far the most important crop whether by value or by weight is potatoes, which on Torolapa are grown on both irrigated and dry land. Other crops most frequently grown on irrigated land are dry corn, peas, and broad beans. While farmers who do not own any irrigated land are able to produce peas and broad beans, corn is grown only on irrigated land. Root crops like oca and papaliza and grains such as wheat, barley, and rye grass are generally grown on unirrigated land. These crops also do better at higher elevations than peas and beans which are less able to tolerate the cold.

While most income on Torolapa is derived from agricultural production, each family has its own flock of sheep and one or more yoke of oxen, a couple of pigs, some poultry, and a horse or burro. Poultry and livestock, however, are held more for family use than as a major source of income for the family budget.

Cropping patterns have changed less in the Tiraque region than in the Lower Valley because no new frost-resistant crops have been brought into the region which had not been grown there before the Revolution. Even on irrigated land, double cropping is not possible because of the short growing season. Elsewhere in the Upper Valley a shortage of water appears to be the limiting factor in crop diversification and increasing the intensity of agricultural operations.<sup>6</sup>

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5. Ibid., p. 5.

6. See Carlos Camacho Saa, "Minifundia, Productivity, and Land Reform in Cochabamba," Land Tenure Center Research Paper no. 21 (December 1966), p. 15.

## C. Demographic, Economic, and Social Makeup of the Area and Ex-Hacienda

The population of the Tiraque area was approximately 8,400 according to the 1950 census and may have risen to about 13,000\* by 1973.<sup>7</sup> The 1950 census estimated that more than 83 percent of the population of this region was rural. Roughly 43 percent of the population of the Cochabamba Valley lived in the Upper Valley. Only one person in eight in this region was classified as urban by the 1950 census. Even this figure may understate the degree of dependence of the region on agriculture, since many of those classified as urban either worked in or derived the major proportion of their income from the rural areas.

In 1950 there were 160 haciendas in the Province of Arani; assuming that the number of people in the families of hacendados was not far from the national average of five per household, landlords and their families constituted about 3 percent of the population of the region. Piquerías, or communities of independent small holders, numbered about 280 in the Province and occupied approximately 16 percent of the farm area.<sup>8</sup> Since population density is generally higher in small-holder communities than on the haciendas, I suspect that this group represented a somewhat higher percentage of the total population. Urban population is estimated to have been approximately 12 percent in 1950. Thus colonos and their families must have constituted approximately 60 to 70 percent of the population of the Province of Arani, and probably not much lower percentages of the population of the Upper Valley as a whole. Since the reform there has been a rather spectacular growth of small campesino market towns in the Upper Valley, documented by Katherine Barnes von Marschall and Juan Torrico,\*\* which

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\*Since there have been no censuses since 1950, this figure is derived by extrapolating from the census figure using the estimate of the national annual growth rate of 2.16 (also used by Peinado). In fact, because of out-migration found in the sample, I suspect that this figure overestimates the true population of the region.

7. Ibid., p. 55.

8. Ibid., p. 58.

\*\*"Cambios socio-económicos en el Valle Alto de Cochabamba desde 1952," LTC Reprint no. 1098 (November 1973).

## I.5.

has probably had the effect of increasing the percentage of urban population to about 20 percent.

At the time of the original survey (May and June 1967) the total population of Toralapa was 88 families, of which a sample of 20 was chosen and interviewed. In August 1973, 18 of the original group (or their children, in those cases where the original respondent had died) were reinterviewed. All respondents were ex-colonos themselves or children of ex-colonos; in the Tiraque region particularly and in the Upper Valley in general, the influence of miners in the sindicatos, or peasant unions, was much less important than in the Lower Valley. (The fact that the Upper Valley is not on the main route from Cochabamba to the Oruro mining region may in part explain the miners' lack of influence and their failure to acquire ex-hacienda land.)

The average level of family income reported in the Toralapa sample exceeds those for the farms of the Lower Valley by between 25 and 40 percent in both 1967 and 1973.\* While the national average for per capita income was US\$127 in 1967,<sup>9</sup> the figures for Toralapa range around US\$200, slightly more in 1967 and somewhat less in 1973. Peinado found a similar average level of per capita income on a piquería he studied in the same region in 1967. However, average figures for the Upper Valley, if available, would be found to be somewhat lower since generally less land was available for distribution to each family; in many cases land distributed was of poorer quality, much of the land is not irrigated, and many ex-haciendas and small-holder communities did not possess the easy access to market enjoyed by Toralapa.\*\*

Despite their higher average incomes, residents of Toralapa generally have a lower standard of living than do campesinos in the Lower Valley.

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\*These figures are somewhat misleading, however, since one individual with a much larger landholding than the rest has an income of more than five times the average for the rest of the sample.

9. Peinado, The Reform in Three Communities, p. 184.

\*\*One example of these difficulties is to be found in ex-hacienda Kaspicancha Alta where farmers have to carry products several kilometers to Tiraque on donkeys or on their own backs. Their per capita income in 1967 was only \$30. (Peinado, The Reform in Three Communities, p. 183, Table 55.)

## I.6.

Their integration with the market on both the supply and the demand side is significantly lower.\* Likewise, the numbers and kinds of consumer durable goods found in survey data are fewer and less diversified than those observed in the Lower Valley case study. Similarly, a higher percentage of the income of respondents from Toralapa is unaccounted for and presumably is saved in the form of cash kept in the house.

Social differentiation is of a lesser degree in the Tiraque area than is found in the Lower Valley, in part because of the presence of fewer distinct social groups.<sup>10</sup> It has been noted that the reform did not bring a major influx of miners to the region. Landlords as a group have disappeared from rural areas around Tiraque since the sindicatos have adamantly opposed their return (although in some other areas of the Upper Valley and in the Mizque region, they have retained some of their hacienda lands). Some have moved into Tiraque and other towns where they have set up small shops and other businesses and continued to constitute an elite within the community. Nonetheless, the reform has narrowed the distance between this group and the vecinos or mestizos who have traditionally occupied a middle station in rural towns between the landowning class and the campesinos (disparagingly referred to as indios before the reform). The differentiation found in the Lower Valley between campesinos living on the valley floor and those from higher elevations is absent in the region around Tiraque. Piqueros remain a recognizably separate group from ex-colonos due to greater interaction with mestizos and whites in the pre-reform period as well as higher average levels of education.<sup>11</sup> However, the community of interest between piqueros and campesinos appears to have been greater than in the Lower Valley since at least some piqueros formed sindicatos to obtain access to hacienda lands through the workings of the Agrarian Reform Law and were as vehement as the campesino sindicatos in their opposition to the return of landlords.

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\*At the 1 percent level, comparing variables measuring supply and demand integration for Toralapa and Parotani (1973 data),  $Z = 4.01$  and  $2.68$ , respectively, with 41 d.f.

10. Ibid., p. 80.

11. Ibid., pp. 80-81.

The last of the free-holding Indian communities in this area had been taken over by haciendas before the turn of the century. Only 4 percent of the farms in the Department of Cochabamba listed in the 1950 agricultural census belonged to Indian communities,<sup>12</sup> which gives some idea of the unimportance of community Indians in the Cochabamba Valley compared to the Altiplano where both their numbers and the amount of land they controlled were greater.

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12. Calculated from Agricultural Census of 1950.

## II. Pre-Reform Tenure Situation

### A. Pre-Reform Tenure Structure

Before 1953 the dominant feature of the land tenure system in the Province of Arani was the large hacienda. The 160 haciendas in the province averaged a little more than 300 hectares in size.<sup>13</sup> Its 8,000 hectares and 150-200 colono families made Toralapa perhaps the largest and most important hacienda in the region. It was divided into five sections, each of which was administered separately by its own mayordomo or manager.<sup>\*14</sup> This case study will concentrate on the principal section of the hacienda, Toralapa, which was located closest to the main road and the town of Tiraque and which contained the landlord's house. Toralapa like all haciendas in the region was operated under the colonato system where, in exchange for a varying number of days of unremunerated labor on the hacienda and other fees and services, colonos or resident farm laborers were given the use of a house and a plot of land. The size of the usufruct plot varied from farm to farm depending on the quality of the land and the supply of labor; where labor was in short supply, landlords had to offer larger plots to attract a labor force sufficient to meet the requirements of the hacienda.

On Toralapa, where labor was not in particularly short supply, the average size of use plots was two hectares. The agreement between the landlord and the colonos over the size and location of the use plot was almost invariably verbal and in case of subsequent disagreement between the two parties was not subject to review by civil authorities. The best land on Toralapa as elsewhere was reserved for the hacienda; indeed, 35 families were forcibly ejected from the hacienda a few years before the reform for refusing to exchange the use plots they had been granted for other plots of poorer quality. A similar situation was found on another hacienda

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13. Peinado, The Reform in Three Communities, p. 58.

\*A full description of the social and administrative structure of the hacienda will be given later in this section.

14. *Ibid.*, p. 54.

## II.9.

(Kaspicancha Alta) where, in exchange for two days work per week, campesinos received five hectares of marginal land in the upper section of the hacienda while the better land at lower elevations was cultivated for the benefit of the landlord.<sup>15</sup> Based on the two hectare average size of the use plot reported by Peinado, campesinos controlled approximately 5 percent of the land of Toralapa. Since most of the use plots consisted of arable land, this figure somewhat understates the productive value of the land, since large parts of the hacienda, particularly in some of the upper sections, are unsuitable for agriculture. In any case, the inequality of distribution of land is apparent, although lack of sufficient data on the pre-reform situation makes it impossible to quantify exactly the degree of inequality.

The piquería or small-holder community is the other significant form of land tenure found in the Cochabamba Valley and in a few other areas of Bolivia. Its origins are diverse, with some piquerías tracing their founding back to the early nineteenth century when tracts of land were given to soldiers in retribution for their services in the Wars of Liberation from Spain. More commonly, however, they developed out of the disintegration of the smaller haciendas of the region which during the second half of the nineteenth century became increasingly uneconomical. By 1950 there were more than 280 such communities encompassing 7,700 hectares in the Province of Arani. A typical example of the development of such communities is the case of Piquería Palca located just north of Tiraque and described by Peinado. Disintegration of the small hacienda which was to give rise to the community began about 1850 with the sale of five parts of the original hacienda to other landlords; before 1900 they had begun selling parcels of land to colonos, a process which continued down to 1953.<sup>16</sup> By that time only 35 hectares of hacienda land were left, part of which was worked by three colonos with relatively light labor obligations while the rest was sharecropped by neighboring piqueros. It is possible that in the very long run this process might have led to the replacement of the hacienda by the

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15. Ibid., p. 69.

16. Ibid., pp. 58-60.

## II.10.

piquería as the dominant tenure form in the Cochabamba Valley; however, because piquerías tended to develop only where haciendas were relatively small to start with, land market operations alone could not have been expected to have created any semblance of an equitable distribution of land resources within this century, if ever.<sup>17</sup>

### D. Pre-Reform Economic Structure

Before 1953 the main source of food supplies for the urban population of Bolivia was the production on the hacienda lands. Very little of the production from the use plots of colonos ever reached the market because not much remained after the minimum needs of the colono family were supplied. Like all haciendas in the Tiraque region, production on Toralapa was highly market-oriented and concentrated largely in two crops, potatoes and to a lesser extent barley. Until the April 1952 Movimiento Nacional Revolucionario revolution, production technology was unmechanized and indistinguishable from that employed by the hacienda's colonos on their own plots.<sup>18</sup> All farm operations, including land preparation, were performed by colonos with the aid of only their oxen. Except for the administrator's salary and possibly the purchase of potato seed, production on the hacienda required almost no cash expenditures.<sup>19</sup> Labor requirements, manure for fertilizing the potato crop,\* sacks for transporting products to market, and the transportation of such products were all provided for at no cost to the land owner as part of the obligations of the colonos under the colonato system. Basically, the landlord of Toralapa maximized profits subject to the constraint that cash expenditures not exceed some small, fixed amount. As may be observed in Table 1, 90 percent of hacienda production was marketed.

Production technology was similar on the use plots of colonos. The half of the manure which colonos retained after fulfilling their obligations

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17. Peinado comes to a similar conclusion; *Ibid.*, p. 82.

18. *Ibid.*, pp. 65-66.

19. *Ibid.*, p. 66.

\*No chemical fertilizer was used either by the hacienda or by the colonos before the reform.

Table 1. Crop Land, Agricultural Production, and Sales on Toralapa  
in the Pre- and Post-Reform Periods

	Pre-Reform (1950-51)	Post-Reform (1965-66)
<b>PRODUCTION<sup>a</sup> (metric tons)</b>		
Owner:		
Potatoes**	467	
Other crops	25	
Total	<u>492</u>	
Campeſinos:		
Potatoes	33	831
Other crops	25	<u>336</u>
Total	<u>58</u>	1,167
Total Crop Production	550	1,167
<b>LAND UNDER CULTIVATION (hectares)</b>		
Owner:		
Potatoes	40	
Other crops	20	
Total	<u>60</u>	
Campeſinos:		
Potatoes	6	72
Other crops	20	<u>224</u>
Total	<u>26</u>	296
Total Land Under Cultivation	86	296
<b>SALES (metric tons)</b>		
Owner:		
Potatoes	390	
Other crops	22	
Total	<u>412</u>	
Percent sold	89	
Campeſinos:		
Potatoes	3	658
Other crops	<u>3</u>	<u>171</u>
Total	6	829
Percent sold	10	71
Total Production Marketed	418	829
Percent Marketed	76	71

\*All figures include a 10 percent allowance for seed.

\*\*Two-thirds of the colonos had a sharecropping arrangement with the owner and had to part with half of their potato production. Thus, the owner received an additional 17 metric tons of potatoes.

Source: Peinado, The Reform in Three Communities, pp. 203-205, Unnumbered Table.

## II.12.

to the landlord was applied to their own crops. The value of manure in maintaining the fertility of the soil and increasing yields had been recognized in rural Bolivia for centuries; it was applied preferentially to the potato crop on the use plots as well as on estate land. Since technological differences are not apparent, the fact that average production per hectare should be more than twice as high on hacienda land (11.7 vs. 5.5 mt/ha.) compared with the colonos' use plots is somewhat surprising.\* On closer scrutiny, several explanations for this difference come to mind. The hacienda had preferential access to land, labor, and water<sup>20</sup> which meant that its crops were grown on the best land of the hacienda, planted and harvested at the optimal time, and irrigated whenever necessary. The use plots generally consisted of poorer quality land, at least some of which was not irrigable; colonos were free only one or two days a week to work on their own plots, which means that much of the work on these plots must have been done by women and children. Only 10 percent of production on colono plots was sold, consisting mostly of potatoes which were sold to rescatadores (itinerant merchants) who resold them in Punata; perhaps another 25 percent was bartered either on the farm or at local markets.<sup>21</sup>

The only major improvements introduced by the hacienda were a small number of sheep of improved ancestry brought in after the 1952 MNR revolution and potato seed brought by the landlord from another locality. It had long been recognized by colonos as well as by landlords that potato seed planted year after year in the same soil is less resistant to disease than is seed of the same quality which is brought from another area. Making use of his partial monopoly over transportation, the landlord provided seed to about two-thirds of the campesinos, who in return were obliged to turn over half the production to him. The rest of the colonos, one way or another, obtained seed on their own from another locality to avoid this

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\*Particularly since the 1950 Agricultural Census showed average production per hectare to be inversely proportional to farm size (documented in the main report).

20. Ibid., p. 66.

21. Ibid., p. 76.

sharecropping arrangement with the landlord. New seed was acquired every one to two years on Toralapa.\*<sup>22</sup>

#### C. Pre-Reform Land Availability and Use

In a few areas like Piquería Palca the transformation of small haciendas into small-holder communities continued up to the Revolution. A major focus of piqueros was the accumulation of cash to finance the purchase of additional land from such haciendas. Some haciendas in the Province of Arani were gradually being transformed in this way into piquerías, but this was generally not the case, particularly in the Tiraque region, where the only access campesinos had to land was through participation in the colonato system.<sup>23</sup> Plots varied in size among haciendas, depending on the quality of the land and the availability of labor; use plots on Toralapa (called pegujales) averaged 2 hectares in size.

#### D. Pre-Reform Labor Availability and Use

The major source of labor on haciendas in the pre-reform period was the colonato system which simultaneously determined the amount of land a colono would control. Large haciendas like Toralapa did not require additional labor beyond that provided by colonos and their families. Some small haciendas like Hacienda Cabrería (the source of most of the land for recent growth in Piquería Palca) did employ wage labor at harvest time, supplied by small holders from the community.

In exchange for the use of a plot of land, the principal obligation of colonos was to provide a certain number of days a week of labor to the hacienda. On Kaspicancha Alta located above Tiraque, the obligation was for two days a week in exchange for a 5 or 6 hectare plot of rather poor quality land. Campesinos from Toralapa unanimously agree that their obligation consisted of 6 eight-hour days of unremunerated labor each week, while the former landlord claims that the obligation was only 5 days.

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\*Peinado found that on Piquería Palca small holders acquired new seed only at longer intervals.

22. Ibid., pp. 66-67.

23. Ibid., p. 78.

## II.14.

Basically, the labor obligation was determined by what the market would bear: where it was difficult to attract labor or where the quality of the land was poor, fewer days of work could be required and the amount of land would have to be greater. Generally, President Villaroel's 1945 decree, limiting to four the number of days that could be required under colonato, was generally not applied except where four days reflected a kind of equilibrium which would have prevailed anyway. Just as the number of days of labor called for varied from hacienda to hacienda, even in the same geographical or political area, so also was there a wide variation in the other obligations the colonato system entailed.

Pongueaje or domestic service in the landlord's house was also part of the colonato system. The colono and his wife performed various kinds of personal service in the landlord's house for a set period, usually one week per year. These obligations were known collectively as pongueaje and the colono performing them was referred to as a pongo or houseboy. Pongueaje frequently involved working in the patrón's house in town or on another hacienda, in which case it was up to the colono to get there on his own without any remuneration or travel expenses from his patrón. Technically abolished by Villaroel in 1945, in fact pongueaje continued to be performed by colonos throughout most of rural Bolivia down to the Revolution.

Transporting the agricultural products of the hacienda to market was also the responsibility of the colonos, which in the case of Toralapa meant moving them primarily on the colonos' own animals to Punata (about 20 km. distant) or to Cochabamba (over 60 km). For this job, colonos were paid a small wage just sufficient to cover their expenses for chicha (fermented maize) and coca.<sup>24</sup> This obligation which had historically been an accepted part of colonato was on the wane in many parts of Bolivia even before the Revolution or was becoming somewhat less onerous with the expansion of the rail and road networks into the countryside. Thus, colonos in some areas would now have to transport products only to the nearest railhead or main road rather than to the market itself which was usually much farther away.

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24. Ibid., p. 71.

## II.15.

One obligation which existed on Toralapa and appears to have been common throughout the country was the provision of manure from the colonos' animals (particularly sheep and in the higher regions llamas) for use on the hacienda lands. The campesinos of Toralapa greatly resented this obligation since they fully recognized the value of manure in improving the fertility of the soil of their own plots. Manure was especially important since chemical fertilizer was not used in this region before 1953. For this purpose, sheep were gathered into corrals every night so that the manure would be concentrated in one place where it could be collected. Fifty percent of it was then taken by the hacienda. In addition, in payment for the use of pasture, colonos were required to provide a tithe consisting of one lamb out of every ten born into the colono's flock.<sup>25</sup> On Kaspicancha colonos were required to provide the hacienda with ten bags of sheep manure each year (with no other payment required) for the right to graze their animals on hacienda lands with no limit to the size of their herds.<sup>26</sup>

An additional obligation fulfilled by the colono's wife and other female members of the family consisted of the weaving of four bags per month for the transportation of the hacienda's products. These quotas were rigidly enforced and not infrequently made it necessary to put out part of the work to other women in exchange for remuneration in order to fulfill the quota.<sup>27</sup>

The obligations of colonos in Toralapa were considerably more onerous than those found in the Lower Valley and were the source of much dissatisfaction. Failure to perform an obligation could result in severe penalties,\* such as doubling the obligation, physical punishment, or even expulsion from the hacienda. Expulsion of colonos was often related to the owner's desire to get back the use plots for the hacienda. Treatment of colonos on Toralapa appears to have been harsher than on many other haciendas

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25. Ibid., p. 71.

26. Ibid., p. 74.

27. Ibid., p. 71.

\*For example, loss of an animal of the hacienda by a shepherd taking care of it meant that he would have to forfeit a similar animal from his own flock. This was the case in most of the country, not just Toralapa.

in the region and elsewhere in the country, although no exact measure is possible. The owner claims that he intended to reduce some of the obligations but was prevented from doing so by staunch opposition from his peers in the rural towns who felt that to do so would decrease the power of land owners with respect to campesinos and would make the haciendas less profitable operations.<sup>28</sup> The mechanisms of the colonato system were such that they provided the hacienda with all the labor as well as nearly all other inputs that were necessary for the production in which the hacienda engaged, with virtually no expenditure of cash.

#### E. Pre-Reform Income Levels and Distribution

While exact measurement of the degree of inequality in pre-reform distribution of income is not possible, figures on net production and agricultural product sales for Toralapa give some indication of the degree of inequality which prevailed on large haciendas before 1953. Nearly 90 percent of the physical output of the hacienda accrued to the owner and his family, while just over 10 percent was available to the 20 or 30 colono families working on the hacienda. The disparity is even more marked with relation to the sale of agricultural commodities produced on the hacienda: over 98 percent was sold for the landlord's account and just under 1.5 percent for the colonos'.\* To the extent that these figures ignore the livestock production of both the colonos and the hacienda, it is possible that they somewhat overstate the disparity in income between the land owner and the colonos. Furthermore, in addition to the 10 percent of their production which colonos sold, they also bartered another quarter of it at the nearby fairs and with rescatistas (roving merchants) who came to the hacienda to acquire their products. In any case, the income disparity between the land owner and the colonos was enormous, particularly for cash income.

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28. Ibid., pp. 72, 74, 75.

\*It is worth noting that the vast majority of the urban food supply was produced on hacienda lands rather than on the use plots of the colonos; perception of this fact and the fear that peasants would not be quick enough in increasing their own production and orienting it to the market appear to be partly responsible for the sections of the Agrarian Reform Law which made it possible for landlords to retain a nucleus of land from their former haciendas.

Of the 900 hectares of Toralapa which were classified by the Servicio Nacional de la Reforma Agraria (SNRA) as cultivable (one-third of the total farm area), the campesinos had somewhere between 40 and 60 hectares, or less than 7 percent of the cultivable land.<sup>29</sup> Colonos farmed perhaps half this land in any given year. The hacienda also used less than 7 percent of the cultivable land available. The major factor limiting any increase in production on the use plots seems to have been the availability of labor,\* since the colonos disposed of only one or two days of their own labor each week, which might also explain the surprisingly low yields they obtained with a technology virtually indistinguishable from that employed on the hacienda lands. Thus income levels of colono families were restricted to very low levels by the limitations placed by the colonato system on the ability to allocate family labor to their use plots. The fact that labor and not land availability was the limiting factor in raising family incomes can be observed indirectly from the presence of arrimantes or "outsiders" who worked for the colonos in exchange for part of their use plots. Although they were less common in the Cochabamba region than in some other regions of the country (such as Chuquisaca and Potosi),\*\* an undetermined number of arrimantes did live on Toralapa before the reform, and in some cases may have become colonos.<sup>30</sup> Arrimantes constituted the lowest group within the hacienda structure and had the lowest incomes of any group, little or none of which would have been in cash.

Curacas (the equivalent of the jilakatas of the Aymara-speaking regions of the country) were the highest group among those who were known as Indians in the pre-reform scheme of socio-racial classification. Chosen by the landlord or the administrator "from among the most reliable persons of the hacienda on the basis of their allegiance to the established order and also [of] their social and economic status in the community,"<sup>31</sup> the curacas acted

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29. Ibid., calculated from figures on pp. 95 and 204.

\*By extension, results from multiple regression analysis presented in Section IV also lend support to this conclusion.

\*\*See Daniel Heyduk, "Bolivia's Land Reform Hacendados," Inter-American Economic Affairs 27, 1 (Summer 1973), pp. 87-95.

30. Ibid., p. 62.

31. Ibid., p. 61.

as links between those who ran the hacienda and those who did the work.

Curaca was the highest position within the hacienda structure to which an indio could aspire. Generally, the curaca received some economic benefits, perhaps a larger use plot or the right to keep more animals, although it is not clear what those benefits were on Toralapa nor whether the higher economic condition associated with curacas was a result of their position or a reason for their being chosen for the office.

Responsibility for the day-to-day operation of the hacienda rested with the administrator, an educated mestizo who was the only employee on Toralapa to receive a salary. Below and answerable to him were five mayordomos or overseers, one for each of the sections into which Toralapa was divided. Just how much of a hand the owner had in the day-to-day operations of the hacienda is not clear, although it appears that most matters were handled by the administrator and the mayordomos.

While there is clear evidence of piqueros occupying a higher position in the pre-reform social structure, their economic position relative to other groups is harder to estimate since data on income and production are not available. Although many piqueros in the Toralapa region had plots of land averaging less than half a hectare in size, those described by Peinado generally had some irrigated land, making possible a harvest of "early" and therefore higher value potatoes.<sup>32</sup> Furthermore, since they were not limited as were the colonos to only a couple of day's work a week on their own land nor constrained by similar limitations on time for marketing,\* I suspect that their incomes averaged at least as high as those of campesinos, while their cash incomes were probably considerably higher as well as their standards of living due to their greater degree of integration with Spanish-speaking society.

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32. Ibid., pp. 78, 252.

\*Piqueros marketed up to a quarter of their production as opposed to 10 percent for campesinos.

## F. Pre-Reform Social Infrastructure

### 1. Housing

From the fact that Peinado failed to mention anything distinctive about the houses colonos from Toralapa occupied in the pre-reform period and since virtually all houses ex-colonos occupied in 1973 at the time of the survey had been built since the reform, it is safe to assume that there was little to distinguish housing conditions on Toralapa from those prevailing on other haciendas in the Cochabamba Valley. Houses occupied by colonos in the pre-revolutionary period generally consisted of a single room, used without distinction for cooking, eating, sleeping, protecting poultry and other small animals from the cold and predators, and storage of crops. Construction was generally of adobe and roofs thatched. Since glass was almost unknown among lower income groups and windows were a rarity, the only light in colono houses was that admitted through the open door. The only structure on Toralapa whose construction can definitely be dated from the pre-reform period formerly housed the patrón; this stuccoed and tile-roofed, two-story country house of modest size is currently used by the sindicato as a granary for corn and other crops and is falling into disrepair.

### 2. Education

As was the case on many other haciendas, there was no school on Toralapa before the reform. As a result, their low level of education and general inability to speak Spanish made colonos the social inferiors of piqueros, although, as has been suggested earlier, the disparities in income between the two groups cannot have been great.\* As may be observed in Table 2 (comparing literacy and ability to speak Spanish of heads of households on Piquería Palca and Ex-Hacienda Toralapa) there is almost as high a percentage of literates in the sample from the free-holding community

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\*Piquerías and free-holding Indian communities, almost to a one, had schools built which were usually supported financially by the community. Many, if not most, of the haciendas had no school. Thus it is not surprising that the few professionals of campesino background that one encounters in Bolivia grew up on comunidades or piquerías and not on haciendas. (I am indebted to Mauricio Mamani P. of SNRA for this point.)

Table 2. Percentage of Heads of Households Literate and Able to Speak Spanish, by Farm

	Ex-Hacienda Toralapa (N = 87)	Ex-Hacienda Kaspicancha (N = 27)	Piquería Palca (N = 60)
Literate	24	15	72
Illiterate	76	85	28
Some Spanish	33	15	75
No Spanish	67	85	25

Source: Peinado, The Reform in Three Communities, p. 120, Table 30.

as there are illiterates in the 1967 Toralapa sample. The low level literacy of heads of households on Toralapa and their general inability to communicate in Spanish are attributable to the lack of educational opportunities in the pre-reform period. (This matter will be investigated in greater detail in Section V-B.) Data for Kaspicancha reflect its extreme isolation.

### 3. Health Care

Little information is available on health care before 1953. It is clear, however, that a very high percentage, probably approaching 100 percent, of treatments which were received by colonos were performed by yatis or medicine men. In marked contrast to ex-haciendas in the Lower Valley where even in the pre-reform period at least emergency medical care seems to have been available, now in the Tiraque area of the Upper Valley much of this essential treatment is still provided by medicine men.

### 4. Clothing

Peinado reports that "before the agrarian reform the amount of money spent on clothes was nearly zero" and surmises the effect this had on aggregate demand for textiles<sup>33</sup> (which have been produced industrially in Bolivia since at least the 1930s). What this means is that in addition to their weaving obligations for the production of sacks for the hacienda, the wives and daughters of colonos must have spent nearly all of their time spinning and weaving the wool from their own flocks of sheep into bayeta or homespun for their families.

33. Ibid., p. 194.

### III. The Land Reform Process

#### A. Sindicato Formation and the Initiation of the Reform

The dissatisfaction of Indians forced to submit to the colonato system was endemic and deep-rooted. Sporadic and often violent local uprisings punctuate Bolivian history from the time of the Spanish conquest. Not until the middle 1930s, however, did colono veterans of the Chaco War and the Paraguayan prison camps begin to organize sindicatos for the purpose of obtaining land to be worked by campesinos directly for their own benefit rather than as colonos of a hacienda. As has been the case in other countries, attention was initially focused on Church and government-owned land. During the "Military Socialist Government" of Col. David Toro, two haciendas in the Upper Cochabamba Valley, one belonging to a religious order and the other to the Municipality of Cochabamba, were rented to sindicatos formed on the respective farms under the leadership of Chaco War veterans and elementary school teachers from the Indian Normal School at Warisata.

Agitation for change in the system of land tenure and labor relations continued to increase throughout the late 1930s and early 1940s. Huelgas de brazos caidos or sit-down strikes became frequent during this period and at least two major uprisings in the Upper Valley were put down by government forces. Widespread rural unrest during the 1940s was largely responsible for the decrees of President Villaroel in 1945 abolishing unpaid personal service and limiting labor obligations of colonos to four days' work a week on the hacienda lands. Though never enforced until 1952, their existence did serve to deprive the hacienda system of some of its legitimacy and encourage further agitation for change and an increasing call not just for improvement of conditions of colonos but for basic reform in the Bolivian land tenure structure.<sup>34</sup>

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34. For more information of the development of the agrarian syndical movement in Bolivia, see Luis Antezana E. and Hugo Romero B., Historia de los sindicatos campesinos: un proceso de integración nacional, Departamento de Investigaciones Sociales, SINRA (La Paz, May 1973).

### III.22.

The tighter organization and greater militancy of sindicatos of the Upper Valley than those of other regions of the country\* became evident soon after the MNR-led revolution of 9-11 April 1952. Within a month of the revolution, newspapers were reporting meetings throughout the Upper Valley with the objective of "founding campesino sindicatos, with the forms of cooperative(s), associating these aims with the adjudication of land to the Indians."<sup>35</sup>

Interest by campesinos from the Tiraque region in sindicatos pre-dated the 1952 revolution. An attempt to form a sindicato in Piquería Palca had been made in 1946 following the first National Indian Congress but was thwarted by the opposition of hacendados and vecinos from Tiraque. According to Peinado, the sindicato movement of that time was directed not at land reform but at increasing the participation of literate campesinos in the political process and in improving the opportunities for education available to them.<sup>36</sup> A sindicato finally was organized by the piqueros of Palca in October 1952. It is perhaps indicative of the greater militancy of campesinos in the Upper Valley that even piqueros, who stood less to gain than campesinos from an agrarian reform, organized into sindicatos whereas those of the Lower Valley generally acted as if they saw the changes being brought about by the land reform as a threat to their interests.

Self-interest also played a part in this decision. The sindicato was invariably the motive force behind successful land reform cases and in Palca a small block of land from the hacienda out of which the piquería had developed still remained in the hands of the patrón in 1952. As a result of the action of the Palca sindicato, Hacienda Cabreria was expropriated and all but 4 hectares were awarded to the 12 piquero sharecroppers and the 3 resident ex-colonos.

Campesinos were mobilized throughout the country in late 1953 and early 1954 in reaction to attempts by Bolivian mine and landowners to overthrow the MNR government. Campesino militias were dispatched to several provinces

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\*Except perhaps for those of the northern Altiplano and the Achacachi region.

35. Ibid., p. 211.

36. Peinado, The Reform in Three Communities, p. 104.

### III.23.

of the Upper Valley, including Arani, searching the homes of vecinos and confiscating whatever arms were found. Searches were orderly and almost completely without incident until the militia arrived at Tiraque. Here their ranks were swelled by campesinos from Toralapa and confrontations with the vecinos and acts of vandalism ensued.<sup>37</sup> In many parts of the country during this period campesino militias were involved in armed confrontations with vecinos, sometimes resulting in bloodshed and the sacking of rural towns. In areas like the Upper Valley where campesino militancy was strong, most landlords left their farms for the safety of the cities or foreign countries, never to return again to what had been their haciendas.

The sindicato of Toralapa was not formed until September 1953, and some haciendas located at higher elevations were not organized into sindicatos until even later, with March 1954 marking the founding of the Kaspicancha sindicato.<sup>38</sup> Probable reasons for the late organization of the sindicatos of these haciendas are 1) isolation, in the case of Kaspicancha, and 2) the importance and power of the patrón of Toralapa. In both cases there was at least some intervention from outside sindicato leaders.<sup>39</sup> It was typical of the organization of sindicatos in much of the country for campesinos to wait for the arrival of officials from the federation or central offices of sindicatos before actually establishing their own local. Peter Graeff has shown how the power of a patrón, particularly one who lived on the hacienda, has been effective even since the Revolution in offsetting some of the power that might otherwise have accrued to the sindicato and in delaying the development of the effective peasant leadership.<sup>40</sup> In view of the size and importance of Hacienda Toralapa in the economy of the region in the pre-revolutionary period, these factors were

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37. Antezana and Romero, Historia de los sindicatos campesinos, p. 267, and Appendix, p. 22.

38. Peinado, The Reform in Three Communities, p. 104.

39. Ibid., pp. 104, 105.

40. Peter Graeff, "The Effects of Continued Landlord Presence in the Bolivian Countryside During the Post-Reform Era: Lessons to be Learned," LTC no. 103 (October 1974).

### III.24.

probably at least partially responsible for the delay in formation of the sindicato.

#### B. The Land Reform Process and Inability of Landlords to Reassert Their Control in the Post-Reform Period

In June 1954, less than a year after its organization, the sindicato of Toralapa initiated a land reform process against the former owner, demanding that the farm be classified a "latifundio," a designation which legally required that all land be transferred to the colonos who resided on the hacienda. The landlord contested the sindicato's claim at each stage of the proceedings before the judges of the National Agrarian Reform Service (SNRA), as was his prerogative under the terms of the 1953 Agrarian Reform Law. The landlord claimed that, far from deserving the latifundio classification, which legally could have left him without any land whatsoever, Toralapa should be classified an "agricultural enterprise." According to one section of the law, a hacienda where the owner had made a small investment in fixed or movable capital (relative to the taxable value of the land) would be declared an agricultural enterprise, if the system of labor relations prevailing on the hacienda was based on wage labor rather than the colonato system. Since it is doubtful that a single hacienda in Bolivia was run predominantly on the payment of wages rather than by means of the colonato system, this provision of the law was ordinarily ignored and judgment was based on the value of capital invested in the hacienda, excluding the value of the land itself. The value set by the law was so low that the construction of a house for the landowner or the purchase of a single tractor was usually enough to meet the requirement for agricultural enterprise status.

The owner of Toralapa based his contention on the existence of some improved livestock and machinery on the hacienda at the time the Agrarian Reform Law was being written. The list of livestock included 50 Holstein cows and 20 calves, 50 Duroc Jersey hogs, 40 thoroughbred horses, and 900 sheep. Machinery was limited to two small tractors and their equipment; there is no indication that the tractors were in fact ever used for

agricultural purposes.\* The sindicato contended that the machinery and livestock were brought to the hacienda in June of 1952--at a time when the clamor for agrarian reform was everywhere--precisely to assure agricultural enterprise status.<sup>41</sup> In fairness to the landowner's position, it should be noted that the commission drafting the Agrarian Reform Law had not even begun its work by the date he is alleged to have brought the machinery and animals to the farm; on the other hand, it did appear likely that some such provision would finally be incorporated into the law before it was promulgated.

When the agrarian reform case was concluded in May 1959, nearly five years after its initiation, Toralapa was declared a latifundio, but though there was no legal basis for such a decision, the former owner was allotted 200 hectares of land. Peinado surmises that the decision was apparently based on the persistent opposition of the former owner to a latifundio designation and the fact that there was more than enough land available to provide each of the colono families resident on the hacienda at the time the case was being decided with a parcel of reasonable size. Decisions like this one, resulting in a retention of a greater amount of land than the former hacienda owner perhaps had a legal right to, were very common. But they generally involved declaring a farm, which by the interpretation of the law to the letter would have fallen in the "latifundio" category, to be a "medium-size property" or an "agricultural enterprise." In areas such as the Upper Valley, where sindicatos were strong and militant, such designations were infrequent.

On Kaspicancha, the patrón put up no opposition to the expropriation of the hacienda and to its classification as a latifundio. However, since the hacienda had been managed as two separate units and colonos of the two parts had different labor obligations and formed two separate sindicatos, the agrarian reform process dragged on for nearly eight and one-half years.

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\*In March 1953, more than a year before the initiation of the agrarian reform case by the sindicato and before the Agrarian Reform Law was signed, the owner withdrew all the animals and most of the machinery, alleging a lack of security for their conservation.

41. Peinado, The Reform in Three Communities, p. 89.

The cost per person was nearly US\$35 over the course of the process, a rather considerable sum considering the extremely low level of income on Kaspicancha, the result of the short growing season prevailing at such a high altitude (about 12,500 feet, average). The duration and high cost of the Kaspicancha judicial process are not unrepresentative of the difficulties faced by campesinos throughout the country in obtaining land.<sup>42</sup>

The agrarian reform process brought by the sindicato of Palca against Hacienda Cabreria, out of which the piquería had developed and on which 12 piqueros still sharecropped at the time of the reform, also took more than eight years. The final decision awarded the sharecroppers an average of 1 hectare apiece and 1.5 hectares to each of the three remaining colonos. Four hectares were awarded to the landlord, although opposition from the sindicato to his return has prevented him from ever coming back to farm the land.<sup>43</sup> The land was worked collectively by the sindicato for a few years but subsequently abandoned; numerous requests have been made, particularly by young men starting families, for this land, but because nearly everyone is interested in the land, no grants have been made to anyone.<sup>44</sup>

The former landlord of Toralapa, in an interview with Peinado in 1967, stated that he wanted to return to farm the 200 hectares he had been awarded in the most mechanized fashion possible in order to have to depend as little as possible on resident farm labor.\* Officials from the sindicato, and indeed from sindicatos in the entire Tiraque area, have been adamant in their refusal to allow the former owner of Toralapa or any other landlord to return. Despite pressure by the government since the late fifties and particularly since 1964 favoring conciliation with former owners who

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42. Ibid., p. 90. The reader interested in seeing just how complex an agrarian reform case can be is referred to Peinado, pp. 240-243, where he explains the complexity frequently found in agrarian reform processes.

43. Ibid., pp. 90, 91, 94.

44. Ibid., p. 99.

\*This is precisely the type of operation generally established by landlords in other parts of the country who were able to retain parts of their original holdings. For one example, see my "A Case Study of the Lower Cochabamba Valley: Ex-Haciendas Parotani and Caramarca" (Madison, Wis.: Land Tenure Center and the World Bank, November 1974).

had been allowed to retain title to part of their land, landlords who fled from their haciendas in 1953 and 1954 are not being allowed to return to their former haciendas in areas like the Upper Valley where feelings of campesinos still run strongly against such a move. Peinado asserts that:

In the Upper Valley no single owner has been allowed to return, and the few isolated attempts to do so have been severely dealt with. Personal violence and physical damage to any remaining property of the ex-owners--the hacienda house or improvements--are common.<sup>45</sup>

By 1973 the former owner of Toralapa had not returned and was not expected to. As time draws on and nearly all the land granted to landlords in the Tiraque region is divided up among campesinos, as it is in Toralapa, it becomes inconceivable that any Bolivian government would try to or could enforce a decision to return land adjudicated to former landowners by the SNRA to their effective control.

#### C. Changes in the Sindicato Structure in the Post-Reform Period

The Upper Valley was the birthplace of Bolivian agrarian unionization in the late 1930s and the center of numerous uprisings and acts of repression in the late 1940s and the first two years of the 1950s. At the same time, the union movement spread through the formation of clandestine sindicatos, and particularly after 1945 the movement became a national rather than a purely Cochabamban phenomenon.<sup>46</sup>

Whereas the organization of sindicatos in much of the country required the leadership of organizers sent by the MNR, particularly miners, in the Upper Valley less help from the outside was required in organizing and running local sindicatos. Though it was usual for representatives from the sindicato federations to be present at the meeting marking the chartering of the sindicato, subsequent management of sindicato affairs and prosecution of the agrarian reform case through the channels established by the Agrarian Reform Law were generally in the hands of local sindicato officials. While one of the leaders from the Ucureña federation did take up residence

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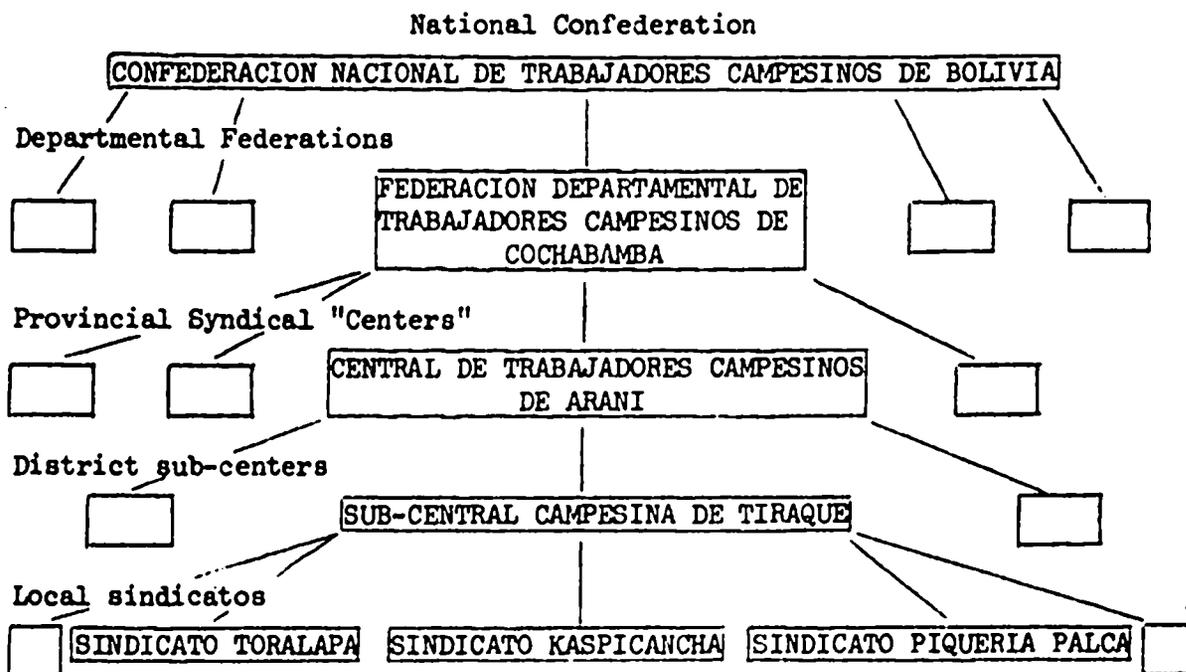
45. Peinado, The Reform in Three Communities, pp. 97, 100.

46. Antezana and Romero, Historia de los sindicatos campesinos, p. 77.

on Toralapa for a while, long-term control of local sindicato affairs by miners and federation leaders never was the problem it was on some ex-haciendas in the Lower Valley.

The national sindicato organization followed the pattern shown in Figure 1. The degree of independence of a local sindicato and the amount of assistance it required or could count on from the sub-central or departmental federation varied from one sindicato to another. Of the numerous elective offices within each local sindicato, only those of the secretario general and secretario de relaciones were of real importance in most sindicatos. In general the leadership of the sindicato and particularly the office of secretary general was occupied by campesinos who had achieved prominence in the pre-revolutionary social order by greater wealth than other campesinos or by having held the position of curaca on the hacienda.\*<sup>47</sup>

Figure 1. Structure of the Bolivian Campesino Sindicato Movement



\*A similar situation occurred in the Chilean agrarian reform during the Frei administration where the first directiva, or leadership, of most newly formed asentamientos was partially or entirely made up of empleados or overseers from the pre-reform fundo.

47. Ibid., p. 108.

### III.29.

Strong sindicatos, such as that of Toralapa, generally superceded civil authorities for most purposes. With regard to sindicatos of this type, Peinado makes the point that "only in extreme cases are conflicts between farmers settled outside the sindicato's territory and under national laws."<sup>48</sup> As in the pre-reform period, civil law stops at the hacienda gate. In the Tiraque area, minor disputes are settled by the sindicato leader and punishment, if any, usually consists of working for the dirigente for a couple of days or paying a fine. More serious cases, or cases which cannot be resolved within the local sindicato, are sent to the Central Campesina de Ucureña\* for decision.<sup>49</sup>

Sindicato's such as that of Kaspicancha do not have sufficient standing in the eyes of the campesinos of the ex-hacienda to permit settlement of disputes internally. Instead, most problems end up in Tiraque where they are resolved by the local police.<sup>50</sup>

The organization of sindicatos in rural Bolivia is associated with the defense of the MNR revolution from attempted counter-revolution in 1953. The movement grew in strength as sindicatos became the vehicles for carrying out the agrarian reform process. The cost burden of the agrarian reform process in the Upper Valley was borne almost entirely by the campesinos, ranging from US\$18 to US\$35 per household. Usually this sum was generated by a series of quotas collected from the campesinos by the sindicato. In some cases, as in Kaspicancha, the sindicato organized the campesinos of a hacienda to work a plot of land collectively and used the returns from the sale of this production for paying part of the cost of the process.<sup>51</sup> Part of the cost was directly related to the agrarian reform process (stamps, preparation of briefs, etc.); but a large part of the cost went for paying the expenses of sindicato leaders who had to make trip after trip to the

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48. Ibid., p. 102.

\*Leaders from the Ucureña Central lived on Toralapa occasionally between 1956 and 1960, creating the ties shown here and raising the status of the secretario general of Toralapa.

49. Ibid., p. 102.

50. Ibid., p. 103.

51. Ibid., p. 242-3.

cities where the various steps of the proceedings were going on to make sure that the process advanced to the next stage. Cases advanced only as long as there was active interest on the part of campesinos on moving their particular case along to the next stage. Of the 88 campesinos living on Toralapa in 1966 when Peinado did his survey, 79 have received title to their land.\* The other nine have not received title because they failed to contribute to the prosecution of the agrarian reform case. (They, however, have retained and continue to work their pre-reform use plots.) Without the persistent efforts of the sindicatos, few if any agrarian reform cases would have been brought to a successful conclusion.

Since the reform, the sindicato has remained the only effective community-level organization in most of the ex-haciendas of the Upper Valley. Because attendance at sindicato meetings is still obligatory and enforced on most ex-haciendas by fines and censure for those who do not attend, the sindicato meeting constitutes the only forum at which community problems and development projects can be discussed. What projects have been accomplished generally owe their success to cooperation of the sindicato. On Toralapa, for example, maintenance of the access road to the paved highway is carried out by the campesinos of the ex-hacienda and is organized and scheduled by the sindicato; participation in maintenance work fulfills an individual's annual transportation tax obligation, with the list of those participating kept by the sindicato. Similarly, the construction of a one-room school shortly after the reform and its replacement in the late 1960s by a larger school were largely due to the organizational efforts of the sindicato.<sup>52</sup>

I fully agree with Peinado's contention that for community development programs to succeed it will be necessary:

to activate the efforts of sindicatos toward attainment of community improvement programs by providing a minimum amount of material help to initiate such programs [and to tap] the large fund of goodwill . . . controlled by the sindicatos in each of the communities.<sup>53</sup>

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\*Only in a few cases have titles to the land been registered, as they must be to have legal validity.

52. Ibid., p. 123.

53. Ibid., p. 112.

### III.31.

The provision of matching funds by Desarrollo de Comunidades (Bolivian government Community Development Program) is a step in the right direction, since savings by Bolivian campesinos are large and cannot be mobilized by the banking system. However, no such programs had taken shape in Toralapa; and in other areas where they had been set up, the programs either failed to take account of the importance of the sindicato or actually set up separate organizations to compete with them for power within the community.

#### IV. Economic Situation in the Post-Reform Period

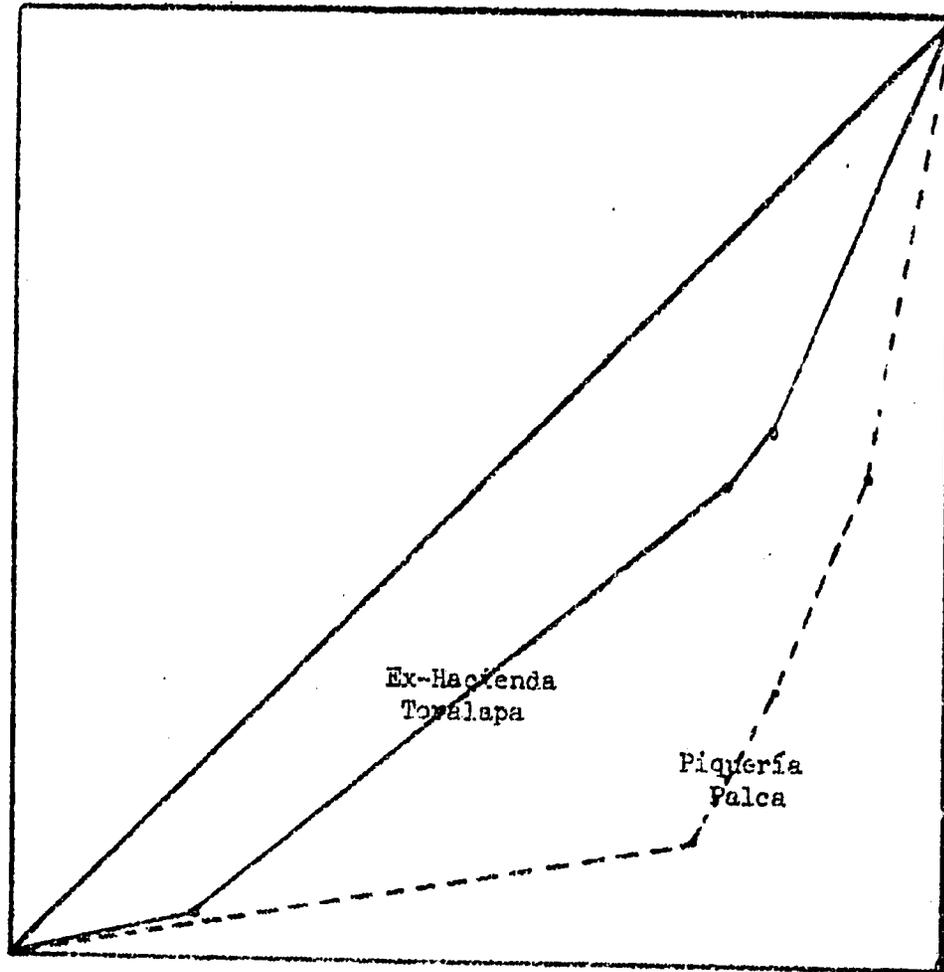
##### A. Land Tenure in the Post-Reform Period

The most immediate effect of the agrarian revolution was the elimination of the labor obligations to the hacienda, thus making it possible for campesinos to work full-time on their own plots of land. By one of the first provisions of the Agrarian Reform Law, campesinos became owners of whatever land they had previously been using within the framework of the colonato system. Thus a minimum was set to what campesinos could expect to receive under the provisions of the reform. This provision also eliminated out-of-hand the possibility of achieving an equitable distribution of land resources except in those few cases where enough land was available from expropriation from the hacienda to bring all plots up to the size of the largest plot, since no reduction was possible in the size of this plot. Thus, while most pegujales or use plots on Toralapa were of the order of 2 hectares, some individuals had considerably larger plots; even after distribution of hacienda land, including the 200 hectares awarded to the landowner, it was possible to increase the allotment of the majority of campesinos to 3.5 or 4 hectares. But the achievement of a totally equitable distribution of land (and thus income) was not possible.

Although the distribution of land on Toralapa resulting from the reform was less than perfect, redistribution of hacienda land did make possible a far more equitable distribution of land. Superimposition of Lorenz Curves calculated by Peinado for Toralapa and Piquería-Palca show that the distribution of land resulting from the reform was far more equal than that resulting from individual purchases by small holders, even after some increase in holdings as a result of the reform. (See Figure 2.)

In the Lower Valley land generally seems to be the constraining factor on raising income. Land is highly significant in multiple regression equations explaining income. Campesinos purchase land whenever available, enter into sharecropping, rental, and other types of agreements to increase their land holdings, and double-crop the land they have. On Toralapa, on the other hand, each campesino generally has enough land, an average of

Figure 2.  
Lorenz Curves for Land Distribution in Post-Reform  
Ex-Hacienda Toralapa and Piqueria Palca



Source: Peinado, The Reform in Three Communities, pp. 251A and 251C.

about 15 percent of the irrigated land, and a slightly higher percentage of the rain-fed land (about 20 percent) is left fallow every year.\* Many of those surveyed reported that the same plots had been fallow for periods up to four years, apparently indicating that some other factor, probably labor, limited achieving further increases in production by the incorporation of marginal land.

Where a latifundio was declared, campesino access to land almost invariably increased. On Toralapa this amounted to an additional 2 to 4 hectares per family. It was also common for an additional number of families to be included in the community as a result of the reform, as has been seen in the Lower Valley case study where ex-miners were able to acquire land. At the time of the reform, there were approximately 20 to 30 colono families residing on Toralapa; by 1967, there were 88 families. Thirty-five families, expelled from the Hacienda Toralapa when the landlord reincorporated their pegujales into the land worked directly by the hacienda, were able to return. The remaining families receiving land under the terms of the reform decree were probably arrimantes and recently married sons of ex-colonos who had not had their own pegujales before the reform. Nine families received only their pegujales since they had been unwilling to support the sindicato's legal process to have the farm expropriated under the terms of the Agrarian Reform Law.

Even after the 200 hectares awarded to the former owner had been divided up among the 79 families who had supported the sindicato, some marginal land still remained. The use of an additional plot of land could be obtained from the sindicato for the asking. In fact, few families have gone to the bother of obtaining additional plots since the work involved in clearing the stones from such marginal land is not compensated for by the additional yield that could be expected from it, particularly since clear title to such land could not be established.<sup>54</sup>

According to a 1963 study of Arani Province by the Inter-American Agricultural Service,<sup>55</sup> sharecropping with 4 percent of the area surveyed

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54. Peinado, The Reform in Three Communities, p. 113.

55. The study cited by Peinado is H. Murrillo and E. Jauregui, "Socio-Economic Study of the Rural Area of the Province of Arani" (Cochabamba: Inter-American Agricultural Service, 1963); citation by Peinado, p. 116.

\*The overall percentage of land fallow was 20 percent in the 1967 sample.

(no. of respondents = 119) was the next most common form of land tenure after ownership. Peinado's own study showed that 4.5 percent of the campesinos of Toralapa "had a sharecropping arrangement with landless farmers of the same ex-hacienda . . . to obtain additional labor." It will be recalled that campesinos had such arrangements before the reform with arriantes, showing how pre-reform institutions have been adapted to the post-reform situation. No example of this type of sharecropping turned up in the 1973 sample, although one campesino did report sharecropping land belonging to a former Toralapa resident now living in Santa Cruz. Both the 1967 and the 1973 surveys found that a little more than one-third of those surveyed engaged in sharecropping, mostly with local vecinos, for the purpose of acquiring fertilizer and seed potatoes from another area. Since sharecropping is most commonly related to acquisition of factors of production other than land, further discussion will be deferred until later in this section.

Other forms of tenure found in Arani Province in the 1973 study are rental agreements (2.5 percent of the area) and collective production (less than 1 percent). Neither of these tenure forms were found on Toralapa for either of the two periods for which data are available.\* In general, individual ownership is the dominant tenure form both in the Upper Valley and elsewhere in Bolivia; thus far land has not been the contraining factor for most campesinos.

In most ex-haciendas, campesinos' houses are concentrated in the area around the former landlord's mansion, church, school, and soccer field. As a result, distances to some parcels may be as much as two to four kilometers, although most campesinos live much closer to their land.<sup>56</sup> Reflecting the way holdings were distributed before the reform, most campesinos

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\*In the years following the reform, collective production was often used to provide the necessary revenue to the sindicatos for defraying the cost of the judicial process of expropriation and titling; furthermore, land awarded to the landowner whose return was prevented by the sindicato was sometimes worked collectively, and in a few cases still is. Peinado gives examples of both types of collective production of Kaspicanha and Palca; see Peinado, The Reform in Three Communities, pp. 108, 242, 243, and 110.

56. Ibid., pp. 96, 119.

still have more than one plot of land. According to Peinado,

In the communities studied, no campesino has his farm property in one single unit, and this appears to be the usual case in the area of Tiraque.<sup>57</sup>

Peinado suggested various ways that fragmented holdings might be consolidated, thereby reducing the costs of running an operation scattered over numerous plots of land.<sup>58</sup> In fact, such costs either do not exist or are of negligible importance in many areas of Bolivia. Fragmented holdings may actually benefit campesinos since spreading the farming operation over several locations creates some diversification of risk, especially where frosts and other climatological phenomena are localized. It also permits growing different crops on land most suited to their production: irrigated land for an "early" crop of potatoes, corn and broad beans on unirrigated land, wheat and barley on drier land at a higher elevation. Where such costs are significant, one would expect to find campesinos selling and buying or exchanging plots to consolidate holdings, something not observed on Toralapa or anywhere else in the areas of Bolivia most affected by the reform.

In addition to their individual plots, campesinos from Toralapa have the right to graze their flocks of sheep and other animals on the 700 hectares of collectively owned land. There is no limit put on the numbers of animals each family may pasture.<sup>59</sup>

## B. Agricultural Production, Intensity of Land Use, and Changes in Technology in the Post-Reform Period

### 1. Changes in Agricultural Production

Changes in cropping patterns were perhaps less dramatic in the Tiraque region than in the Lower Valley and in that respect were more typical of what occurred in most areas of rural Bolivia. Shorter growing seasons, the ever-present danger of frost, and the failure to develop and diffuse frost-resistant varieties left campesinos with no alternative but to continue producing those crops which they had grown both on their pegujales

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57. Ibid., p. 148.

58. Ibid., p. 149.

59. Ibid., p. 91.

and on hacienda lands in the pre-reform period. While totally "new" crops did not appear, crops whose importance had been minor in the pre-reform period showed dramatic increases in the area planted to them, in total output, and in their position relative to the staple crop, potatoes. Despite massive increases in the area under cultivation and the incorporation of land of progressively poorer quality, gross estimates of production per hectare on Toralapa follow the generally rising trend observed in macro-level statistics for per hectare production of different crops.

Potatoes remain the single most important crop, both for their value commercially and for their use within the individual household directly and in their dehydrated form.\* Potatoes alone constituted about 77 percent of the total value of crop production in 1967.<sup>60</sup> In 1973, the value of potatoes as a percentage of the value of the six major crops\*\* was only 68 percent, although as in the Lower Valley case study it seems likely that bad weather in 1973 may have had something to do with the decline in this percentage as well as in an apparent drop in per hectare production of potatoes. Nonetheless, potatoes remain, as before 1952, the most important crop on Toralapa. Only a small fraction of the production since the reform is destined for on-farm consumption; 73.5 percent of the potato crop is sold, 9.5 percent is saved for seed, 11.5 percent is consumed on the farm, and the remaining 5.5 percent is divided between making chufio and bartering. Chufio is consumed for the most part, but about one-third is marketed either by sales or by barter.

Data from Table 1 show that an increase of more than 50 percent in the area planted to potatoes between 1950/51 and 1965/66 was accompanied by a small rise in per hectare production (from 10.87 to 11.54 metric tons/

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\*Either chufio: crushed by stomping on them and left exposed to the sun and frosts over a period of several weeks; after dehydration occurs, chufio can be stored for several years and is somewhat smaller than the original potatoes; or tunta: dehydrated in a similar fashion but including submersion in flowing water for several weeks; tunta possesses similar properties for conservation and is somewhat lighter and more compact than the amount of chufio produced from the same initial weight of potatoes.

60. Unpublished survey data from the archives of SNRA, gathered by Peinado.

\*\*Potatoes, barley, wheat, broad beans, oca, and corn.

hectare). Production observed in 1973 was under 9 metric tons/hectare; however, this figure fails to take account of substantial quantities of potatoes turned over to partners in sharecropping arrangements. It has been possible to maintain productivity by the adoption of chemical fertilizers in addition to the manure used before 1952. (This question will be investigated in more detail later in this section in the discussion of changes in technology.)

The area planted to other crops has risen more than fivefold since 1953, from about 40 hectares to over 200 hectares in 1966 (see Table 1). Over the same period production per hectare of these crops has risen from 1.25 to 1.5 metric tons per hectare, although little more can be said because this increase may reflect changes in the composition of output more than anything else since no breakdown of pre-reform production is available. In physical terms, these crops rose from just over 5 percent of the total volume of production in 1950/51 to a little less than 30 percent by 1965/66. By 1973, crops other than potatoes constituted a little more than 30 percent of the value of production.

Of crops other than potatoes, all but 4 percent of the value of agricultural production comes from just five crops. In order of their importance, these are: barley, wheat, broad beans, oca,\* and corn. The first three are definitely produced more for market than for on-farm consumption and constitute, respectively, about 40, 30, and 20 percent of the value of non-potato products, with approximately equal contributions made by oca and corn. Producers of oca are evenly divided between those who sell more than they consume and those who consume more than they sell; production of corn is strictly for consumption or bartering for chicha.\*\* Small quantities of wheat and corn form part of the family diet: little or none is used for livestock, poultry, or other farm animals. Some barley and oats are grown for forage, although it was not possible to put a cash value on them since none is bought or sold. A few farmers also grow small amounts

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\*Oca is a root similar to the parsnip in shape but a little smaller.

\*\*A fermented beverage made of a mash of finely ground malted corn and water.

of papaliza (a diminutive and tasty reddish potato), peas, and quinua (a hardy and protein-rich grain which does well at high altitudes) for on-farm consumption. Particularly in the case of some of the minor products, production is clearly directed at domestic consumption, with whatever surplus that remains being sold.

Regardless of how one chooses to measure it, the degree of integration of campesinos from Toralapa and all other areas of Bolivia into Spanish-speaking society is considerably higher than in the pre-reform period. Before the reform, campesinos sold only about 10 percent of what they grew and used another quarter of what they produced for barter. Data from Table 1 show that little more than a decade after the reform campesinos were marketing over 70 percent of the volume of agricultural production; since bartering still has not disappeared, more than three-quarters of what was produced found its way to market one way or another.

Most production in the Tiraque region is primarily agricultural. Although the sale of animals and animal products as a percentage of total income more than doubled between the 1965/66 and the 1972/73 agricultural year, to a little over 10 percent, it still represents a very small part of total income and less than one-fifth of all sales. Most of the value of such sales comes from the sale of sheep. The value of consumption of animals and animal products has remained constant over the two periods at approximately the equivalent of US\$75, or just under 10 percent of total income. Taking the two surveys together, slightly more animals and animal products are consumed than are sold. On the average, however, only about one-fifth of the value of agricultural products is used for on-farm consumption, while about four-fifths is marketed or bartered. Bartering accounts for only a little more than 5 percent of the value of agricultural production. Bartering in livestock is extremely uncommon.

## 2. Changes in the Intensity of Land Use

Change in the land tenure system was responsible for a massive increase in the number of hectares in crop production. Between the 1950/51 and the

1965/66 agricultural years, the total amount of land in production rose more than three times, from 86 to 296 hectares. Peinado reported that on Toralapa the normal rotation cycle consisted of a crop of potatoes, then barley, a year fallow, another crop of potatoes, and then four years or more fallow. In general, the period of fallow was between three and six years.<sup>61</sup> According to a soil scientist from the University of Wisconsin,\* fallow is of absolutely no use in improving the fertility of soil. What the long fallow periods apparently reflected was a lack of sufficient resources to use all available land and probably an inherited belief that fallow was necessary. In the 1973 survey it was found that less than 15 percent of irrigated land in the sample was left fallow. The average fallow period for irrigated land was one year. Four of the 15 respondents who had some irrigated land reported that they were using all the land they had available. As was to be expected, a slightly higher percentage of unirrigated land (just over 20 percent) was not cultivated in the 1972/73 agricultural year and showed an average fallow period of little more than three years. The percentage of land left fallow is slightly lower for those with 3 hectares or less compared with campesinos with more than 3 hectares (15 vs. 20 percent), but this difference is not statistically significant. In no case did the fallow period exceed four years. The individual with the smallest land holding (0.6 hectare of unirrigated land) naturally planted his entire holding.

Another indication of increasingly intense land use is that while 13 families reported receipt of wages in the 1967 survey for work off their own land, only 4 reported such earnings in 1973, apparently implying that returns to labor on the family parcel of land exceeded the going wage rate. Those reporting the receipt of wages also had lower than average incomes. Those who did report wage earnings all reported earning \$b. 15 in 1973 (the equivalent of 75¢/day), equaling or exceeding the wage rate paid in most rural areas. Furthermore, all respondents reported making wage payments in the 1972/73 agricultural year, averaging just over \$b. 170 or roughly

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61. Ibid., pp. 95, 138.

\*Conversation with Dr. Richard D. Powell, 17 April 1974.

the equivalent of 12 man-days per year, assuming that they paid \$b. 15 a day. Family size on Toralapa averages 4.5 members; this is apparently insufficient to provide enough labor at peak periods.

Table 3. Work as Day Labor by Levels of Farm Income, 1973  
(N = 18)

	0-9,000	9,001-13,500	13,501-50,000
Day Labor	2	2	0
No Day Labor	1	6	7

### 3. Population Retention as a Result of the Reform

One immediate result of the land reform was to permit the return of 35 families who had been evicted a few years before as the upshot of a conflict with the landlord who wanted them to exchange their pegujales for other land of poorer quality. In addition to this group, a number of families (somewhere in the range of 25 to 30) also acquired land as a result of the reform; many of these were probably sons of colonos and arrimantes, some of whom might have been expected to acquire a pegujal from the hacienda at some point. Generally, however, where a hacienda was declared a latifundio, colonos who already had some land could expect additional land and others who could establish some prior claim (previous residence on the hacienda, arrimantes, young men, etc.) were frequently also able to acquire land within the judicial process of the agrarian reform.

The increase in the area under cultivation on Toralapa was so substantial that hired labor is required during peak periods of agricultural activity, providing employment for landless workers. Based on the size of the average wage bill, campesinos of Toralapa must contract for between 1,000 and 1,500 man-days per year. Because of the cyclical nature of agriculture, large numbers of outside workers are hired, but for short terms of employment.

Few cases of migration were reported in the 1973 survey. Two families reported daughters who had married and moved to other rural communities. One respondent reported that a son had moved to Argentina and was working there. One respondent to the 1967 survey (whose income exceeded the average) had moved to the Santa Cruz area and had a parcel of land on which he

grows rice. At the time of the survey, his land was being sharecropped by a young campesino (one-third for the owner in Santa Cruz, who provided only the land, and two-thirds for the sharecropper). The owner had no intention of returning and had recently agreed to sell the land to the sharecropper for \$b. 10,000 to be paid over a period of five years.

#### 4. Changes in Production and Prices Between the Two Surveys

In the years immediately following the reform, reorganization of the country's entire marketing system resulted in a quantum jump in the price of potatoes of about 100 percent. Prices rose even further in the drought-stricken years of the mid-1950s before resuming the downward trend one would expect to find in a product with an income elasticity of demand as low as potatoes during a period of rising production and income. The average retail price of potatoes in 1950 in the La Paz market was about \$b. 2.5/kg.<sup>62</sup> (measured at 1973 prices), or about 5.7¢/lb. Assuming that the Toralapa crop was sold at this price,\* the value of the 393 metric tons originating in Toralapa would have been nearly US\$50,000, of which more than 99 percent would have represented the owner's share of potato-sales revenue. Since production and transportation costs were minimal and taxes negligible, net revenue from the potato crop alone could provide the owner of a large hacienda like Toralapa with satisfactory income even by the standards of developed countries.

Potato crops in 1965/66 and 1972/73 of 813\*\* and 579 metric tons, respectively, would have sold at wholesale for about US\$70,000 and \$38,000 at current prices and the exchange rates (\$b. 12/\$1 in 1967 and \$b. 20/\$1

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62. Stephen M. Smith, "The Potato Market of La Paz, Bolivia, and the Effects of the Agrarian Reform," LTC no. 76 (April 1971), and unpublished retail price data from the same author.

\*Hacendados usually had their own retail stores (called aljerías) connected to their houses in the city out of which much of their production was sold at retail. On the more conservative assumptions that most of the production was sold at wholesale and that retail prices retained a proportion of twice wholesale prices, the value of the crop would have been only about US\$25,000 and the wholesale price about \$b. 1.25 (1973 prices), or roughly what campesinos were receiving in 1973.

\*\*My estimate of the crop (88 producers X [sample] average quantity/producer) comes out about 3 percent lower than Peinado's.

## IV.43.

in 1973) then prevailing. Thus a potato crop 41 percent lower in 1973 compared to 1967 resulted in an 86 percent drop in revenue from the crop. The reasons for the drop in production may well be related to climatic conditions as well as to the response of campesino producers to low prices. As may be observed from Table 4, between 1967 and 1973 the prices actually received by campesinos on Toralapa for their three most important cash crops failed in each case to keep pace with the 63 percent increase in the Consumer Price Index between the two periods. Similar unfavorable price movement was observed in the Lower Valley case study. For wheat the nominal price of a kilo is actually lower in 1973 than in 1967 despite massive inflation. Weighting each of the three products by its value in that year's production to produce an index of that year's prices and dividing the 1973 index by the 1967 index produces a ratio of 1.17:1; on the other hand, the ratio of the 1973 and 1967 CPIs for La Paz yields a figure of 1.63. The failure of agricultural prices to keep pace with consumer prices implies severe hardships for Bolivian campesinos since their integration with the national economy makes it necessary for them to sell most of what they produce and purchase most of what they consume, which has been stated earlier and will be confirmed later in this section.

Table 4. Mean Production and Prices Received by Campesinos for Potatoes, Barley, and Wheat

<u>Product</u>	<u>Q (kg.)</u>	<u>P/kg.</u>
		1967
Potatoes	9,243	\$b. (1967) 1.04
Barley	1,325	0.68
Wheat	870	1.20
		1973
Potatoes	6,578	\$b. (1973) 1.31
Barley (grain)	1,482	0.89
Wheat	1,144	0.93
<u>Price Ratio</u>	<u>1973 Price/1967 Price</u>	
Potatoes	1.26	
Barley	1.30	
Wheat	0.78	

Ratio of Consumer Price Index (for La Paz) August 1973/June 1967 = 1.63

(cont.)

(Table 4. Mean Production and Prices Received cont.)

Ratio of the Value of the Implicitly Weighted Price Index (for Potatoes, Barley, and Wheat) 1973/1967 = 1.17

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Source: Unpublished survey data from the archives of the SNRA prepared by Dr. Marcelo Peinado S. and 1973 survey data.

The high degree of competition at the producers' level\* in the agricultural sector, its generally good record in keeping up with increases in demand to food and other farm products, and the imposition of maximum prices for various agricultural commodities (by local governments [alcaldías]) appear to be the major reasons for the failure of agricultural prices to rise proportionately to the general rise in the price level. The devaluation of the Bolivian peso (from 12 to 20 pesos per dollar) in late 1972 had a strongly negative impact on rural incomes due to the inability of campesinos to raise their prices while groups with more market power were able to pass through approximately 100 percent of the increased costs of imported goods.

#### C. Technological Change in the Post-Reform Period

##### 1. Fertilizer

More intensive land use since 1952 has required some changes in technology, particularly in the maintenance of soil fertility through increased usage of both organic and chemical fertilizers. Since all parties recognized the importance of manure for improving yields, the provisions of the colonato system which on Toralapa required campesinos to turn over half the manure produced by their animals to the hacienda was felt by colonos to be one of the most onerous requirements of the entire system. No chemical fertilizer was used before the reform nor is there any record of additional purchases of manure from pastoral haciendas or comunidades at higher elevations (as occurred on some of the haciendas in the Lower Valley before 1952).

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\*This is not the case farther down the distribution chain in transportation, wholesaling, etc., where considerable elements of market power are felt.

Most of the manure used comes from sheep which are by far the most numerous animals both now and before the reform. (Cattle manure is of less value for increasing soil fertility and has alternative uses as a source of fuel for cooking.) Sheep are kept in corrals over night so that their manure will accumulate in one place where it can be collected. As was noted on page III.24, the hacienda had about 900 sheep before the reform. Generally speaking, colonos tended to have at least as many animals as the hacienda,<sup>63</sup> suggesting that there may have been about 2,000 sheep on Toralapa in the years before the reform. Based on Peinado's estimate of 25.51 sheep per family, the 88 families on Toralapa must have had about 2,200 sheep in 1967, or about the same number as there were on the hacienda before 1952. Since the area under cultivation is impressively greater and in particular the number of hectares planted to potatoes (the crop most often fertilized)<sup>64</sup> is up by more than 50 percent, additional fertilizer would be required to maintain yields at similar levels and especially to offset declines which might otherwise be expected through the incorporation of land of lower productive potential.

A thriving trade has developed between campesinos from higher elevations\* who raise sheep (and llamas) and sell the manure and campesinos like those of Toralapa who live at lower elevations and concentrate on crop production. In general, campesinos from Toralapa do not have the necessary connections to trade directly with campesinos from highland regions for sheep manure and with other areas to get seed potatoes, or cannot get truck owners to bring them without the incentive of a sharecropping agreement. Only three farmers purchased their own organic fertilizer in 1973; seven entered into sharecropping agreements with local vecinos, probably truck owners, who provided seed and manure (and in four cases chemical fertilizer as well); seven more used only the manure available from their own animals

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63. LTC-CIDA Team, Final Report (La Paz, 1971), Chapter IV.

64. The National Bolivian Oil Company (YPFB) found that 90 percent of all chemical fertilizer used in Bolivia went to potatoes. The cost per truckload (about 500 kilos) is \$b. 143.5, or approximately 1.5¢ on a per kilo basis.

\*Land in many highland regions is either too high and cold, of very poor quality, or too steeply sloped for cultivation.

and bought their own chemical fertilizer; and one woman planted without chemical fertilizer of any sort.

The average number of truckloads of organic fertilizer for the three farmers making such purchases was two truckloads. The cost per truckload (about 500 kilos) is \$b. 143.5, or approximately 1.5¢ on a per kilo basis. Unfortunately, information is not available on how many truckloads of sheep manure were usually provided under the sharecropping arrangements. The average number of 100-pound sacks of pre-mixed chemical fertilizer used was 3.14 sacks and the median lay between 2 and 3 sacks at an average cost of \$b. 134.5 per sack or about 15¢ per kilogram. What one would like to know, of course, is the cost per kilo of nutrient (nitrogen, phosphorous, and potassium) but this information is unavailable.

In an attempt to determine the value of chemical fertilizer in potato production,\* multiple regression equations were run, using kilos of potatoes produced as the dependent variable and land, sacks of chemical fertilizer, and a dummy for sharecropping\*\* (0 if no arrangement existed and 1 if sharecropping was found) as the independent variables. Production data come from a section of the questionnaire designed to measure "gross income from crops"; so potato production does not include potatoes turned over to a partner in a sharecropping arrangement. Land could be measured either as available hectares devoted to potatoes or as a constructed variable attempting to equate the productivity of irrigated and unirrigated land; results will be presented for the simpler definition of land only, since very little appears to be gained by the more complicated definition, the construction of which is described in detail in a subsequent part of this section. Chemical fertilizer is measured in sacks, which is the way campesinos buy it; in some areas of the country (where lesser amounts are used), campesinos buy it in lots as small as one kilo. Thus the coefficient

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\*It bears repeating here that virtually all fertilizer is used on potatoes and practically none of other crops.

\*\*To make the problem interesting, most of those engaging in sharecropping also had other plots which they farmed exclusively for their own benefit; data were available only on total retained potato production and area in potatoes.

on fertilizer is the marginal return to an additional 50-kilo ( $\approx$  110 lbs.) sack of fertilizer. The coefficient on the dummy variable for sharecropping is a measure of the amount of potatoes turned over after account is taken for the increased yield due to the arrangement (better seed and organic fertilizer). Results are presented below:

## MODEL 1

$$\text{POTATOES} = -3072 + 5157 \text{ HECTARES} + 1840 \text{ CHEMICAL FERTILIZER}$$

$S_b$	(1508)	(2017)	(263)
t with 7 df	-2.03	2.56	6.99
sig. level	0.08	0.03	0.00
$R^2 = .9785$			

standard error of the estimate, 18.92

F-Ratio for overall regression with 2 and 7 df = 159.40, significant at .0000 n = 10

## MODEL 2

$$\text{POTATOES} = -2841 + 4881 \text{ HECTARES} + 1663 \text{ CHEMICAL FERTILIZER} + 1089 \text{ SHEEP MANURE}$$

$S_b$	(1509)	(2015)	(309)	(1022)
t with 7 df	-1.88	2.42	5.38	1.06
sig. level	.11	.05	.00	.32
$R^2 = .9819$				

standard error of the estimate, 18.75

F-Ratio for overall regression with 3 and 6 df = 108.69, significant at .0000 n = 10

For the first model only those observations (10 of the 18 total) were used, in which no sharecropping arrangement existed. As expected, a strong relationship between the amount of land in potatoes and total potato production was observed. More importantly, the high value and level of significance on the coefficient of fertilizer confirm what had been suspected: that the return to the use of chemical fertilizer far exceeds its cost. Experts on chemical fertilizer from the Tennessee Valley Authority concluded that rapid adoptions of a new technique of input in developed countries will take place only if the ratio of value of increased output to cost of the associated input is of the order of three to one; in developing nations

that ratio has to be even higher.<sup>65</sup> With chemical fertilizer at \$b. 135 per sack and potatoes selling for \$b. 1.24 per kilo, the estimate of the coefficient for chemical fertilizer from Model 1 yields a benefit-cost ratio of nearly 17 to 1. However, because accurate measures of all factors used in potato production, particularly labor, animal traction, and organic fertilizer, were not included in the equation because of lack of data, the coefficients are only approximations of the marginal physical products of the inputs and probably overestimate true values of these parameters. Although the estimate of the return to sheep manure in Model 2 is imprecise, its lower value compared to the coefficient on chemical fertilizer suggests that substitution into chemical fertilizer can be expected to continue. Even after recent price increases are taken into account, I expect that returns to chemical fertilizer are still sufficiently favorable to encourage increased usage in potato production.

The fact that only three of the respondents purchased manure themselves and that the amounts of fertilizer purchased were small reflects two problems. First, the campesinos probably do not fully appreciate the value of fertilizer in increasing output. Most apply only about 2 sacks on an average area of 0.86 hectares, or about 2.3 sacks per hectare. However, the respondent with the highest income in the sample used 16 sacks on a total area in potatoes of 2.5 hectares, or about 6.5 sacks per hectare. As time goes on, the amount of fertilizer individual farmers think should be applied can be expected to rise, as long as the benefit-cost ratio remains highly favorable, both as a result of their own experience and of the demonstration effect of superior results obtained by individuals such as the one mentioned above.

A second problem, however, may be the question of connections for purchasing and transporting organic fertilizer (and potato seed from another

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65. Tennessee Valley Authority (D. A. Russell, R. J. Ballew, J. I. Buez, and Donald Wartzman) for USAID, "A Fertilizer Program for Bolivia" (Muscle Shoals, Ala., June 1970), p. 39.

area) and the availability of cash at the planting time for purchasing chemical fertilizer.\* The major reason for sharecropping arrangements with vecinos from Tiraque are their connections with campesinos in other areas and their ability to obtain organic and chemical fertilizer and potato seed either with their own resources or with the help of loans they have obtained from the Banco Agrícola, which until the early 1970s had a branch office in Tiraque. Sharecropping takes a variety of forms, described by Peinado in detail in Appendix 4, under which vecinos from Tiraque provide one or more of the following inputs: seed, chemical fertilizer, and manure. The ex-colono provides all remaining inputs. The division of the proceeds of the sharecropping operation ranges from equal parts of the harvest going to each party after deducting the seed provided by the vecino (in the case that all three inputs are provided by the non-working sharecropper) to a two-thirds, one-third division with no deduction for seed when the vecino provides only one of the three inputs. Seven of the eight sharecropping arrangements found in the 1973 sample were of this type. (One campesino was involved in an arrangement with a former resident of Toralapa to acquire additional land, as described in the previous section.)

## MODEL 3

POTATOES	= -4230 + 6651 HECTARES + 1658	CHEMICAL FERTILIZER	- 1458 SHARECROP
$S_b$	(1394) (1780)	(239)	(1217)
t with 10 df.	-3.01 3.74	6.93	-1.20
sig. level	0.01 0.01	0.001	0.26
$R^2 = .9688$			

standard error of estimate, 19.64

F-Ratio for overall regression with 3 and 10 df = 103.46, significant at .0000 n = 14

As may be seen from Model 3, the inclusion of a dummy variable to estimate the total effect of sharecropping on the amount of potatoes

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\*Fertilizer dealers simply cannot give credit to campesinos coming in individually to purchase a few bags at a time. Author's field notes, 17 July 1973: Interview with Fernando Carrasco L. of Agroservicio, Ltda., a branch of Grace and Company dealing in fertilizer and other agricultural chemicals.

#### IV.50.

campesino brings home at the harvest time appears with the expected negative sign, although the estimate is very imprecise. This imprecision is a reflection of the failure of the questionnaire to capture the diversity of sharecropping arrangements found on Toralapa.

In addition to chemical fertilizer, campesinos are also using various kinds of insecticides, particularly to protect the all-important potato crop. What percentage of the farmers use insecticides is not clear since the questionnaire did not include a specific question on their use.<sup>66</sup>

Campesinos are generally aware of the positive results obtainable from the use of chemical and organic fertilizer; most use a little of both, and the farmer with the highest usage of chemical fertilizer on Toralapa does approach the seven sack per hectare one fertilizer dealer suggested as a "ball-park" estimate of what is generally required for potatoes.\* Even at higher prices, the benefit-cost ratio remains highly favorable to chemical fertilizer in potato production. The continuing employment of sharecropping arrangements for the acquisition of seed and chemical and organic fertilizers indicates that this is one area in which public policy could act to increase production and farm incomes. Peinado mentions an effort of a cooperative near Vacas (also in the Upper Valley) to obtain fertilizer for its members;<sup>67</sup> similar activities were engaged in by cooperative groups in the Northern and Central Altiplano working with the UNDP Bolivia 21 program, with some success in increasing fertilizer usage. The closing of the Tiraque office of the Banco Agrícola is not likely to have affected usage of these inputs by campesinos from the area since none of them received credit from the Banco\*\* except through sharecropping with vecinos who did receive loans. Vecinos frequently were able to acquire credit from the Banco to finance sharecropping arrangements which they had with

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66. Peinado, The Reform in Three Communities, pp. 182, 210.

\*Precise estimates of soil requirements for N, P, and K could only be determined with a program of soil testing with results made available to the campesinos; the soil testing that has been done so far in Bolivia (in a project carried out by North Carolina State University) has been for soil mapping rather than individual farm-use purposes.

67. *Ibid.*, p. 112.

\*\*None from Toralapa received such credits.

campesinos.<sup>68</sup> It is likely that some kind of a group credit scheme, such as the Banco Agrícola was setting up in the Central Altiplano in 1973, could have a substantial effect on increasing usage of fertilizer and seed from other areas. To the extent that curtailment of competition by the national organization of truck owners limits the ability of campesinos to obtain manure and seed, action by the national government in this area might also be beneficial in increasing production.

## 2. Land Preparation and Tractor Usage

Two small changes in land preparation are found in the 1973 data which were not found by Peinado in 1967. The first is in the use of the metal plow, which improves land preparation because of its deeper penetration than the wooden plow which has been used for centuries and in some cases eliminates the need for plowing twice, thus decreasing the amount of labor necessary for preparing a given amount of land. In the interim between the two studies, three families have acquired such plows. Their high initial cost (over 100 pesos), high maintenance costs (about 50 pesos/year), and relatively short life (about four years) are factors limiting their adoption on Toralapa; how rocky some of the land on Toralapa is was remarked upon earlier. For these reasons, two of the three individuals reporting owning plows of this type also reported the highest incomes in the sample.

Table 5. Average Number of Livestock per Family

	<u>1967</u>	<u>1973</u>		<u>1967</u>	<u>1973</u>
Cows	1.00	1.00	Chickens	---	4.22
Oxen	2.25	2.06	Poultry	4.39	4.22
Calves	0.63	0.50	Pigs	0.72	2.39
Cattle	3.53	3.56	Guinea Pigs	2.86	3.11
Sheep	25.51	42.83	Horses	0.51	0.50
Donkeys	1.01	0.94			

Source: Peinado, The Reform in Three Communities, Table 35, p. 140, and 1973 survey data.

<sup>68</sup>. Author's field notes for 8 August and 5 July 1973.

There has also been a slight decline in the mean number of oxen owned by each family (from 2.25 to 2.06). Though this change is not of sufficient magnitude to indicate definitely that campesinos are consciously switching away from oxen as a means of traction for land preparation, in combination with the increase in the number of sheep observed in Table 5, it may indicate a desire to move into animals which by providing meat, manure, and income for the family increase its welfare more than oxen which are useful exclusively for pulling a plow. Two individuals obtain the use of oxen by aini or exchanging their labor with campesinos who have extra oxen; one individual with one ox swaps with another individual who also has only one ox to make a yoke.\* All three respondents earned less than average incomes. There is no rental of oxen in the 1973 Toralapa sample nor is such an arrangement mentioned by Peinado.

The 1973 sample turned up one campesino who had hired a tractor for three hours for land preparation. None were reported in Peinado's 1967 study. Since the same respondent had three yokes of oxen, more than any other campesino surveyed, the hiring of a tractor would seem to indicate that the ability to prepare land within a given period of time may be a constraint to increasing agricultural production. Particularly with respect to the large areas of stony, marginal land, mechanization of land preparation may be the only way additional land can be brought into production. The slow appearance of tractors in an area where grains are major cash crops is something of a surprise unless one takes account of the effect of the agrarian reform. The major sources of farm machinery in areas where campesinos are rapidly adopting them, such as the Lower Cochabamba Valley, are the landlords who have set up capital-intensive farm operations on the land they have succeeded in keeping and a few vecinos who have purchased tractors and provide custom service, mainly for landlords with relatively small holdings of land. By 1953 landlords were expelled from the Upper Valley and have never been allowed to return. Thus, the nucleus of land owners with large amounts of land to farm, generally well-endowed with their own capital and able to acquire additional capital from the Banco Agrícola

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\*This arrangement was also found in the Lower Valley case study.

and to count on a dependable and "cooperative" supply of labor, simply does not exist in the Upper Valley. Setting up a custom-service operation for land preparation without an assured market is a risky business, which may be why it took so long for tractor owners to appear in Toralapa. Even with increases in the cost per hour of operation (resulting from higher fuel and import costs), such operations are likely to expand rapidly now that initial contacts have been made.\* The process could probably be speeded up and the benefits from mechanization more clearly transferred to the campesinos of Toralapa and other rural areas. Credits from the Banco Agrícola and international lending institutions could be channeled to agricultural service cooperatives rather than to well-to-do vecinos or landlords who have been their major recipients thus far. Such action could be expected to increase the area of land under cultivation (particularly for grains like wheat, of which Bolivia has long been a net importer), raise employment and total production, and perhaps even improve production per hectare (through better and more timely preparation of land that is currently being used).

Peinado reported that gasoline-powered threshing machines had been used on Toralapa in the 1965/66 agricultural year.<sup>69</sup> This system represents a considerable improvement over the wooden hand-swung flails which are the other way in which threshing is accomplished. Perhaps the fact that the 1973 survey was conducted later in the year (August as opposed to May and June) than the 1967 survey explains why this operation was not observed; by August the harvest from the previous year is basically finished. As with insecticides, one would have expected threshing expenses to show up as a cost of production (in the appropriate section of the questionnaire); their failure to appear, however, may only be a result of the absence of a specific question on threshing machines.

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\*As was the case on one hacienda in the Lower Valley (Caramarca) where tractor usage rose from 10 to 75 percent of the respondents over a six-year period.

69. Peinado, The Reform in Three Communities, p. 136.

## D. Levels of Income and Standard of Living in the Post-Reform Period

## 1. Determinants of Gross Farm Income

The 1973 survey provided data on various factors thought to have some effect in determining gross farm income of campesinos from Toralapa. For some variables, data could be used in the form in which they were collected; for others, various kinds of coding or transformations were used to develop additional variables, as described below. Information on the following base variables was available from the survey:

1. Irrigated land, expressed in square meters. Since there was no information to the contrary from field interviews, all irrigated land was treated as homogeneous.
2. Unirrigated land, expressed in square meters and also treated as homogeneous.
3. Fallow irrigated land, expressed in square meters and defined as that area not planted in the year previous to the survey.
4. Fallow unirrigated land, also in square meters and defined in a like manner.
5. Value of animals, including poultry as well as oxen, horses and other livestock, measured at the time of the survey and expressed in Bolivian pesos of August 1973.
6. Household goods, a component of wealth and defined to be the value in 1973 pesos of the major purchased items found in the home of the respondent.
7. Fertilizer purchases at purchase prices made in the year previous to the survey.
8. Market sales, defined to be the number of sales transactions in which the farmer sold agricultural products or livestock.
9. Additional information was also available on the age, sex, and occupation of all members of the campesino's household.
10. Gross farm income, defined to be the sum of the value of all agricultural production (including sales, on-farm consumption of crops, and retained seed) plus livestock and poultry production (including both consumption and sales but excluding off-setting sales and purchases) plus the value of sales and on-farm consumption of animal and poultry products.

Where possible, actual transaction prices were used; when many sales took place, an average price was used both for sales and to impute the value of on-farm consumption of farm products. Since information on sharecropping arrangements was incomplete and there was no measure of the amount of farm-produced inputs, particularly manure used in production, no accurate estimate of production costs could be developed. This made

it necessary to use gross rather than net farm income in the regression equations.

The only other source of income for families from Toralapa was income from wage labor, which averaged less than 3 percent of total income, though in a few cases the figure did go as high as 15 percent.

From the above information, several additional variables were developed: Variables 1, 2, and 6 were developed after observation of residuals from the initial models revealed patterns apparently related to these variables.

1. Management ability, a dummy variable which takes on the values of 1 for households headed by men between the ages of 27 and 59 inclusive and 0 for all others, i.e., female-headed households not including males in the above age group and young (by extension), less-experienced, or older and less highly motivated, or physically able farmers.
2. Labor supply, defined to be the number of adult workers of either sex in the above age group.
3. Wealth (1), defined to be the product of the values of livestock and household goods. This variable was constructed because I felt that alternative definitions failed to give sufficient importance to the value of household goods, an indicator of degree of integration with Spanish-speaking society, since the mean value of livestock is approximately five times that of household goods.
4. Wealth (2), defined to be the sum of the value of livestock and household goods, is used in one of the equations in the appendix.\*
5. Basic irrigated meters (hereafter Land), defined to be the sum of the area of irrigated land plus .70 times the area of unirrigated land. An off-the-cuff estimate of the productive value of irrigated versus unirrigated land was about two to one\*\*; in other words, about 2 hectares of unirrigated land were thought to be needed to produce crops of the same value as those that could be grown on 1 hectare of irrigated land. The .70 figure, which probably overestimates the value of unirrigated land, was derived by dividing the average value of production on each type of land by the amounts of each type of land. Unfortunately, the major crop (potatoes) is produced on both types of land and only

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\*The value of all movable property was thought to be an inadequate measure of wealth because it undervalued the importance of purchased household goods.

\*\*Stephen M. Smith, Research Associate in Agricultural Economics, proposed this ratio in response to my question on the productive value of irrigated compared to unirrigated land.

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aggregate production figures were available. Other crops are produced on one type of land or the other, but not on both. The fact that this estimate was made without including the major crop may have the effect of biasing the estimate upward, as I suspect is the case.

6. Irrigated land, a dummy variable taking the value of 1 for campesinos who own some irrigated land and 0 for those who have none. Only 3 of the 18 campesinos surveyed in 1973 had no irrigated land.

Land, fertilizer, marketing, and some measure of wealth were the initial factors thought to be important in determining gross farm income. All of these factors are correlated with income at .80 or higher. Unfortunately, however, they are linearly correlated with each other as well. A correlation matrix is presented below.

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Farm Income	Fer- ti- li- zer	Live- stock	House- hold Goods	Land	Wealth (1)	Wealth (2)	Man- age- ment	Labor	Ir- ri- ga- ted Land	Mar- kets	
Farm Income	1.00										
Fer- ti- li- zer	.968	1.00									
Live- stock	.819	.798	1.00								
House- hold Goods	.905	.852	.745	1.00							
Land	.799	.763	.656	.706	1.00						
Wealth (1)	.964	.944	.773	.966	.732	1.00					
Wealth (2)	.890	.837	.692	.995	.691	.964	1.00				
Man- age- ment	.369	.240	.299	.325	.369	.248	.289	1.00			
Labor	.384	.247	.414	.345	.510	.269	.304	.928	1.00		
Ir- ri- gated Land	-.326	-.428	-.196	-.356	-.005	-.451	-.378	.388	.418	1.00	
Mar- kets	.929	.933	.764	.819	.785	.911	.819	.179	.184	-.327	1.00

According to Dennis Aigner, "High simple correlation between two variables is a sufficient but not necessary condition for the existence of multi-collinearity." <sup>70</sup> As a general rule, any time the inter-correlation between two variables is above .70 (as it is for nearly all the most important variables here), one should be on guard to the possibility of multi-collinearity.\*

70. Dennis Aigner, Basic Econometrics (Englewood Cliffs, N.J.: Prentice Hall, 1971), p. 96.

A relatively high degree of intercorrelation between some of the variables should not be entirely unexpected. Fertilizer is frequently purchased in town when an individual is marketing some of his products or by trucker-owner merchants (rescatadores) who buy crops from campesinos. Thus an individual with a higher number of transactions could be expected both to have more money available to purchase fertilizer and to have more contact with people who sell it. A similar explanation could be made for the high correlation between the "wealth" variables and the value of fertilizer purchases. The intercorrelation between land and most of the other variables is lower than that between fertilizer, marketing, and wealth. Land is also less correlated with the dependent variable than are some of the other proposed independent variables. One explanation for this is that until now, land has not been a constraining factor on income. This hypothesis will be investigated below.

Initially a simple regression was run with gross farm income as the dependent variable explained by amount of land in production.

#### INCOME MODEL 1\*

FARM INCOME	=	-13746	+	1.025	LAND
S <sub>b</sub>		(5732)		(.193)	
t-value (16df)		5.75		28.28	
Sig. level		0.03		0.00	

1. F-Ratio (for overall regression) = 28.28    Significance level = .0001
2. R<sup>2</sup> = .64, Standard error 7662
3. Durbin-Watson = 0.73 (d<sub>L</sub> = .82, k = 3, n = 18, alpha/2 = .05)

The low value of R<sup>2</sup>, a significantly low Durbin-Watson statistic\*\*, and the unacceptable pattern of the residuals make it clear that using land as an explanatory variable for income in a simple regression involves a clear misspecification of the model and calls for the addition or substitution of other variables. It is worth noting that land is simply not as effective explanatory variable for income in the Toralapa region

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\*Plots of the Standardized Residuals are presented in the Appendix.

\*\*0.73 < d<sub>L</sub> = 1.03 for k=1, n=18, implying positive serial correlation. Observations are arranged by the value of the dependent variable, from smallest to largest.

of the Upper Valley as it has been found to be in the Lower Cochabamba Valley.\* In Toralapa, a considerable proportion of the land is left fallow every year (an average of 16 percent of the irrigated land and about 20 percent of the unirrigated land). The failure to fully utilize available land may be due to a continuation of the traditional practice of including a fallow period in the rotation cycle; but a more likely explanation is that some other factor is limiting the amount of land that can be put into production, probably the ability to prepare land for planting.

Other variables were added to the initial model to improve the accuracy of the estimates and correct the apparent omission of relevant variables. The first two variables added were fertilizer and wealth (1), yielding the following results:

## INCOME MODEL 2

FARM INCOME =	3798	+ .17 LAND	+ 11.06 FERTILIZER	+ .0001 WEALTH (1)
$S_b$	(2391)	(.10)	(3.86)	(.00003)
t-value (14df)	1.59	1.78	2.86	3.08
Sig. level	.13	.09	.01	.01

1. F-ratio w 3 and 14df = 137.8 Significance level = .0000

2.  $R^2 = .9672$ , Standard error 2466

3. Durbin-Watson = .75 ( $d_L = 0.82$ ,  $k = 3$ ,  $n = 18$ ,  $\alpha/2 = .05$ )

This model provided considerable additional information. First, the two new variables are highly significant in the regression equation; at the same time, the significance level of land has declined from the previous equation implying that much of the variation in the income is being picked up by the other two variables. The high value of the coefficient on fertilizer, which is something like a marginal return to fertilizer use, helps explain why adoption of fertilizer has been almost universal in the Upper Valley in the face of an almost total lack of agricultural extension services and institutional credit. In addition to

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\*See my case study, "A Case Study of the Lower Cochabamba Valley!"

purchases of this input, campesinos of Toralapa frequently engage in sharecropping arrangements with vecinos from Tiraque who do have access to institutional credit and therefore are able to obtain fertilizer and repay the Agricultural Bank after the division of the crop at harvest time. The coefficient on wealth (1) is deceptively low; in fact, since the mean value of this measure of wealth is  $0.22587 \times 10^8$ , this represents an average value for this term of more than 2000 pesos.

The Durbin-Watson statistic still indicates positive serial correlation at the 95 percent confidence level and a glance at the residuals confirms this suspicion. What this appears to indicate is that some systematic variation remains due to the omission of an important variable. Further examination of the survey data led to the creation of the variable called "management ability" based on the age and sex of the head of the household and also to the development of a variable measuring the number of adult workers in the family.

It also led to the discovery that the three respondents (noted by "+" signs in the plot of the residuals) who had no irrigated land showed up with negative residuals in this model. This suggested the hypothesis that the value of irrigated land was underestimated by the weights assigned to irrigated and unirrigated land, and that the lack of at least some irrigated land hampered an individual's ability to achieve his potential income. While it was not possible to test this hypothesis because of the small number of respondents with no irrigated land, the dummy variable was added to previously estimated models and usually turned up positive with values of anywhere between 400 and 5000 pesos.\* Except for one model (described in the appendix) the coefficient was not significant. Further research is warranted on this subject and can be expected in the not too distant future with the expansion of the UNDP Bolivia-14 hydrology project into the Cochabamba Valley.

The variables on labor and management ability were tried separately with the results presented below. They were not tried together because they are highly correlated (.928) and because either of them alone appears to correct the specification error.

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\*Models are presented in a statistical appendix to this paper.

## INCOME MODEL 3

$$\text{FARM INCOME} = .4074 + .65 \text{ LAND} + 12.66 \text{ FERTILIZER} + .0001 \text{ WEALTH} + .3200 \text{ MANAGE-}$$

$S_b$	(2048)	(.92)	(3.34)	(.00003)	(1290)
t-value (13df)	1.99	.70	3.07	3.48	2.48
Sig. level	.068	.492	.002	.004	.028

1. F-ratio w/4 and 13df = 143.0 Significance level .0000
2.  $R^2 = .9778$ , Standard error 2108
3. Durbin-Watson = 2.00 ( $d_U = 1.77$  for  $k = 4$ ,  $n = 18$ ,  $\alpha/2 = .05$ )

## INCOME MODEL 4

$$\text{FARM INCOME} = 4104 - .049 \text{ LAND} + 12.82 \text{ FERTILIZER} - .00009 \text{ WEALTH} + 1803$$

$S_b$	(2042)	(.095)	(3.36)	(.00002)	LABOR 720
t-value (13df)	2.01	.51	3.81	3.35	2.51
Sig. level	.066	.615	.002	.005	.026

1. F-Ratio w/4 and 13df = 143.91 Significance level = .0000
2.  $R^2 = .9779$ , Standard error 2102
3. Durbin-Watson = 2.011 ( $d_U = 1.74$ ,  $k = 4$ ,  $n = 18$ ,  $\alpha/2 = .05$ )

The inclusion of either the labor or management variable in the equation reduces the standard error of the estimate by about 15 percent over the previous model and diminishes the systematic error in the residuals (observed by the movement of the Durbin-Watson statistic into the non-significant region for positive correlation or directly from the plot of the residuals). The inclusion of the additional variable reduces the significance level of the coefficient on land to the point that its contribution to the explicative power of the regression is of doubtful value. This does not mean that in general the amount of land an individual campesino has does not affect his expected income. What it implies is that land is not a binding constraint on potential income for most campesinos on Toralapa, and this is probably true for most areas of the Central and Northern Altiplano away from Lake Titicaca. Especially where latifundios were declared, the amount of land acquired through the agrarian reform is greater than a campesino can expect to farm in any given year.

Several other models are presented in the appendix to this paper. They basically show that the problem of multi-collinearity makes accurate

simultaneous estimates of the coefficients associated with the fertilizer and marketing variables impossible. As would be expected of variables as closely linked as these, either one above is significant at the .01 level or lower in regression equations, although fertilizer is the better of the two variables as a predictor of income. For the purposes of this paper it is sufficient to note that the amount of fertilizer used and the frequency of market transactions are linked since it establishes the mechanism by which one of the inputs of modern agriculture is brought into the community. However, before the nitrogenous fertilizer plant being constructed near Santa Cruz comes on stream the link between the marketing system and use of fertilizer should be investigated with larger samples to determine the best way of raising the demand for this product on the part of Bolivian campesinos.

It is also interesting to note that the return to fertilizer is shown to be highly positive\* (and stable with respect to changes in the variables in the regression equation) in Toralapa, while no such positive relationship was observed between the use of chemical fertilizer and income in the Lower Cochabamba Valley. On average, the amount of fertilizer used on Toralapa is more than three times that used on Parotani (one of the most highly market-integrated farms of the Lower Valley). This confirms the findings of the Bolivian national petroleum company (YPFB) which estimated that 90 percent of the chemical fertilizer consumed in Bolivia was used for potatoes, a major crop in the Toralapa region and a very minor one in the Lower Valley.<sup>71</sup> It also confirms the highly favorable benefit-cost ratios for various types of fertilizer which have been observed in field trials.<sup>72</sup>

Also of interest is the coefficient on the wealth (1) which also measures the degree of integration with modern society by weight assigned purchased consumer goods as opposed to the sheer value of wealth stored in animals. This suggests that programs such as rural electrification, which stimulate the demand for such consumer durable goods, could be

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\*As was found in the previous sub-section's estimates of potato production.

71. See TVA, "A Fertilizer Program for Bolivia," p. 39.

72. Ibid., pp. 55, 56, Tables 55 and 57.

expected to have the effect of increasing agricultural output substantially.

The consistently high and positive coefficients on both the management and labor variables support the assumption which prompted their inclusion in the equations (the result of apparent initial misspecifications of the proper model) which was that higher levels of production are achieved when land is in the hands of people in their prime (defined to be between 27 and 59 years). Households headed by males below and above that age, either because of motivation or experience, appear to produce less than others, as do female-headed households. Agrarian reform laws in other countries (Chile, for example) have included limitations on the right to receive land under the provisions of the agrarian reform to male heads of family between 18 and 60 years. Similarly, the high level of significance of the coefficient on labor suggests that the number of adult workers may be a limiting factor on output.\* Attempts to include labor in similar equations in the Lower Valley (where the major constraint is land) failed dismally. Coupled with the fact that the income models excluding land do reasonably well,\*\* the high value and significance level of this coefficient leads me to believe that labor, not land, is a constraining factor on output in this region (and many other traditional areas of the country). This is entirely contrary to the opinion of many of those involved in the reform process inside Bolivia, who express great concern with the dangers of "minifundismo," the fragmentation of land into uneconomical units of excessively small size.

## 2. Degree of Market Integration (Supply Side)

The degree of market integration shown in Tables 6 and 7 is probably a better indication of general levels of integration prevailing in most of rural Bolivia than are similar indicators for the Lower Valley, where higher degrees of integration have prevailed from pre-reform times. Only about 10 percent of the production from the pegujales of colonos was marketed in the pre-reform period, with perhaps another 25 percent finding its way to market through barter transactions between roving merchants and traders at local fairs. In any case, 35 percent, if anything, is a

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\*This also suggests that complex specifications of labor supply function (including weights for women, children, grandparents, etc., as has been done by some authors, may only serve to confuse the issue.

IV.64.

high estimate of the proportion of production actually marketed from use plots in the area. On some isolated highland haciendas like Kaspicancha, where possibilities for agricultural production were more limited still, the degree of colono integration with the market was even lower. Before 1953 amounts traded must have been negligible; more than a dozen years later only about 11 percent of the potato crop produced on this hacienda was marketed (either sold or bartered) and percentages of other crops marketed were even lower.<sup>73</sup>

Table 6. Components of Gross Family Farm Income  
(average value in \$b. 1973)

	<u>1967 (n = 8)</u>	<u>1973 (n = 18)</u>
1. Retained Seed	962	806
2. Agricultural Products Consumed on the Farm	3,782	2,017
3. Agricultural Product Sales	12,271	8,383
4. Barter	911	842
5. Livestock and Poultry Consumed on the Farm	1,091	996
6. Livestock and Poultry Sales*	569	1,771
7. Livestock and Poultry Product Consumption (incl. wool)	394	515
8. Livestock and Poultry Product Sales	<u>208</u>	<u>166</u>
9. Total Income from Farming	20,188	15,496

\*Offsetting sales and purchases (replacement) of animals excluded.

Source: 1967 and 1973 survey data.

As may be observed from Table 7, about 65 percent of gross farm production on Toralapa is sold. If barter were included in the calculation

73. Calculated from Peinado, The Reform in Three Communities, p. 166, Table 47.

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Table 7. Marketed Production as a Percent of Total Production,  
Grouped by Agricultural and Livestock and Animal Products

	<u>1967</u>	<u>1973</u>
1. $\frac{\text{Agricultural Product Sales}}{\text{Gross Farm Production}} \times 100$	60.8	54.1
2. $\frac{\text{Livestock and Animal Product Sales}}{\text{Gross Farm Production}} \times 100$	3.8	12.5
3. $\frac{\text{Total Sales}}{\text{Gross Farm Production}} \times 100$	64.6	66.6
4. $\frac{\text{Agricultural Production}}{\text{Gross Farm Production}} \times 100$	88.8	77.8
5. $\frac{\text{Livestock and Animals Product Production}}{\text{Gross Farm Production}} \times 100$	11.2	22.2
6. $\frac{\text{Agricultural Product Sales}}{\text{Total Agricultural Production}} \times 100$	68.5	69.6
7. $\frac{\text{Livestock and Animal Product Sales}}{\text{Total Livestock and Animal Product Production}} \times 100$	34.4	56.2

Source: Calculated from Table 6.

of the percentage of farm products actually reaching market, the percentage rises to about 70 percent.\* By far the largest component of marketed agricultural production is potato sales, followed by barley and wheat. Most of the other crops are grown as much or more for consumption than for market. A comparison of numbers 1 and 2 of Table 7 gives some idea of the importance of agricultural product sales relative to sales of livestock and animal products.

Within the category of livestock and animal product sales, animal product sales constitute only a miniscule proportion either of the number or of the value of these sales. Only 3 respondents reported sales of animal products (cheese and a little wool) in excess of US\$15 in 1973; the value of such sales for the remaining 15 respondents was either zero or very close to it. The most important category in this group, then, is the sale of livestock, particularly sheep. For 14 of the 18 respondents, sale of sheep constituted 100 percent of the value of livestock sold.

\*1967 = 69.1 percent and 1973 = 72.0 percent.

#### IV.66.

The other four respondents all sold one or more oxen, accounting for most of the remaining value of livestock sold. (Interestingly, three of the four decreased their total numbers of oxen, and the fact two of the three were the top two income earners lends support to an earlier assertion that perhaps campesinos are finding it better to decrease their holdings of oxen and that land preparation may soon become mechanized.) Only one individual showed much diversification of livestock sales with sales of sheep and an ox, pigs, and a calf.

The value of the sale of sheep rose from about 300 pesos in 1967 to nearly 900 pesos\* in 1973. This change may partially represent a response of campesinos to a "bad year" by dissaving; particularly sheep (but also other livestock) are the major form in which assets are accumulated in this region and in rural areas in general. However, it does seem that at least in part this represents a move toward increasing the importance of sheep sales in the family income. This change is also responsible for the notable increase in the value of sales as percentage of total livestock production.

Because of the failure of the prices of farm commodities to keep pace with the increases experienced by effectively all other goods, direct comparisons of items in Table 6 are not valid, especially as measures of changes in the real value of production. To the extent that they do reflect the loss of purchasing power by rural groups, they are an accurate indication of the ability of campesinos to purchase processed and manufactured goods. While there has probably been some decline in the consumption of agricultural products on the farm, I suspect that it is more like 25 percent in physical terms rather than the 87 percent that is apparent for the monetary figures given in number 2 of Table 6; the 25 percent figure could be supported by the use of the implicit price inflator developed in Table 5 (1.17) rather than the ratio of the 1973 and the 1967 consumer price indices (1.73). Similarly the apparent declines in the value of barter transactions and the consumption of livestock and poultry and the sale of their associated products are overstated while the increases in the value of consumption of

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\*1973 pesos in both cases.

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of such products and in the sale of animals and poultry are understated. Though it shows up as a decrease in market participation, the increased consumption of animals and animal products reflects a real improvement in the diet of campesinos of Toralapa; increased consumption of both was also found in the Lower Valley case study.

3. Market Participation (Demand Side)

Market participation is defined here to be the ratio of total of cash expenditures for consumption to the total value of consumption (both purchases and on-farm consumption of farm products). The average market participation ratio for Toralapa was .427 in 1967 and .405 in 1973, which are not different from one another statistically.\* Table 8 ranks market participation by income levels for 1973 and displays no particular relation between the two. Nor does classification by amounts of land owned by the respondent show any clear relation.

Table 8. 1973 Market Participation\*\* (Demand Side)  
by Levels of Farm Income (1973 Pesos)

	Below 9000	9001-13500	13501-50,000	Over 50,000	Row Totals
0-.20	0	0	0	0	0
.21-.30	0	1	0	0	1
.31-.40	1	2	2	1	6
.41-.50	1	5	3	0	9
Over .50	1	0	1	0	2
Column Totals	3	8	6	1	18

Food consumption constituted over 42 percent of cash consumption expenditures in 1967 and about 52 percent in 1973; the higher proportion of cash consumption expenditures devoted to food is another indication of campesinos' declining real purchasing power. Unlike some of the Lower

\*Standard deviations are .091 and .075 and sample sizes 8 and 18, respectively.

\*\*Defined as (cash expenditures for consumption)/(total value of consumption).

#### IV.68.

Valley haciendas where agricultural production has almost completely displaced livestock, except for oxen, Toralapa still has sufficient production of livestock for each family to supply its need for meat and other animal products. Some products like wool are produced almost exclusively for domestic consumption. Only one respondent (the one with the highest income) reported selling any wool at all; the average value of wool retained per family was nearly \$b. 350, kept for use as bayeta (or "homespun") and weaving woolen bags in which to transport agricultural products. In regions more integrated into the market economy, bayeta has been almost completely eliminated from household production. Fewer sheep, a warmer climate, and a higher degree of acculturation into Spanish-speaking society may explain why this product has nearly disappeared from the Lower Valley while retaining much of its former importance in the Tiraque region and in many other parts of the country. Before 1953, virtually all the clothing colonos and their families owned was made at home out of homespun cloth.

The value of this ratio for Toralapa is probably more representative of the degree of market participation in the country as a whole than are the ratios in the .75 and higher ranges found in the Lower Valley case study. In areas like Toralapa, where the opportunity cost of land is not as high as it is in the Lower Valley and the differential returns from market crops compared to crops for household consumption are lower, it will be the logical response for campesinos to continue to produce a high percentage of what their families require. This is particularly true where transportation costs and transit time to market are high.

#### 4. Investment in the Post-Reform Period

The two major forms of individual investment for campesinos of Toralapa are housing and livestock. So far land is not a scarce resource for most families; therefore, saving to acquire additional land, which is a major motive for piqueros, is generally not a consideration on Toralapa. Ninety percent of the value of livestock is made up by only three animals: oxen, sheep, and cows. Changes in the total value of campesinos' holdings of these three animals were developed since direct comparison of the total value of livestock in the two periods was not possible. Such comparison was not possible due to the fact that changes in the prices of livestock did not reflect changes in the consumer price index for La Paz, the only index that was available. Regardless of

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whether 1967 or 1973 prices are used, the total value of these three animals increases by about 15 percent. Of equal interest is the fact that the proportion of the total made up by oxen and sheep reverse between the two periods, while that of cattle remains virtually unchanged.

Table 9. Change in the Total Value of Oxen, Sheep, Cows and in the Composition of Livestock Holdings

	1967 (n=8)			1973 (n=9)			1973/1967
Value of animals at 1967 prices	5684			6385			1.12
Value of animals at 1973 prices	8180			9622			1.18
	Oxen	Sheep	Cows	Oxen	Sheep	Cows	
	46.7	37.4	15.8	36.1	48.3	15.6	
	Sum=99.9% (because of rounding)			Sum=100.0%			

Source: Survey data 1967 and 1973

Another major form of investment since 1953 has taken the form of housing. Before the reform there was no incentive on the part of campesinos to invest their labor and cash in such improvements since the risk of expulsion from the hacienda was always present; investments in movable property like livestock were much safer in that respect. Houses of colonos were generally of the one-room, thatched roof type described in the second section of this paper. No data exist which would permit us to compare the value of those houses with that of the houses observed in 1967 and 1973 surveys. The average value of the 19 houses in the 1967 sample is just under 2700 pesos of that year (or, using the CPI, about 4650 pesos of 1973). By 1973 the value of housing had risen to an average of 12,000 pesos, or approximately 2.5 times what it had been in the earlier period. Most of this increase can be attributed to investment in a new house or improvements in the old one rather than an increase in the individual's appreciation of the value of housing. (Figures are derived from estimates made by the individual respondents and are based on actual cost figures in most cases.) Most of the houses on the hacienda appeared to be of fairly recent construction, certainly post-1953.

#### IV.70.

Small amounts of money are spent on hand tools and equipment for use with oxen by individual farmers, but this is largely for replacement of worn-out or broken tools. No major change in technology has taken place in the area which would require substantial new investments by individual farmers. Collective efforts for the acquisition of production technology have not occurred and are not likely to occur without outside support.

A substantial surplus of cash over current expenditures exists on Toralapa, as was observed in the Lower Valley case study. In the 1967 data only 46 percent of cash income can be accounted for as expenditures on production or consumption; similarly only 37 percent is accounted for in the 1973 data. The percentage of income saved actually rose in 1973, a year when real income had dropped. At least in part, this appears to be a reaction to the 1972 devaluation which raised the prices of many of the consumer durable goods campesinos have been acquiring by more than 50 percent, due to their high import coefficient. The individual with the highest income in the 1973 sample reported expenditures which account for only 23 percent of his total income, implying that 77 percent, or nearly US\$ 1900, was saved probably in the form of cash kept in the house. In view of the failure of banks to act as financial intermediaries for the country's rural population and other forms of discrimination still practiced against campesinos, it is not surprising that little, if any, money is deposited in savings accounts. Because of the inability of campesinos to tap financial institutions for credit and the inherent variability of agricultural income from one year to the next, savings constitute the basic form of insurance a campesino can have. Until the banking system becomes more responsive to the needs of the campesinos, it is not likely that it will be possible to mobilize the substantial resources accumulated by individual campesinos like those of Toralapa. In the meantime, inflation acts as a substantial tax on these assets.

##### 5. Standard of Living in the Post-Reform Period

Major changes in housing have taken place since 1952, as described in the previous section. The improvement in housing has been accompanied by the accumulation of various household possessions which represent an improvement in the campesino's standard of living. Table 10 below shows the percentage of families reporting purchases of various items in

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the years preceding the interviews. This section of the questionnaire was designed to measure the number of various kinds of consumer durable goods that each respondent had in his home and to date the individual items by year of acquisition. In fact, the figures included in the table if anything understate the number of such goods, since campesinos appear to have interpreted the question as referring only to fairly recent purchases, as shown by the response "doesn't know" to the question of when some types of goods had first been purchased.\*

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\*In a random survey of 22 households in Toralapa, Peinado found that 64 percent owned bikes; 32 percent transistor radios; and 18 percent each of record players and sewing machines. In all cases these figures exceed the percentage of those reporting purchases. Peinado, The Reform in Three Communities, p. 147, Table 37.

**Table 10. Families Reporting Purchases of One or More  
of Various Household Items in 1967 and 1973  
and Average Number of Items Purchased  
(Excluding Non-Purchasers from the Calculation)**

	1967 (n=8)										
	Bed	Radio	Sewing Machine	Bike	Lamp	Kerosene Burner	Record Player	Metal Table Service	Wheel- barrow	Metal Roof	Metal Pots
% of Families Reporting Purchases	100%	13%	13%	38%	0%	13%	6%	-	38%	0%	-
Avg. No. of Items Purchased/ Purchaser*	1.9	1.0	1.0	1.0	0	1.0	0	-	1	0	-
	1973 (n=18)										
% of Families Reporting Purchases	88%	22%	17%	44%	17%	17%	17%	67%	33%	6%	61%
Avg. No. of Items Purchased/ Purchaser*	1.7	1.0	1.0	1.1	1.0	1.0	1.0	One Table Setting	1.2	1.0	2.5

\*Excludes non-purchasers from calculation of the average size of purchase.

#### IV.73.

Before the reform, few if any of these items were found in the houses of colonos. Colonos typically had no metal or wooden beds; the entire family slept on the floor or on raised adobe pallets, covered by untanned skins from their own sheep. Cooking was done in earthenware pots and the only eating utensils were wooden spoons fashioned by the colonos themselves. None of the respondents to the 1967 survey for whom data are available reported purchases of any of these items before 1953. In general, the first purchases of beds are reported in the early sixties. According to Peinado, by 1967 all families surveyed in Toralapa had wooden or metal beds.<sup>74</sup> The first bicycles and radios followed in the middle sixties. Wheelbarrow purchases appear throughout the period, starting as early as 1955. Few kerosene burners have been purchased, and as was found in ex-haciendas of the Lower Valley, few campesinos have kerosene lamps, making do instead with candles for the short time the family is up after dark or before dawn. Only one campesino (the respondent with the highest income) reported purchasing galvanized roofing material, although numerous houses were observed with galvanized steel roofs; red Spanish tile is the other common roofing material, usually favored over metal in this region, perhaps because of its better insulating properties.

The average value of clothing purchases was \$b. 500 in 1973 and slightly more in 1967 (although again comparisons are difficult because of the index number problem). Clothing for use on holidays and for trips to town is almost exclusively purchased; clothing of bayeta is generally used in work around the farm, as are abarcas, or sandals made from the sidewalls of car and truck tires. Campesinos going to town almost invariably will have on manufactured shoes, and women have completely abandoned the use of abarcas in favor of inexpensive, mass-produced plastic shoes.

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74. Peinado, The Reform in Three Communities, p. 147; however, 70% of families surveyed in Kaspicancha in the same year still slept on the floor.

## V. Social Infrastructure, Government Services, and Political Change

### A. Health Care

The proximity of Toralapa to Tiraque where a small hospital is located makes it possible for its residents to receive competent medical attention from the staff of the local hospital. Peinado told me over the telephone that while he was carrying out his field work in Toralapa that some campesinos still frequented yatiris, or medicine men, although campesinos had already begun to foresake their services in favor of those of medical doctors in Tiraque. The cost of the two kinds of treatment is reportedly about the same.<sup>75</sup> In both samples, approximately 38 percent of those surveyed reported that some member of their family had made one or more visits to a doctor in the previous year. In 1973, the average cost of a medical appointment was just under \$US. 10, or nearly 200 pesos. None of the respondents in the survey reported expenditures for treatment by yatiris.\* Although their influence does appear to be declining, it certainly has not disappeared completely, which is one way this information could be interpreted. Particularly in regions where access to medical facilities is more difficult and the level of acculturation into Spanish-speaking society lower, much of the medical treatment received by campesinos probably still comes from yatiris.

The rate of infant mortality in rural areas of Bolivia is over 120 per thousand live births, more than three times the national average. Of the respondents for whom data are available from the 1973 survey, seven reported having had children die before age five. The problem is even more acute in isolated areas; Peinado presents data from Kaspicancha which show that there were nearly twice as many children in the 0-4 as in the 5-9 groups,<sup>76</sup> suggesting a high rate of mortality for children from childhood diseases which have been nearly eliminated as causes of death in most countries.

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75. Peinado, The Reform in Three Communities, p. 193.

\*The failure to admit treatment by yatiris may be a cultural problem in that campesinos expect that the interviewer would look more highly on treatment by a medical doctor than a medicine man.

76. *Ibid.*, p. 226.

### B. Education in the Post-Reform Period

Probably the most significant single contribution of the Bolivian agrarian reform was in improving the level of education of the country's rural population. Before 1952 educational opportunities were limited almost exclusively to urban groups and to campesinos residing in piquerías and comunidades. These groups constructed and supported their own schools; indeed much of the involvement of piqueros in politics was for the purpose of improving the educational opportunities for their children. Children of colonos on haciendas in the Tiraque region had far more limited educational opportunities. Since the ability to speak Spanish was almost invariably the product of an elementary school education, not only the illiteracy but also the inability of most ex-colonos to speak Spanish was still evident more than a decade after the reform, while most piqueros were able to read and write and to speak Spanish. (Please refer back to Table 2.)

One of the first reactions of campesinos to their liberation from the quasi-feudal obligations of the colonato system was the construction of a small school. Schools were built on nearly every hacienda in the country within a few years after the reform. As on Toralapa, subsequent community efforts have typically resulted in the construction of a larger school on most ex-haciendas in the country.

This massive campaign for improving the educational opportunities of children has not been without its tangible results, as may be seen from Table 11. The adult population of the community (defined as those members 15 years of age or older no longer going to school) was divided into two age groups: those under 35 years of age and those 35 and older, and subdivided by sex. An individual who was 35 years old in 1973 would have been 15 in 1953; by that age his education was finished and he was not likely to have returned to school. Thus what is being measured is the difference in educational levels of those who grew up before the agrarian reform and those who grew up and received their education after it. The differences in the average number of years of schooling received by men in the post-reform period is four times the average for the pre-reform period. Similarly, while none of the women 35 or older had any formal education, the average level of education for the 10 women who have grown up since the reform is nearly one year. It is also interesting to

note that the average number of years of school for children currently in school is 2.86, which promises some increase in the average level of education in the future. Nearly all children in school beyond the first grade are able to speak some Spanish; it was also my experience that young campesinos were far more likely to be able to speak Spanish than their fathers; Spanish spoken by older campesinos was generally harder for me to understand.

Table 11. Average Educational Levels  
of Male and Female Adults, by Age Groups

	Men	Women
15-34	3.00 n=8	0.90 n=10
35 and above	.75 n=12	0.00 n=14

There is a marked discrepancy between the average educational level attained by men and women in the sample. The gap between the levels of educational attainment of men and women does not appear to be narrowing very much, based on what is happening with the younger generation. All school age boys are in school while more than half their sisters are not. Furthermore, boys within the 6-14 age group are allowed to continue studying while the education of girls basically stops at their tenth birthday, at whatever level they have attained. Above that age, they take care of the sheep and help their mothers with various domestic labors (weaving and spinning, as well as in light agricultural work). The gap between the education of boys and girls is dramatized every year in the parades of students in rural towns to celebrate the Día del Indio (the second of August): while almost equal numbers of boys and girls from the lower grades march by, in the upper grades and in secondary schools boys outnumber girls by four to one, and sometimes more. Closing this gap may be a matter with which local school boards (Juntas de Auxilio Escolar) and governmental authorities should be concerned.

Table 12. Education of Children Aged 6 Through 14 from Toralapa

	Number	No. in School	Avg. Age of Those in School	No. of Children Over 10 Yrs. of Age	No. of Children Over 10 Yrs. in School	Avg. No. of Yrs. of School
Boys	7	7	10.3	3	3	2.70
Girls	11	5	7.4	3	0	.91

### C. Governmental Programs Supporting the Reformed Sector

Campesinos from Toralapa have not been recipients of any form of institutional credit, as was stated in Section IV. Nor have extension programs had any major impact on Toralapa. Where the impetus came from promoting initial use of fertilizer is not clear. One area in which considerable extension activity is going on in some regions of the country is in the use of improved varieties of potato seed (although there is no evidence that campesinos from Toralapa have had any contact with the Servicio de Extensión Agrícola, or extension service). Such seed costs over twice as much as traditional varieties but has substantially higher expected yields. Evidence from the 1973 survey data indicates that none of the campesinos have adopted the new varieties. All farmers retained some potato seed from their 1973 harvest for use the following year; one-third of the respondents used only seed they had saved during the 1972/73 agricultural year and another third received seed through sharecropping arrangements and the final third purchased seed from other campesinos. Prices paid for potato seed are in the same range as the prices they received for their own potatoes, indicating that it is very improbable that any of them used improved seed.

The only real service campesinos from Toralapa receive from the government would appear to be the payment of the salaries of teachers at the school. Actual construction of the school was largely accomplished through the efforts of the community.

### D. Taxes

Campesinos do not pay any direct taxes to the government. As Poinado pointed out, few of them have bothered to register the titles to their

land,<sup>77</sup> probably in part out of fear that registration might make them subject to taxation. Effective taxation of the land has been prevented by the concerted opposition of campesino sindicatos throughout the country. However, campesinos do bear much of the burden of indirect taxation. A high percentage of the consumer goods that campesinos buy are taxed. Import duties are a major source of government revenue and are charged on all kinds of items that campesinos buy. In both 1967 and 1973, there even was a duty on fertilizer (of which virtually all was imported and nearly all used by campesinos).<sup>\*</sup> Most of their tools are imported and many of the durable goods they buy are also imported or at least have a high import coefficient. Chicha and other alcoholic beverages are taxed; particularly in the case of chicha, most of the burden of the tax is borne by campesinos since urban residents drink other beverages. All Bolivians pay a transportation tax which goes to construction and maintenance of the country's roads; however, while most pay a small cash fee, campesinos generally pay by *corvée*. During the time field work was going on in 1973, campesinos were observed working under sindicato supervision on the access road to Toralapa in payment of their transportation tax. Since all taxes are indirect<sup>\*\*</sup> it is difficult to calculate just how heavy the tax burden is on the country's rural population.

#### E. Political Changes in the Post-Reform Period

Before 1953 literacy qualifications for voting virtually eliminated the possibility of participation by colonos in the political process. Piqueros did participate in politics to some extent, although their

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77. Peinado, The Reform in Three Communities, p. 96.

<sup>\*</sup>The duty on fertilizer was 12 percent by value until 1972 when it was lowered to 2 percent; in 1973 it was raised again to about 9 percent. See USAID/Bolivia, Agricultural Development in Bolivia: A Sector Assessment (La Paz, August 1974).

<sup>\*\*</sup>Although they are legally obliged to pay a property tax, no respondent in either the 1967 or the 1973 survey data showed any payment for this purpose.

participation was generally directed at the achievement of better educational opportunities for their children. One of the first acts of the MNR was to make suffrage universal and obligatory, incorporating in this way the masses of campesinos who had been excluded from the political process since Independence.

Campesinos from Toralapa, like their peers throughout the country, have exercised their political rights since 1953. Sindicatos have played a major role in getting out the vote at election time, although their participation has generally been limited to supporting whatever government is currently in power in return for the assurance that the land would not be returned to the former landowners. The fact that the electoral process has been in abeyance in recent years does not mean that political participation of campesinos has disappeared; all recent governments have sought to curry or cajole support from the campesinos through various rural development programs and the initiation of a program of group credit through the Banco Agrícola as well as through financial support to selected sindicatos and their leaders. The lack of adequate channels\* through which campesinos can present their positions has occasionally led to misassessments of the effect certain government policies are likely to have on campesinos. It has also occasionally led to outright confrontation between the government and the campesino sindicatos as occurred in Cochabamba in January 1974 over increases in the prices of basic processed foodstuffs.

#### F. Changes in Traditional Practices

In general, traditional practices are still important in the Tiraque region, although their importance seems to have declined somewhat since 1952. Most campesinos at one time or another become prestes, or sponsors, of a major fiesta. The position carries with it both considerable prestige and substantial economic responsibilities. The preste is responsible for paying for a mass in Tiraque, after which the preste's friends and relatives are invited to his house for a banquet with much eating, drinking,

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\*Now complicated by a decree abolishing campesino sindicatos and all other labor unions. See Latin America IX:1 (January 3, 1975).

and music, all at the expense of the preste. There is no estimate of the expense involved in presterio, the activity of being a preste, since no respondents in either survey reported such expenditures during the previous year.<sup>78</sup>

In addition to expenses involved in presterio, which generally occur only a few times in a peasant's lifetime, if that frequently, most families report some expenditures in other celebrations throughout the year: the Día del Indio, Independence Day, Carnival, etc. In 1967 such expenditures averaged a little over 500 pesos of 1973; they had dropped about 150 in 1973, although there was a small rise in the expenditure for alcoholic beverage at times other than fiestas, which could indicate some substitution of one for the other.

Most campesinos are by now convinced that good or bad yields depend on natural rather than supernatural causes. However, various traditional agricultural practices are still maintained to ward off frosts and other natural calamities and to ensure good harvests. At planting time, a certain plant (ckoa) is burned to keep evil spirits off the crop.<sup>79</sup> The practice of challando, or pouring libations to Mother Earth (Pachamama), is still common at planting and especially at harvest time. Most respondents reported purchase of raw alcohol and chicha which is traditionally (since pre-reform times) given to workers as part of their wage during harvest. The first few drops from each cupful are poured on the ground as an offering to Pachamama. This same tradition is found in all areas of the country, although not always with the officiation of yatiris, who are usually present on these occasions in Toralapa. Yatiris are still thought to possess certain curative powers, as described in the previous section; however, their role as medicine men appears to be declining in areas like Toralapa where modern medical care is available.

Another traditional practice which separates campesinos from other members of society, particularly mestizos, is the chewing of coca leaves. Use of coca in the Andean highlands predates the Spanish conquest and

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78. Peinado, The Reform in Three Communities, pp. 155, 156.

79. *Ibid.*, p. 156.

remains one of the cultural elements used to differentiate between campesinos and other groups more integrated into Spanish-speaking society. Younger campesinos who are in many ways more integrated into the national society than are their parents are generally less inclined to use coca because of the low status ascribed to those who chew it. Women generally do not use coca, or if they do, use less than men. Therefore, in trying to check whether there is a difference in the amount of coca used based on age, one household, headed by a widow living alone with her school-age son, was excluded from the calculation. The sample was divided into two groups, one containing only those families where one or more members of the family were 45 years or older, yielding a group of nine families: the other group (numbering eight) was composed only of families all of whose members were younger than 45 years of age. Data were available on purchases of coca (in pounds) by each family. (No data were available on individual use.) Mean family purchases of coca were 47.8 lbs. for the older group and 22.0 for the younger one, with sample variances of 363 and 327, respectively. The mean for the younger group is significantly lower at the 20 percent significance level.\* While the matter is less clear-cut than in the Lower Valley, where all younger families show no purchases of coca, younger families in the Upper Valley do seem to purchase less and many young people do not chew coca at all. This trend seems general, not only in the Cochabamba Valley, but also on the Altiplano and in the colonization regions in the lowlands below La Paz, and is indicative of the acculturation which has occurred in the generation which has grown up since the reform.

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\*t with 15 df = .982 > .866, using the one-sided t-test for the difference of two means.

## VI. Conclusions

Ex-Hacienda Toralapa is located near Tiraque in a predominantly agricultural area, the Upper Cochabamba Valley, on the main road between Cochabamba and Santa Cruz. At the 9,500 meter elevation of Toralapa, changes in the types of crops which are grown have been limited by the short growing season and the ever-present danger of frost. Despite these limitations, which are found over most of the areas in which the agrarian reform has been most important, dramatic changes have taken place in agricultural production, land ownership, distribution of wealth and income, and the acculturation and integration of Bolivian campesinos into the national society. These changes are the product of an agrarian revolution in which campesinos expelled the landowning class from the Upper Valley and adamantly and successfully opposed their return. The immediate result of the reform was to transfer ownership rights to campesinos over the land they had formerly held as usufruct plots under the colonato system. Within a year or two after the MNR took power in 1952, campesino unions, or sindicatos, were formed throughout the countryside. Sindicatos became the instruments by which the land reform process spread from one area to another. Sindicato organizations were actively involved in bringing individual agrarian reform cases to their successful conclusions with the titling of the land to the campesinos by the National Agrarian Reform Service, thus consolidating and expanding on initial gains achieved during the period of agrarian revolution.

After an initial period of disruption in production and marketing while campesinos defended their land and newly won rights against the threat of the return of landowners, campesinos have taken over the role formerly occupied by hacendados as the major suppliers of foodstuffs and other agricultural products to the cities. The amount of land under cultivation more than tripled on Toralapa while per hectare production has generally followed the rising trend observed in statistics for aggregate production and per hectare production for the nation as a whole. Production on Toralapa is mostly agricultural with a small though increasing amount of livestock production concentrated in sale of sheep. The major crop is potatoes, with

nearly three-quarters of what is produced going to market. The most significant changes in technology observed in this region are the uses of chemical fertilizer and insecticides which were not used at all before 1953; use of these products is associated almost exclusively with the production of potatoes. Similarly, campesinos have increased their usage of sheep manure, traditionally used to improve soil fertility, over amounts used during the hacienda period and are obtaining additional manure from highland campesinos through purchases or sharecropping arrangements with local truck-owner merchants. Profitability of organic and chemical fertilizer is high enough that productivity gains from higher levels of fertilization have by no means been exhausted, even at higher fertilizer prices. Improved varieties of potato seed are not being planted, however, although this may reflect lack of effort in credit and extension. Land preparation, rather than land itself (as has frequently been suggested), appears to be the constraining factor on increases in agricultural production; the next change in production technology that will be observed in this region will be the use of tractors to mechanize land preparation.

Enough land was released by the expulsion of landlords from the Upper Valley to make access to land possible to a larger number of families than had been possible under the colonato system. Even before 1953 some landowners had been cutting back on the number of colonos in response to their own needs for more land for the central farm enterprises and to increasing agitation on the part of campesinos for more equitable treatment. Most campesinos living on ex-haciendas have landholdings large enough to occupy available family labor throughout the year and are not forced to seek outside employment or to enter into rental or sharecropping arrangements to acquire additional land; quite the contrary, all farmers on Toralapa have to hire labor during peak periods. Piqueros, on the other hand, still do not have enough land and are forced to seek off-farm employment and ways of increasing their access to land.

Fears that campesinos would be unresponsive to the urban demand for agricultural products have turned out to be unfounded. Within a short period after the reform, campesinos rapidly increased their degree of integration with the market on both the supply and the demand side. By 1967 they were marketing nearly as high an overall percentage of a much larger

volume of production as had come to market from the hacienda in 1950. Integration with the market on the demand side is also dramatically higher than in the pre-reform period. A larger proportion of the needs of families on Toralapa is provided for out of farm production than was found in the Lower Valley case study; nevertheless, a substantial part of the diet of each family consists of purchased, processed foods, like spaghetti and bread, and most of the family needs for clothing are met by purchases rather than domestic production, as they had been up until 1953. The higher standard of living of campesinos from Toralapa is observed in the considerable improvements that have occurred in housing and in the massive increase in the number and variety of consumer durables which campesinos own.

The reform has also entailed significant changes in the position of campesinos within Bolivian society. Although discrimination against campesinos has not disappeared completely since the reform, campesinos have finally become citizens of their own country; even during those periods when the government is not based on electoral representation, campesinos remain a force that any government must reckon with. The strength of campesinos as a group and their organization in a national union movement have made it possible for them to keep the land they won during the period of agrarian revolution and to avoid being taxed, as has often been suggested, on the basis of land ownership.

One of the major accomplishments of campesinos since 1953 has been to make access to a primary school education possible for nearly all children in rural Bolivia. Before 1953 rural schools were found almost exclusively in communities of small holders and of freeholding Indians; access to education on the haciendas was severely restricted for children of colonos. Average levels of education are significantly higher for adults from Toralapa who grew up after compared with those who grew up before the reform. The differences between educational opportunities made available to boys and those available to girls in rural areas is a matter deserving careful attention.

The younger generation is more highly integrated into the national society as demonstrated by its greater ability to speak Spanish (in addition to Quechua) and its apparent rejection of chewing of coca leaves, matters of considerable significance to their acceptance in Bolivian society.

The importance of traditional practices also appears to be declining, although this decline is neither as rapid nor as obvious as it is in areas where a higher degree of acculturation has already been achieved. One manifestation of this change is the fact that campesinos frequently seek medical treatment from the hospital in Tiraque rather than depending on the questionable curative powers of local medicine men residing in the community.

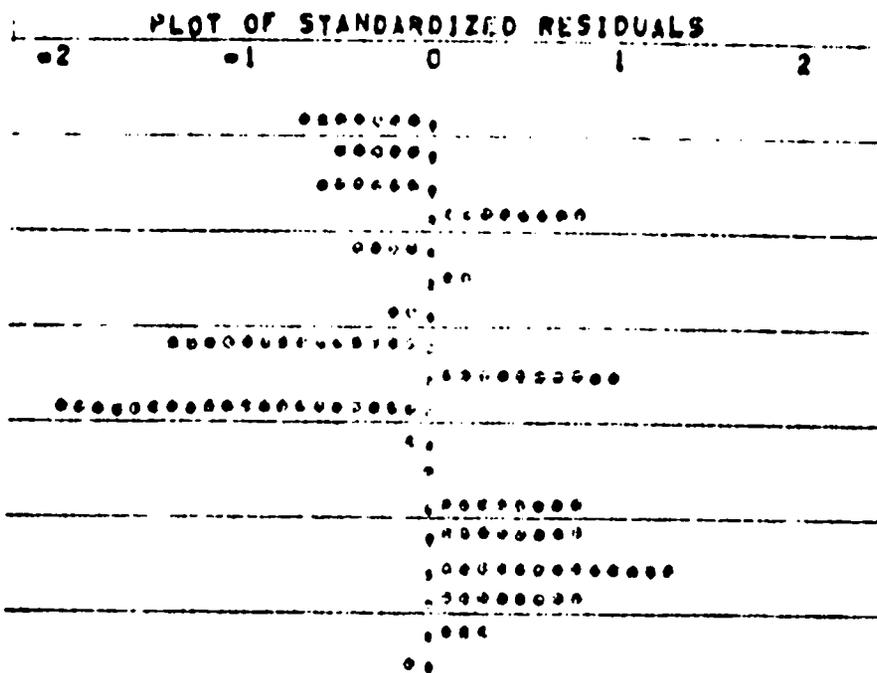
The changes which are taking place on Toralapa, though less dramatic than those occurring in a few areas more highly integrated into the national economy, are more indicative of what is happening in rural areas throughout Bolivia. Campesinos in nearly all parts of the country affected by the agrarian reform have obtained title to or at least effective control over the land they farm. Some semblance of an equitable distribution of income has been achieved when measured against the grossly inequitable distribution shown to prevail before 1953. Agricultural production, far from stagnating as many had feared, has generally kept pace with increases in demand. Various measures of improvements in social conditions and integration of Bolivian campesinos into the national society are all strongly positive. Except for major improvements in the rural educational opportunities, these changes have occurred almost exclusively on the initiative of campesinos themselves without much support from either the national government or international lending institutions. While benefits to be derived from changes already underway have not been completely exhausted, a greater measure of assistance to campesinos of the highland and valley regions of the country in terms of agricultural extension, credit, price policies for inputs and agricultural commodities, and rural development programs could have a major impact on increasing agricultural production and incomes of Bolivian campesinos, who still constitute the majority of the country's population.

## **STATISTICAL APPENDIX**

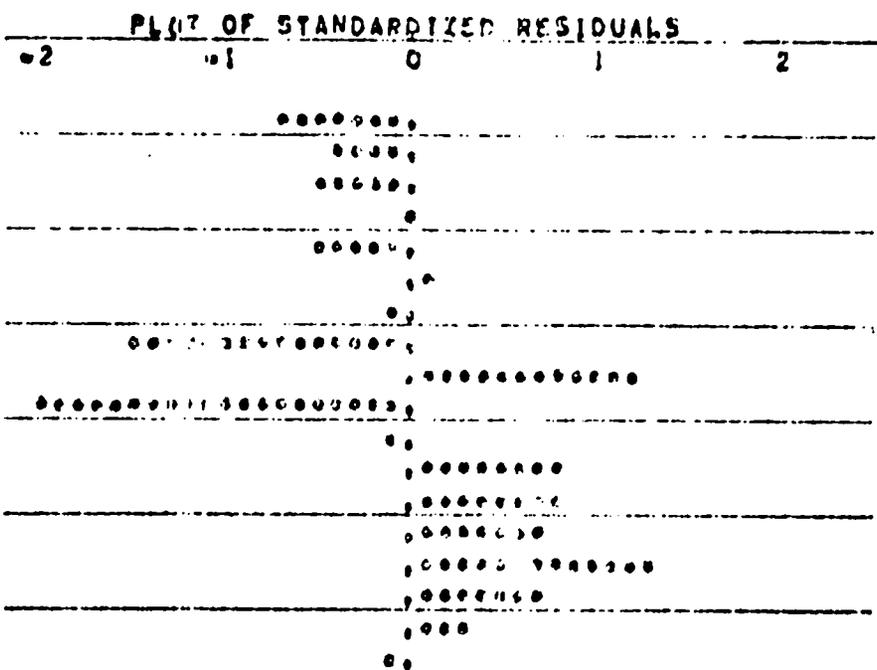


A.2.

Income Model 3



Income Model 4



## A.3.

## INCOME MODEL 5

FARM INCOME	= 3914	+ 10.36	FERTIL- IZER	+ .00009	WEALTH (1)	+ 3856	MANAGE- MENT	+ 261	MARKETS
$S_b$	(1432)	(3.53)		(.00003)		(1098)		(183)	
t-value with 13 df	2.73	2.93		3.17		3.51		1.42	
sig. level	.017	.011		.007		.003		.177	

F-Ratio with 4 and 13 df = 159.6; significance level = .0000  
 $R^2 = .9800$ ; standard error = 1998  
 Durbin-Watson\* = 2.00 ( $d_u = 1.74$ ,  $k = 4$ ,  $n = 18$ ,  $\alpha/2 = .05$ )

\*Plots of standardized residuals are omitted from all subsequent income models since no systematic pattern was evident.

## INCOME MODEL 6

FARM INCOME	= 3240	+ 11.35	FER- TIL- IZER	+ .00010	WEALTH (1)	+ 2949	MAN- AGE- MENT	+ 173	MAR- KETS	+ 1862	LAND
$S_b$	(1601)	(3.69)		(.00003)		(1456)		(206)		(1953)	
t-value with 12 df	2.02	3.07		3.29		2.02		.84		.95	
sig. level	.066	.009		.006		.066		.42		.36	

F-Ratio with 5 and 12 df = 127.0; significance level = .0000  
 $R^2 = .9814$ ; standard error = 2005  
 Durbin-Watson = 2.05 ( $d_u = 1.93$ ,  $k = 5$ ,  $n = 18$ ,  $\alpha/2 = .05$ )

## INCOME MODEL 7

FARM INCOME	= 1023	+ 17.05	FERTILIZER	+ 425.6	MARKETS	+ 2412	LABOR
$S_b$	(1537)	(3.43)		(217)		(.005)	
t-value with 14 df	.67	4.97		1.96		3.32	
sig. level	.51	.000		.071		.005	

F-Ratio with 3 and 14 df = 138.1; significance level = .0000  
 $R^2 = .9673$ ; standard error = 2464  
 Durbin-Watson = 2.48\* ( $4-d_u = 2.44$ ,  $k = 3$ ,  $n = 18$ ,  $\alpha/2 = .05$ )

\*Uncertain region for negative serial correlation.

## INCOME MODEL 8

FARM INCOME = -3089 + 1432 MARKETS + 3179 LABOR

$S_b$	(2080)	(127)	(1141)
t-value with 15 df	-1.48	11.25	2.79
sig. level	.158	.0000	.014

F-Ratio with 2 and 15 df = 75.6; significance level = .0000  
 $R^2 = .9097$ ; standard error = 3955  
 Durbin-Watson = 1.71 ( $d_u = 1.40$ ,  $k = 2$ ,  $n = 18$ ,  $\alpha/2 = .05$ )

## INCOME MODEL 9

FARM INCOME = 2936 + 23.31 FERTILIZER + 2224 LABOR

$S_b$	(1293)	(1.36)	(786)
t-value with 15 df	2.27	17.10	2.83
sig. level	.038	.000	.013

F-Ratio with 2 and 15 df = 172.7; significance level = .0000  
 $R^2 = .9584$ ; standard error = 2686  
 Durbin-Watson = 2.78\* ( $4-d_u = 2.60$ ,  $k = 2$ ,  $n = 18$ ,  $\alpha/2 = .05$ )

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\*Uncertain region for negative serial correlation.

## INCOME MODEL 10

FARM INCOME = 5285 + 13.05 FERTILIZER + .00010 WEALTH + 3619 MANAGEMENT

$S_b$	(1100)	(3.07)	(.00003)	(1125)
t-value with 14 df	4.81	4.26	3.57	3.22
sig. level	.000	.001	.003	.006

F-Ratio with 3 and 14 df = 197.5; significance level = .0000  
 $R^2 = .9769$ ; standard error = 2070  
 Durbin-Watson = 2.19 ( $d_u = 1.56$ ,  $k = 3$ ,  $n = 18$ ,  $\alpha/2 = .05$ )

## A.5.

## INCOME MODEL 11

FARM INCOME	= 3694	+ 13.18	FERTILIZER	+ .00011	WEALTH (1)	+ 2464	MANAGEMENT	+ 2601	IRRI. LAND
$S_b$	(1490)	(2.94)		(.00003)		(1321)		(1723)	
t-value with 13 df	2.48	4.48		3.98		1.87		1.50	
sig. level	.028	.001		.002		.085		.155	

F-Ratio with 4 and 13 df = 162.2; significance level = .000  
 $R^2 = .9804$ ; standard error = 1982  
Durbin-Watson = 2.25\* ( $d_u = 2.26$ ,  $k = 4$ ,  $n = 18$ ,  $\alpha/2 = .05$ )

\*Approaching the uncertain region for negative serial correlation.

## INCOME MODEL 12

FARM INCOME	= 5443	+ 3045	MANAGEMENT	+ .00038	WEALTH (1)	- 22.1	WEALTH (2)	+ 3482	IRRI. LAND
$S_b$	(1234)	(1183)		(.00003)		(4.15)		(1561)	
t-value with 13 df	4.41	2.57		11.99		-5.32		2.42	
sig. level	.001	.023		.000		.000		.031	

F-Ratio with 4 and 13 df = 2.03; significance level = .0000  
 $R^2 = .9843$ ; standard error = 1772  
Durbin-Watson = 1.80 ( $d_u = 1.74$ ,  $k = 4$ ,  $n = 18$ ,  $\alpha/2 = .05$ )

This equation is the result of a stepwise regression using STEPREG1 of STATJOB. I was curious to see what factors were significant within the data set, disregarding any theoretical considerations, as explanatory variables. The same equation resulted from the use of the .05 and .10 significance as the criterion for variables leaving or entering the equation. While no defense is made of this equation as a theoretical model of the factors which can be expected to affect income, two points are worth making. First, despite the small number of observations in the "no irrigated land" category of the irrigated-land dummy variable, it is interesting that the coefficient on the variable should be positive and significant within the equation. This suggests that possible benefits of irrigation to agrarian

## A.6.

reform beneficiaries in this region should be further investigated (which in fact the UNDP Bolivia-14 mission may already be doing) and that it is likely that irrigation projects would probably increase aggregate output in the Upper Valley.\*

A second point of interest is the fact that both measures of "wealth" enter into the "best" equation. An individual's wealth is a reflection of income in previous periods and therefore could be expected to do fairly well as a predictor of present income. Furthermore, both of these formulations of wealth put greater emphasis on the value of household goods purchased by campesinos in market towns and therefore are some indication of the degree of market integration of the individual household. Although tabular data on market participation (= cash expenditures for consumption/total value of consumption) are not clear on this point,\*\* in general one would expect that those farmers showing greater interest in acquiring industrially produced consumer goods would have a greater incentive to increase production.

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\*However, information from the Lower Valley case study indicate that adverse price movement, that could be expected from increased output, could have the effect of leaving income unchanged or actually decreasing it.

\*\*Presented in the main body of the paper in Table 8, and from S. Smith's "The Potato Market of La Paz, Bolivia."

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