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**MEXICAN REPRESENTATIVE FARMS  
1998 ECONOMIC OUTLOOK**

AFPC Working Paper 98-7

July 1998



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**MEXICAN REPRESENTATIVE DAIRY FARMS  
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## **MEXICAN REPRESENTATIVE DAIRY FARMS 1998 ECONOMIC OUTLOOK**

The farm level financial outlook for representative specialized and dual-purpose Mexican dairy operations is projected in this report. The analysis was for the 1997-2002 planning horizon using the Agricultural and Food Policy Center's (AFPC) whole farm simulation model (FLIPSIM) and FAPRI's sector level projections. Data to simulate farming operations in Mexico's major production regions came from the following sources:

- ◆ Producer panels developed economic information to describe representative specialized dairy and dual-purpose farms in Mexico.
- ◆ Projected prices, policy variables, and input inflation rates from the Food and Agricultural Policy Research Institute (FAPRI) January 1998 Baseline.
- ◆ Projected 28-d Treasury Bond rate projections (Heath) were used to estimate interest rates.

The FLIPSIM model incorporates historical production, economic and financial data to project future economic and financial performance of representative agricultural firms over a given planning horizon (Richardson and Nixon).

The primary objective of this analysis is to determine the farms' economic viability by region and production system over the 1997-2002 planning horizon. This report is organized into eight sections. The first section summarizes the status of the dairy industry in Mexico and its typical milk production systems. The second section summarizes the process used to develop the representative dairy and dual-purpose farms and the key assumptions for the farm level analysis. The third section summarizes the FAPRI January 1998 Baseline and the policy and price assumptions used for the representative farm analyses. The fourth through sixth sections present

the results of the simulation analyses for representative specialized corporate dairy farms, specialized family dairy farms, and tropical dual-purpose farms, respectively. The seventh section summarizes simulation results for the representative dairy and dual-purpose farms. Two appendices constitute the final section of the report. Appendix A provides tables that summarize the physical and financial characteristics of each of the representative dairy and dual-purpose farms. Appendix B provides the names of producers, faculty, and industry leaders who cooperated in the panel farm development process.

### **Mexican Dairy Industry**

The dairy industry in Mexico has experienced a wide range of weather, economic, and social conditions during the last two decades. A rapidly growing population has created a constantly increasing demand for dairy products. However, social, economic, and environmental conditions have not been favorable for the milk production sector. The social agenda of the government and its price controls during the 1980's caused a dramatic liquidation of the national dairy herd when many producers were caught in a cost-price squeeze. The result of this policy was the need to import large quantities of liquid and dried milk to meet domestic demand. Efforts to increase the size of the national herd have resulted in increased imports of breeding stock.

Milk production shortfalls and limited production capacity made Mexico the ideal partner for milk exporting countries. Over the last decade, Mexico was the largest importer of milk for human consumption in the world (Garcia). With the liberalization of milk prices from government control in 1998 and changes in government policies towards milk production, a more favorable economic climate has been created for the dairy industry in Mexico. Under these new policy

conditions, analysis of the economics of milk production at the farm level is important for assessing the impact of these policies on the national industry.

### **Characterization of dairy production systems in Mexico**

The Mexican dairy industry is one of contrasts and diversity. Climatic diversity is the major defining feature contrasting the structure of Northern, Central, and Southern dairy farms (Figure 1). Dry and temperate climates allow the use of specialized dairy breeds, such is the case of the Holstein cattle. On the other hand, climatic conditions restrict the use of specialized cattle in the tropics. In these regions, producers have to rely on crossbreeding between the specialized dairy breeds (Holstein and Brown Swiss) and cattle possessing greater adaptation to heat and humidity (Zebu breeds). Hence, dairy production systems in Mexico can be classified as specialized, semi-specialized, and non-specialized according to breed of cattle and level of technology utilized (SAGA-DGIA).

The specialized system primarily uses Holstein dairy cattle and is located in the arid regions of the North and in the temperate highlands of Central Mexico. This system predominates in the states of Chihuahua, Coahuila, Durango, Puebla, Mexico, Queretaro, Guanajuato, Hidalgo and Jalisco. According to data from SAGAR-DGIA, in 1992, specialized production systems produced 59 percent of the nation's milk with only 7 percent of the milking cows. In general, this system can be subclassified as corporate and family operations based on the size, technology level, and capital invested. The corporate operations are large in size, from 300 to more than 5,000 cows. In many instances these farms are part of consortiums or groups of individuals and have high levels of investment and technology usage. These operations commonly employ foreign

consultants, such as private nutrition specialists and veterinarians. The early adoption of innovative technology, the use of private feedmills, and access to market information are typical of this type of production unit. Milk marketing in this system is through large dairy cooperatives as fluid milk, ultra high temperature milk (UHT), and a wide variety of dairy products in the national market.

Specialized family operations are smaller in size, from 20 to 200 cows. They are characterized by a higher level of family involvement in management and by lower levels of investment. The genetic quality of the cattle may not be as high as in the corporate operations and the rearing of replacement heifers may not be performed as efficiently. The purchase of commercial feed brands is typical among these farms. Milk marketing is through large milk buyers such as Nestlé or through small, local milk cooperatives.

The semi-specialized production system is a dual-purpose system. These operations predominate the coastal regions of the states of Jalisco, Chiapas, Michoacan, Tabasco, Guerrero, and Veracruz. Because of the tropical conditions, it is common to use crossbreds involving European breeds such as Holstein and Brown Swiss with Zebu (mostly Brahman) breeds. The size of these operations normally varies from 5 to 80 cows. This system is characterized by its low use of inputs and its lesser dependence on advanced technology and management than the specialized dairies. It is heavily dependent on grazing of tropical forages with a minimum amount of concentrate supplementation made from local industrial and agricultural by-products. As a result, the supply of milk from this system is highly seasonal. In 1992, semi-specialized dairies comprised 21 percent of the total number of milking cows and 33 percent of total milk production in Mexico (SAGAR-DGIA). Milk output per animal is less than that of the specialized systems,



primarily due to the tropical environmental conditions, lower levels of herd health management, and the genetic makeup of the herds. Because of limitations on milk handling and the lack of infrastructure such as cooling tanks and milking machines, the product is generally marketed to small, local dairy processing enterprises or to large dairy processors such as Nestlé. Alternatively, the raw milk is marketed through local brokers to be sold locally door-to-door (IMTA- UNAM).

The non-specialized system is characterized as producers milking a portion of the beef cattle herd, primarily of the zebu breeds, during the rainy season. The common herd size of these operations varies from 25 to 200 cows. This system is common in remote and isolated areas in the coastal regions of the country, mainly in the central and southeast states of Veracruz, Chiapas, Tabasco, Guerrero, and Oaxaca (Torres). The use of specialized, improved production systems and milking technologies is almost non-existent because of the lack of infrastructure such as electricity and adequate roads.

Due to the seasonal conditions under which this system is operated and the breed of cattle used, milk production is significantly lower than that achieved in the other production systems. In many instances, the revenue from milk sales is considered a cash crop, which contributes to the farms' cash flow over the summer months. Based on cash flow needs, producers milk part of the herd once a day or they milk some of the udder quarters leaving the remaining quarters for the calves to suckle. The number of milking cows and/or quarters is also very flexible, depending on the beef/milk price relationship and immediate cash flow needs. The cattle under this system comprised 72 percent of the national herd and produced 8 percent of the total milk in 1992 (SAGAR-DGIA). Milk is marketed through Nestlé or through the local raw milk markets by door-to-door sales (IMTA-UNAM).

## **Panel Process**

With the new and rapid changes in the Mexican dairy industry, the application of modeling and simulation techniques will allow the ex-ante assessment of the economic and financial performance of the dairy production units in each segment of the industry. This analysis is intended to provide insight into the economic and financial performance of representative dairy and dual-purpose farms across the industry for the period 1997-2002.

The representative panel farm process has been successfully utilized in analyses of the U.S. dairy industry for more than a decade. Simulation techniques used in conjunction with the panel farm process have proven to be widely successful in farm level analyses. Results should provide both policy-makers and producers the necessary information to establish a better decision-making process to benefit the Mexican dairy industry, its commercial partners, and the general milk-consuming public.

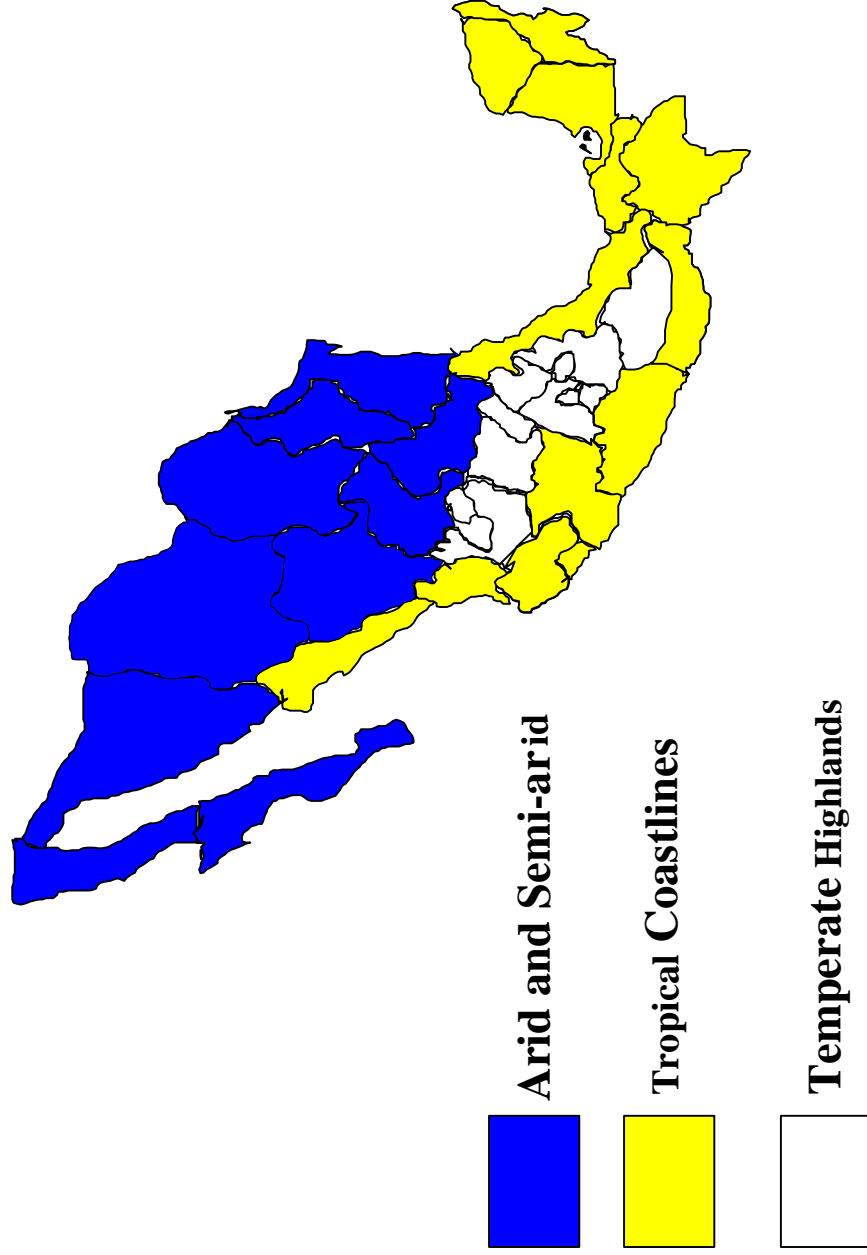
AFPC analysts developed and maintain the data to simulate 13 representative dairy and dual-purpose farms in Mexico (Figure 2). Characteristics for each of the farms in terms of location, size, crop mix, assets, and average receipts are summarized in Appendix A. The representative farms are located in Mexico's principal milk producing regions. Information necessary to simulate the economic activity on these representative farms was developed from panels of producers using a consensus building interview process. Two to three farms were developed in each region using separate panels of producers: one being representative of moderate size full-time farm operations, and the other being representative of farms that are two to three times larger.

After initial data collection, the producer panels are provided pro-forma financial statements for the representative farm they developed and were asked to verify the accuracy of simulated results for the past year and the reasonableness of a four to five year projection. Each panel must approve of the model's ability to reflect the economic activity on their representative farm prior to AFPC using the panel's data for analytical purposes.

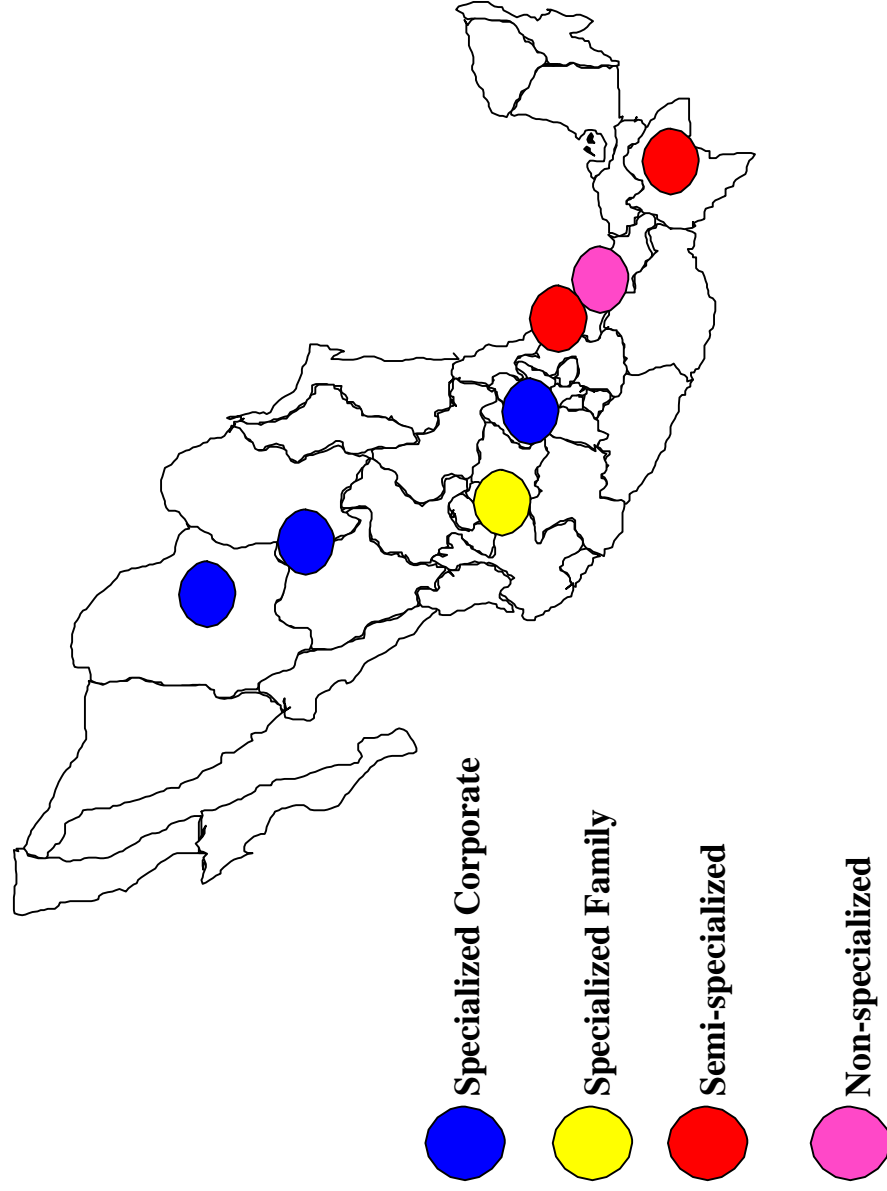
The data collected from the panels were analyzed in a whole farm simulation model referred as FLIPSIM (Farm Level Income and Policy Simulator) developed by AFPC (Richardson and Nixon). FLIPSIM is a general, whole farm simulation model for economic analysis that combines budgeting, accounting, and simulation techniques. It is based on the analysis of economic, financial, and production data.

The results are projected financial statements generated through stochastic or deterministic processes. These capabilities, make FLIPSIM an excellent tool for economic analysis where indicators of future economic performance are needed beforehand to assess the appropriateness of adopting a specific technology or applying government policy changes to the agriculture sector in a country. The stochastic capabilities of FLIPSIM allow the incorporation of risk factors, such as price and productivity into the analysis. This study was carried out deterministically because of the lack of data to establish the probability distribution for the stochastic processes.

**Figure 1. Principal Agro-ecological Regions in Mexico**



**Figure 2. Dairy and Dual Purpose Panels in Mexico**



The farms used in the analysis have been updated with the panels through 1996. The analyses of the panel farms begin in 1996. Initial debt loads are based on information provided by the panel members and personal communications with FIRA (National Land Bank in Mexico). The initial debt levels are given in Table 1. For the large corporate farms, a 20 percent intermediate- and long-term debt to asset ratio was assumed. The family and tropical panels were assumed to begin the analysis period with a 5 percent debt-to-asset ratio.

### **Key Assumptions**

- All farms classified as moderate scale are the size (number of livestock) considered to be representative of full-time commercial farming operations in the study area. In many regions, a second and/or third farm, two to three times larger than the moderate scale farm has been developed as indicators of size economies.
- Herd size was held constant for all farms over the 1997-2002 planning horizon
- Farm program parameters, average annual prices, and input cost inflation are based on the January 1998 FAPRI Baseline.
- All prices were converted to U.S. dollars based on FAPRI's projected exchange rate.
- Annual increase in milk production for Holstein based (corporate and family) dairies was 1.5 percent (Table 2).
- Capital investment of corporate firms included US\$1,000/cow as a membership fee for national dairy cooperatives.
- Minimum family living withdrawals for tropical and family dairies were assumed at a base rate ranging from 17 to 34 percent of gross receipts, according to the panel suggestions.

Actual family living withdrawals are determined by historical consumption patterns.

Therefore, as the farm's profitability increases so does the level of cash withdrawals for family living (Table 1).

- Interest rates (1996-2000) were obtained from Heath (Table 2). Interest rates were held constant at year 2000 rates thereafter.

Table 1. Assumptions on Debt Level, Financing, Managerial Costs and Family Living Expenses

Farm	Debt/Asset (%)	Operating Costs Financed (%)	Managerial Costs (%)	Family Living Expenses (US \$)
Tropical				
VCRZ25	5.0	---	---	6,000 – 10,500
VCRZ54	5.0	---	---	8,000 – 10,500
VCRZ100	5.0	---	---	8,000 – 10,500
CHPS60	5.0	---	---	8,000 – 10,500
Family				
JAL40	5.0	10.0	---	8,000 – 16,000
JAL100	5.0	10.0	---	8,000 – 16,000
Corporate				
DLCS350	20.0	50.0	5.0	---
DLCS1450	20.0	50.0	5.0	---
TORR300	20.0	50.0	5.0	---
TORR2000	20.0	50.0	5.0	---
QRTO350	20.0	50.0	5.0	---
QRTO600	20.0	50.0	5.0	---
QRTO1200	20.0	50.0	5.0	---

- Managerial costs were used instead of family living expenses for the corporate farms. These costs were assumed to be 5 percent of gross receipts. The managerial costs represent the amount of money either paid to a professional manager on a contractual basis and/or the amount of money extracted from the operation by the owners/shareholders as dividends (Table 2).

Table 2. Projections on Animal Performance and Economic and Financial Parameters

	1996	1997	1998	1999	2000	2001	2002
Culled Cow Price (US \$ /cwt.)	32.83	35.36	36.62	37.31	40.61	42.51	44.38
Milk Prices (US \$ /cwt.)							
Corporate	14.32	16.81	17.28	17.69	18.13	18.35	18.52
Family – Small	11.76	14.02	14.45	14.75	15.17	15.32	15.46
Family – Large	11.50	13.60	14.00	14.40	14.80	14.90	15.12
Tropics	11.34	12.57	12.91	13.21	13.57	13.74	13.80
Annual Change in Milk Production per cow (percent)	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Crop Prices (US \$ / Metric Ton)							
Wheat	239.47	214.16	192.55	197.14	199.20	204.95	209.09
Sorghum	171.05	169.95	170.06	164.56	167.18	168.74	174.45
Corn	184.21	181.37	171.96	167.95	168.39	169.24	173.93
WCSM	219.61	216.21	205.00	200.22	200.76	201.76	207.35
Soybean Meal	362.50	356.90	338.39	330.50	331.39	333.05	342.27
Hay	171.05	168.41	159.68	155.95	153.35	157.15	161.51
Silage	39.47	38.86	36.85	35.99	36.09	36.27	37.27
CPI	181.40	219.49	251.98	280.70	307.37	331.96	353.94
Inflation Rate (%)	0.0	21.0	14.80	11.40	9.5	8.0	6.5
Exchange Rate (Pesos / Dollar)	7.60	8.12	8.82	9.41	9.43	10.33	10.68
Interest Rates							
CETES (%) <sup>a</sup>	27.23	23.53	19.50	18.40	17.93	17.93	17.93
Savings Rate (%) <sup>b</sup>	8.17	7.06	5.85	5.52	5.38	5.38	5.38
Intermediate (%) <sup>c</sup>	31.23	27.30	23.50	22.40	21.93	21.93	21.93
Long Term (%) <sup>d</sup>	29.23	25.53	21.50	20.40	19.93	19.93	19.93

<sup>a</sup> 28-d Treasury Bond Rate is used as the base to project interest rates (Heath).

<sup>b</sup> CETES \* 0.3

<sup>c</sup> CETES + 4.0%

<sup>d</sup> CETES + 2.0%

- No off-farm income, such as family employment, was included in the analyses.
- Levels of 0, 10, and 50 percent of operating costs were assumed to be financed for tropical, family, and corporate dairies, respectively.
- The farms are subject to federal and state taxes as a sole proprietor or corporations, according to Mexico's 1997 income tax provisions.



### **FAPRI January 1998 Baseline**

Price projections for the major crops utilized in animal feed were obtained from FAPRI's January 1998 baseline for Mexico's agricultural sector. They were converted to US dollars in this report (Table 4). Trends may not follow closely the projections for the respective commodities in US currency because of the application of the Mexican inflation rates and exchange rate conversions. Similarly, the remaining feedstuffs, not listed in this table, were inflated based on the annual corn price changes during the planning horizon.

Projected beef prices were based on cull cow prices obtained from FAPRI's January 1998 Baseline projections for Mexico and are shown in Table 2. Annual milk prices were also based on FAPRI's January 1998 Baseline projections for Mexico.

Projected milk prices were based on the actual price elicited from the farm panels relative to the national prices. These relative prices were estimated for corporate, family, and tropical farms. Corporate dairies show the highest milk price because of the capital investment required to be shareholders of large dairy cooperatives. The price received by family enterprises represents a fraction of the national prices projected for Mexico. The lowest price is paid to the tropical farms (semi-specialized and non-specialized). In general, milk pricing reflects the levels of capital investments, producer organization and the marketing outreach for the panels under the conditions in the country. Farm milk prices are indicated in Table 2. Both milk and beef prices increase gradually through 2002.

Projected annual rates of change for variable cash expenses are presented in Table 3. The rate of change in input prices were obtained from FAPRI's January 1998 Baseline which relies on

WEFA's and Project Link's macroeconomic projections. Interest rates were obtained for the period 1996-2000 from Heath. Annual interest rates associated with long- and intermediate-term loans and those earned on savings are based on the 28-day CETES (Treasury bond) rate. These rates are summarized in Table 4.

### **Definitions of Variables in the Summary Tables**

- **Annual Percentage Change in Real Net Worth, 1997-2002** -- The annualized percentage change in the operator's net worth from January 1, 1997 through December 31, 2002, after adjusting for inflation. This value reflects the real annualized increase or decrease in net worth or equity for the farm over the planning horizon including changes in real estate values.
- **NIA for Total Real Net Worth, 1997-2002** -- Net income adjustment (NIA) is the annual increase or decrease in net cash farm income necessary to cause the annualized percentage change in real net worth, including land inflation, to equal zero over the planning horizon. If the change in net worth is negative, the NIA is the annual increase in net income necessary to prevent a loss in total real net worth. NIA's are expressed both as total dollars per year and as a percent of average annual cash receipts.
- **Costs to Receipts Ratio, 1997-2002** -- This is the ratio of all cash expenses to total receipts (from the sales of milk, animals, and crops). Cash expenses include interest costs, fixed cash costs, and variable costs but exclude principal payments, depreciation, income taxes, and family living expenses.

- **Total Cash Receipts** -- Total receipts are cash receipts from market sales and other farm-related income. The values in the tables are the total receipts for each year in the planning horizon, as well as the overall average for 1997-2002.
- **Total Cash Expenses** – Total expenses are cash receipts for input purchases related to the farm operation. It excludes depreciation, principal payments, income taxes and machinery replacement costs. The values in the tables are the total receipts for each year in the planning horizon, as well as the overall average for 1997-2002.
- **Net Cash Farm Income** -- Net cash farm income equals total cash receipts minus all cash expenses. Net cash farm income is used to pay family living expenses, principal payments, income taxes, and machinery replacement costs. The values in the tables are the net cash farm income for each year in the planning horizon and the overall average for 1997-2002.
- **Ending Cash Reserves** -- Cash reserves are the cash on hand at the end of the year. Ending cash equals beginning cash reserves plus net cash farm income and interest earned on cash reserves less principal payments, taxes (income and self employment), family living withdrawals, and machinery replacement costs. The values in the tables are the cash reserves for each year in the planning horizon, as well as the overall average for 1997-2002.
- **Nominal Net Worth** -- Total net worth or equity at the end of each year in the planning horizon equals total assets including land minus total debt from all sources. This value of net worth is not adjusted for inflation. The values in the tables are the ending net worth for each year in the planning horizon, as well as the overall average for 1997-2002.

- **Real Net Worth** – It is the nominal net worth adjusted for inflation. It represents the equity of the farm after inflation for each year in the planning horizon. The values in the tables are the ending real net worth for each year in the planning horizon, as well as the overall averages for 1997-2002.
- **Return/Asset** – It is the rate of return based on the total value of assets. This index reflects the economic efficiency of the operation. The values in the tables reflect the annual return to assets, as well as the overall average for 1997-2000.
- **Return/Equity** – It is the rate of return based on the total equity or net worth of the farm. This index considers the financial liabilities of the operation, as well. The values in the tables reflect the annual return to equity, as well as the overall average for 1997-2002.
- **Net Present Value** – This represents the future value of the farm over the planning horizon in current dollars. The table shows the overall average net present value for the period 1997-2002.

## **Baseline Performance**

### **Specialized Corporate Dairies**

The principal performance indicators for all the dairy farms are summarized in Figures 3-6 and Tables 3 and 4. All of the corporate dairies experience an increasing ending cash balance over the planning horizon (Figures 3 and 4). However, at the level of debt assumed, the moderate size Torreon farm (TORR300) shows negative net cash farm income during the first two years of the study. While for the moderate Torreon farm net cash farm income is positive from 1999-2000 it is not sufficient to cover managerial costs, principal payments, and taxes resulting in negative cash balances throughout the period of study. With the exception of the moderate Torreon and Queretaro (QRTO350) farms, the rest of the corporate farms are able to repay their loans early (2-4 years) and generate a significant amount of cash reserves. Both the Torreon and Queretaro moderate farms experience a decreasing level of debt throughout the planning horizon.

Table 3 summarizes the baseline performance of the specialized corporate dairies. The average cost to receipts ratio ranged between 60 and 70 percent for these operations. The two farms that exceeded this range were moderate Queretaro with 80 percent and moderate Torreon with average cost to receipts of 98 percent (Figure 7). The average return to assets ranged from 18 to 28 percent for all of the farms and the return to equity ranged from 15 to 27 percent with the exception of moderate Torreon which had an average return to equity near 6 percent over the planning horizon (Table 3).

The moderate Torreon and Queretaro dairies averaged 3 and 6 percent in annual percentage change in real net worth, respectively (Table 3). For the rest of the corporate dairies,

the annual percent change in real net worth ranged from 13 to 18 percent. Figure 8 indicates the average nominal and real net worth for the corporate farms over the planning horizon.

Under these assumed conditions all the corporate farms show a positive net present value over the 1997-2002 period (Figure 9). The financial position of most of the corporate farms allows them to have an average net income adjustment for percentage of total receipts (NIA) below -15 percent. This means that annual receipts could decline 15 percent and the farm would be able to maintain real net worth. For the large dairies (DLCS1450, TORR2000, and QRTO1200) and for the moderate Delicias dairy (DLCS350) the NIA reaches below -25 percent. The medium Queretaro farm (QRTO600) shows an NIA level of -20 percent. The moderate size Torreon and Queretaro farms had the smallest corporate farm NIA of -2 and -14 percent, respectively (Table 4).

Overall, these results indicate that the corporate dairies experience substantial economies of size. The moderate size Torreon dairy still shows the residual effects of the economic crisis that occurred in Mexico during 1994-5, which had a severe impact on all of Mexico's agriculture. All of the corporate farms have the ability to generate positive cash flow once they payoff their loans early in the planning horizon.

### **Specialized Family Dairies**

The moderate size Jalisco dairy (JAL40) shows a positive ending cash balance over the entire period of study, 1997-2002 (Figure 5). For the large Jalisco (JAL100), the net cash farm income is positive but not enough to cover family living expenses and debt obligations, which causes it to have negative ending cash balance early in the planning horizon. The ending cash

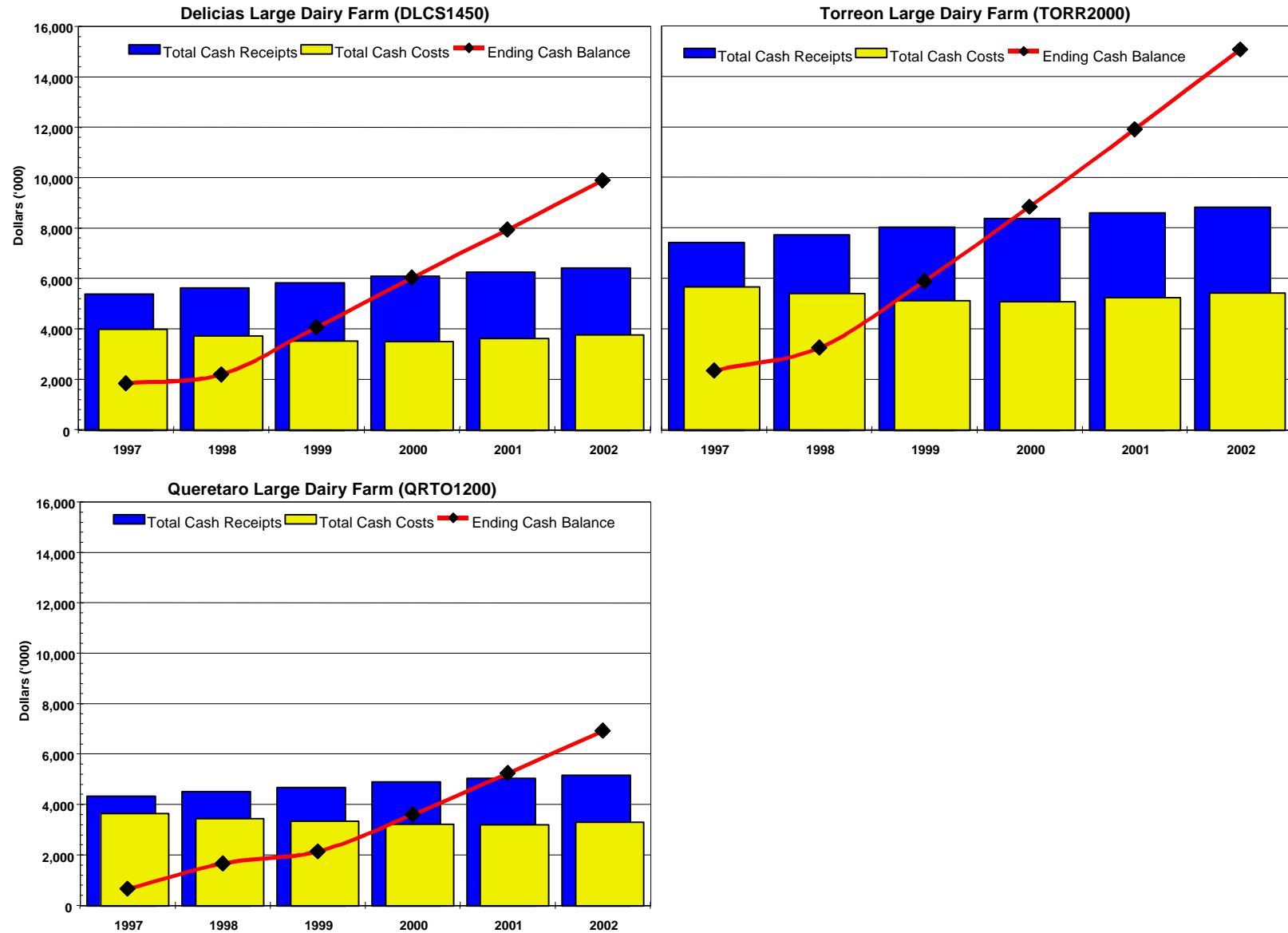
balance for the farm becomes positive in 1999 and reaches about \$80,000 in 2002. Table 4 summarizes the baseline performance of the specialized family dairy farms.

The more intensive and modern production approach makes the moderate Jalisco family farm far more efficient than the large family dairy farm. The average cost to receipts is 65 and 80 percent over the period 1997-2002 for the moderate and large specialized family dairies, respectively. The very small debt load imposed on these farms makes return on assets and equity yield similar values. For the moderate Jalisco dairy, the return to assets and return to equity were 18.9 and 18.3 percent, respectively. For the large specialized family dairy they were 13.2 and 12.3 percent, respectively (Figure 7).

Equity growth, in real terms, for the moderate Jalisco dairy was three times larger than that for the large Jalisco farm, a 5.1 vs. 1.7 average annual percent change in real net worth, respectively (Figure 8). Similarly, the cash flow capabilities of the moderate farm results in a lower NIA for this farm, meaning that receipts could decline 17.1 percent and the farm would maintain real net worth (Figure 9). These are -17.1 and -4.6 percent for the moderate Jalisco and large Jalisco farms, respectively.

These results indicate that the moderate farm has an economic advantage over the larger farm. For the smaller farm, marketing strategies, their highly integrated organization and the adoption of newer production techniques, allows them to obtain higher economic returns and sustain better financial performance.

**Figure 3. 1997-2002 Cash Receipts, Cash Expenses, and Cash Balance for the Specialized Corporate Farms in Mexico**





**Figure 4. 1997-2002 Cash Receipts, Cash Expenses, and Cash Balance for the Specialized Corporate Farms in Mexico**

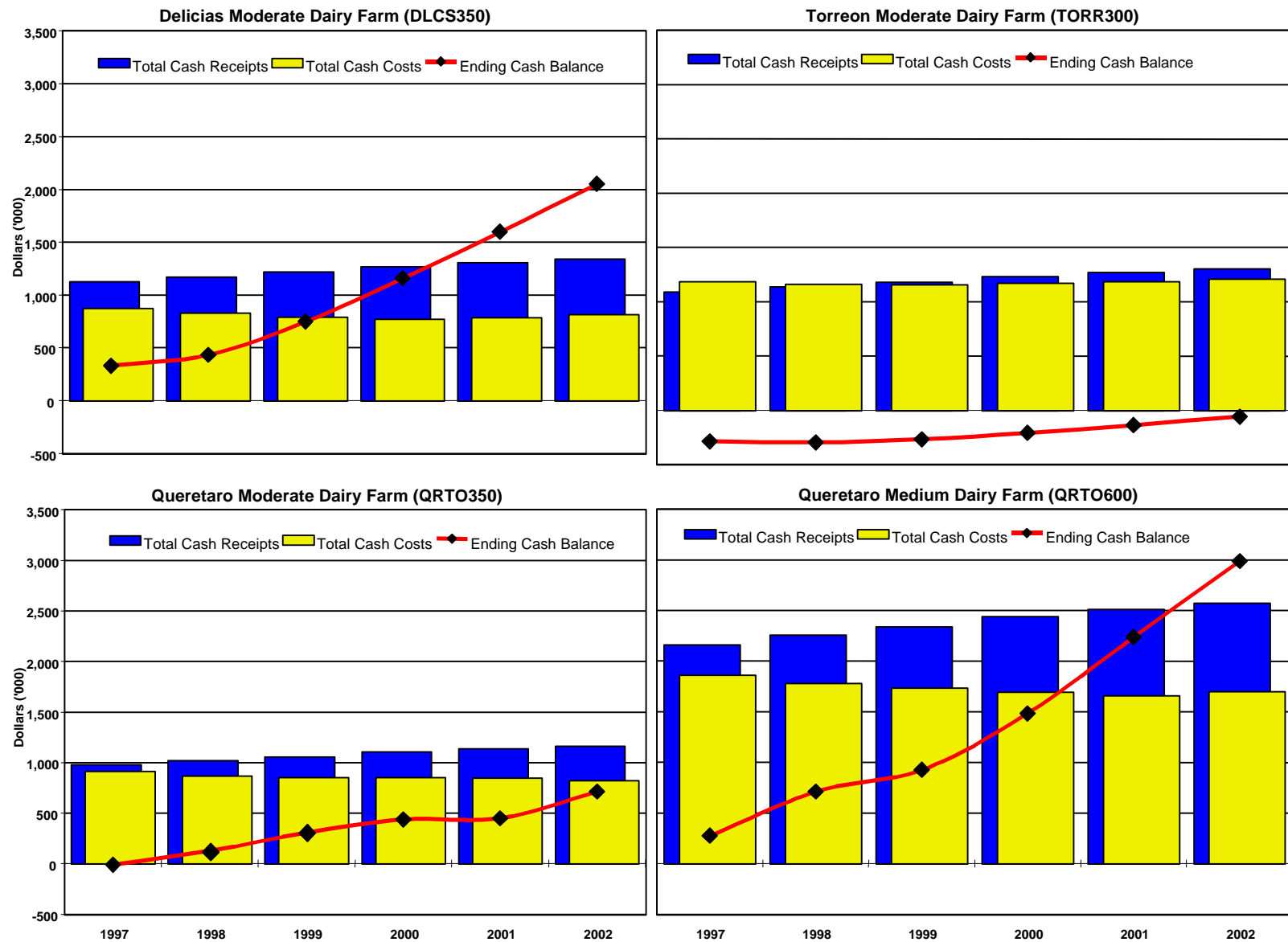


Figure 5. 1997-2002 Cash Receipts, Cash Expenses, and Cash Balance for the Specialized Family Farms in Mexico

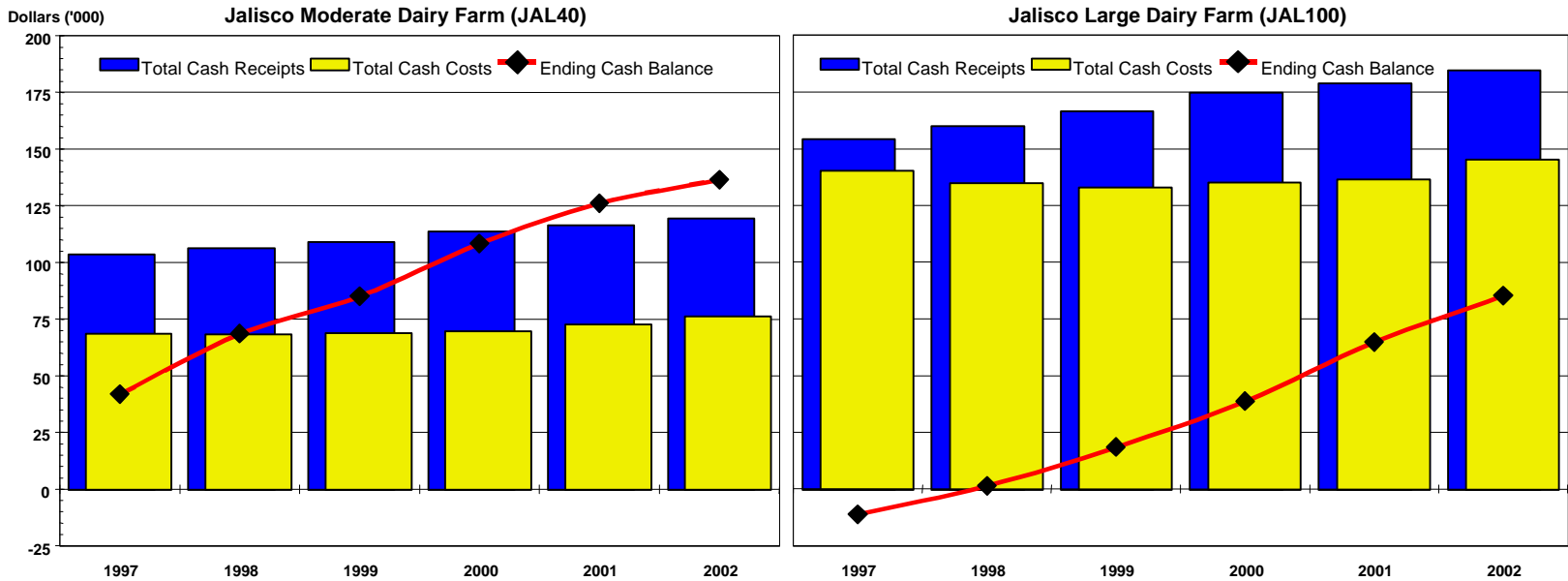


Table 3. Implications of the 1998 Baseline on the Economic Viability of Specialized Corporate Representative Dairy Farms in Mexico.

	DLCS350	DLCS1450	TORR300	TORR2000	QRTO350	QRTO600	QRTO1200
Change in Real Net Worth 1997-2002 (%)	15.71	14.47	3.20	18.27	6.33	13.51	16.69
Expense to Receipts (%) 1997-2002 Average	65.80	62.40	98.20	65.45	80.22	73.42	70.80
Return on Assets (%)	26.10	25.97	18.85	28.39	18.32	24.52	27.41
Return on Equity (%)	23.75	24.24	5.96	26.63	15.13	21.22	24.34
Cash Receipts (1,000)							
1997	1,123.50	5,388.41	1,090.97	7,408.00	977.72	2,162.23	4,326.17
1998	1,171.28	5,617.90	1,137.35	7,724.22	1,019.44	2,254.45	4,510.67
1999	1,215.32	5,830.04	1,180.05	8,017.95	1,058.17	2,339.95	4,681.71
2000	1,268.89	6,084.77	1,232.21	8,363.30	1,103.84	2,441.29	4,884.54
2001	1,305.49	6,259.31	1,267.82	8,600.98	1,135.25	2,510.92	5,023.89
2002	1,338.95	6,418.66	1,300.38	8,817.55	1,163.88	2,574.41	5,150.96
1996-2000 Average	1,237.24	5,933.18	1,201.46	8,155.33	1,076.39	2,380.54	4,762.99
Net Cash Farm Income (1,000)							
1997	254.87	1,398.94	-91.69	1,749.06	64.95	299.70	684.20
1998	343.55	1,897.50	-22.36	2,338.63	150.97	476.19	1,079.24
1999	426.41	2,312.50	24.79	2,898.52	204.14	604.73	1,349.72
2000	498.48	2,598.52	62.80	3,298.10	251.82	749.64	1,667.38
2001	518.47	2,634.15	85.17	3,376.32	292.10	851.81	1,837.37
2002	523.84	2,657.97	94.42	3,401.52	341.99	876.37	1,849.98
1996-2000 Average	427.60	2,249.93	25.52	2,843.69	217.66	643.07	1,411.32
Cash Balance (1,000)							
1997	329.18	1,832.54	-286.43	2,343.59	-9.32	275.70	660.21
1998	433.31	2,197.56	-296.83	3,255.26	126.84	711.51	1,658.87
1999	747.35	4,061.73	-267.90	5,886.50	306.45	926.52	2,136.86
2000	1,158.58	6,038.87	-208.49	8,828.18	436.95	1,481.83	3,608.59
2001	1,598.37	7,940.35	-136.54	11,902.36	449.45	2,237.99	5,244.90
2002	2,053.10	9,892.63	-58.99	15,067.31	712.81	2,988.22	6,921.37
1996-2000 Average	1,053.32	5,327.28	-209.20	7,880.53	337.19	1,436.96	3,371.80
Real Net Worth (1,000)							
1997	1,158.26	6,518.11	799.11	7,356.09	1,809.05	2,218.14	3,903.81
1998	1,260.56	7,056.05	726.10	8,199.48	1,759.15	2,330.39	4,271.19
1999	1,371.75	7,649.00	698.07	9,174.05	1,757.41	2,503.67	4,735.65
2000	1,523.04	8,364.21	716.29	10,313.77	1,802.23	2,748.88	5,321.65
2001	1,669.46	8,989.22	736.41	11,376.69	1,854.49	3,001.70	5,909.80
2002	1,817.31	9,565.04	762.38	12,419.06	1,924.08	3,256.49	6,477.86
1996-2000 Average	1,466.73	8,023.61	739.73	9,806.52	1,817.74	2,676.54	5,103.33
NIA Net Worth 1997-2002 (1,000)	-331.33	-1,786.94	-29.39	-2,335.97	-157.39	-483.12	-1,106.18
NIA Net Worth 1997-2002 (%)	-26.63	-29.95	-2.43	-28.49	-14.54	-20.18	-23.10

Table 4. Implications of the 1998 Baseline on the Economic Viability of Specialized Family and Tropical Representative Dairy and Dual-Purpose Farms in Mexico.

	JAL40	JAL100	VRCZ25	VCRZ54	VCRZ100	CHPS60
Change in Real Net Worth 1997-2000 (%)	5.10	1.71	0.51	4.50	0.67	4.79
Expense to Receipts (%) 1997-2002 Average	63.49	81.21	50.10	54.26	62.67	49.48
Return on Assets (%)	18.89	13.37	15.73	17.52	12.72	19.67
Return on Equity (%)	15.51	17.35	12.42	19.71	18.28	12.18
Cash Receipts (1,000)						
1997	103.65	154.23	16.30	46.13	29.49	42.70
1998	106.41	159.90	17.67	47.97	30.63	44.40
1999	109.09	166.53	17.51	49.44	31.45	45.78
2000	113.68	174.63	19.30	52.46	33.64	48.52
2001	116.52	178.79	19.14	54.35	34.96	50.24
2002	119.33	184.48	19.67	55.96	36.16	51.70
1996-2000 Average	111.45	169.76	18.26	51.05	32.72	47.22
Net Cash Farm Income (1,000)						
1997	35.07	14.09	7.97	19.16	9.95	21.34
1998	38.21	25.15	8.48	21.09	10.93	22.26
1999	40.25	33.54	8.78	22.21	11.34	24.05
2000	44.08	39.56	9.51	25.39	13.04	24.98
2001	43.86	42.46	9.86	26.44	13.81	25.24
2002	42.97	39.41	10.15	26.29	14.57	25.18
1996-2000 Average	40.74	32.37	9.12	23.43	12.27	23.84
Cash Balance (1,000)						
1997	42.07	-11.16	1.59	17.43	0.80	22.96
1998	68.57	1.45	2.84	28.15	1.93	28.08
1999	85.15	18.57	4.04	34.50	2.97	41.47
2000	108.37	38.77	5.67	48.38	5.27	55.46
2001	126.17	64.80	7.41	63.43	7.91	69.84
2002	136.55	85.29	9.22	74.00	10.95	84.20
1996-2000 Average	94.48	32.95	5.13	44.32	4.97	50.33
Real Net Worth (1,000)						
1997	169.20	310.51	55.36	128.17	234.89	157.02
1998	165.77	287.16	50.48	122.24	216.31	151.36
1999	162.97	274.60	47.02	118.99	202.51	148.56
2000	166.12	272.83	45.64	120.48	195.52	148.31
2001	167.28	272.44	44.49	122.14	189.87	148.94
2002	166.90	271.07	43.78	124.10	185.90	150.21
1996-2000 Average	166.37	281.43	47.80	122.69	204.16	150.73
NIA Net Worth 1997-2002 (1,000)	-19.19	-7.85	-0.31	-9.54	-1.62	-11.88
NIA Net Worth 1997-2002 (%)	-17.14	-4.60	-1.70	-18.57	-4.92	-25.00

## **Tropical Dual-Purpose Farms**

All of the tropical farms show positive net cash farm income for the 1997-2002 period (Figure 6). After deducting principal payments, family living expenses, taxes, and cash outlays for machinery replacement, the moderate size Veracruz (VCRZ54) and Chiapas (CHPS60) farms show a rapid growth in ending cash balance over the planning horizon. Both the small and large Veracruz farms (VCRZ25 and VCRZ100) achieve a small, but steady increase in ending cash. The size of the small farm restricts its ability to efficiently use its resources. In the case of the large Veracruz farm, it is basically a beef ranch milking a portion of the herd during the rainy season. The large Veracruz farm maintains an extensive system of production with the characteristic low input/low output approach. Table 4 summarizes the baseline performance of the tropical dual-purpose farms.

While the moderate size farms grow at a steady rate, the small and large farms just maintain their equity over the study period (Figure 8). For the moderate Veracruz and Chiapas farms, the annual percentage change in real net worth averages about 5 percent across the planning horizon. In contrast, the annual percentage change in real net worth averaged 0.5 percent for both the small and large Veracruz farms.

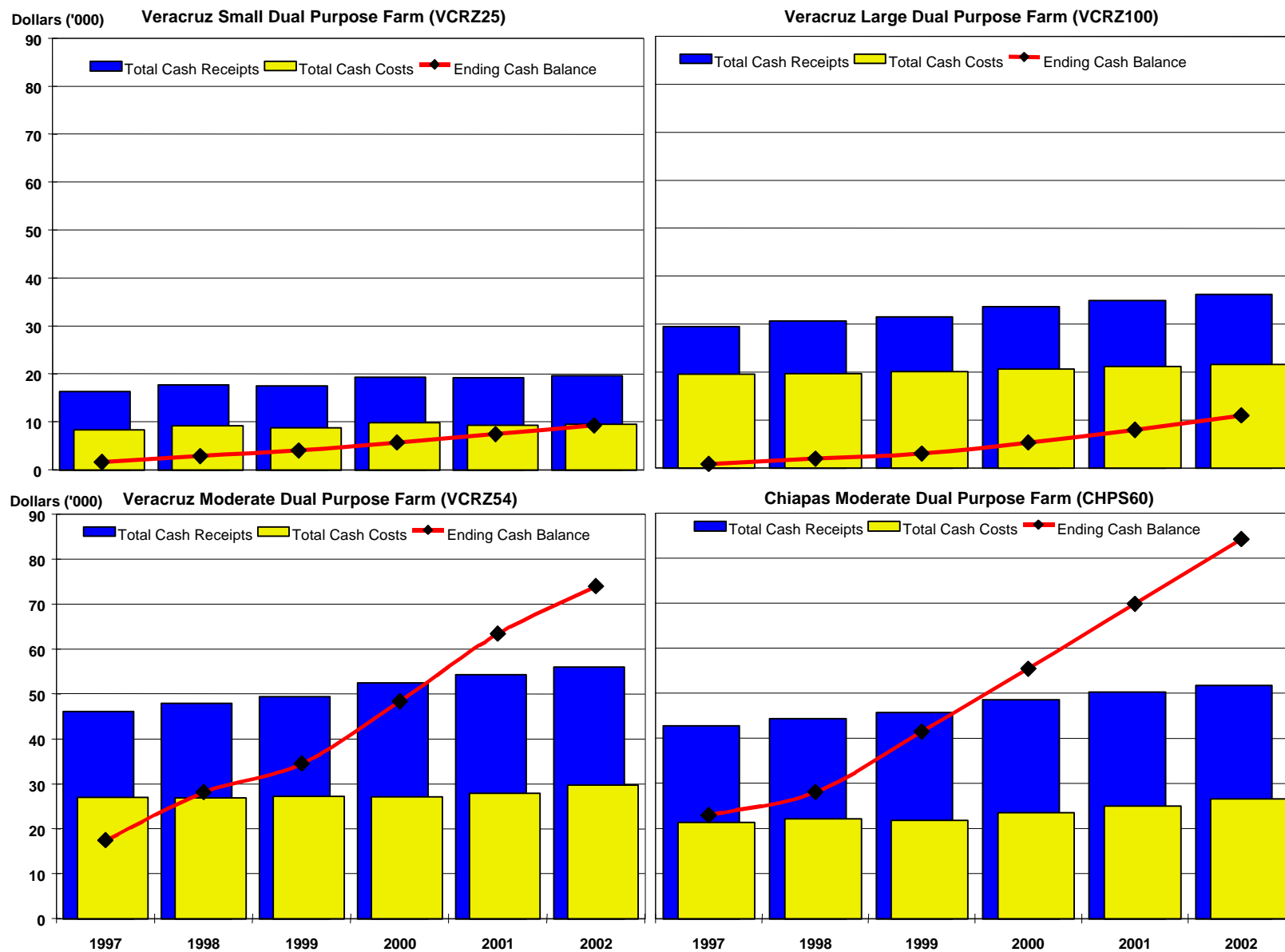
In the case of the small size Veracruz farm, although it is a more intensive production system it is not large enough to produce sufficient cash flow to cover cash requirements beyond production costs. The large size Veracruz farm, under the low input/output production system, is unable to reach an efficient level of milk production. On the other hand, operating more intensively with a 50-60 cow herd the moderate tropical systems are more profitable and financially sustainable. Figure 9 shows the average net present value for the tropical farms over

the 1997-2002 period. The net income adjustment for the small and large Veracruz farms is -2 and -5 percent, respectively. The moderate size farms in Veracruz and Chiapas show an NIA of -18 and -25 percent, respectively. The moderate farms have an advantage in size over the small and large farms. The small farm is not large enough to efficiently utilize its resources and the large farm does not have the resources (cattle, infrastructure, machinery, etc.) to reach higher productivity levels.

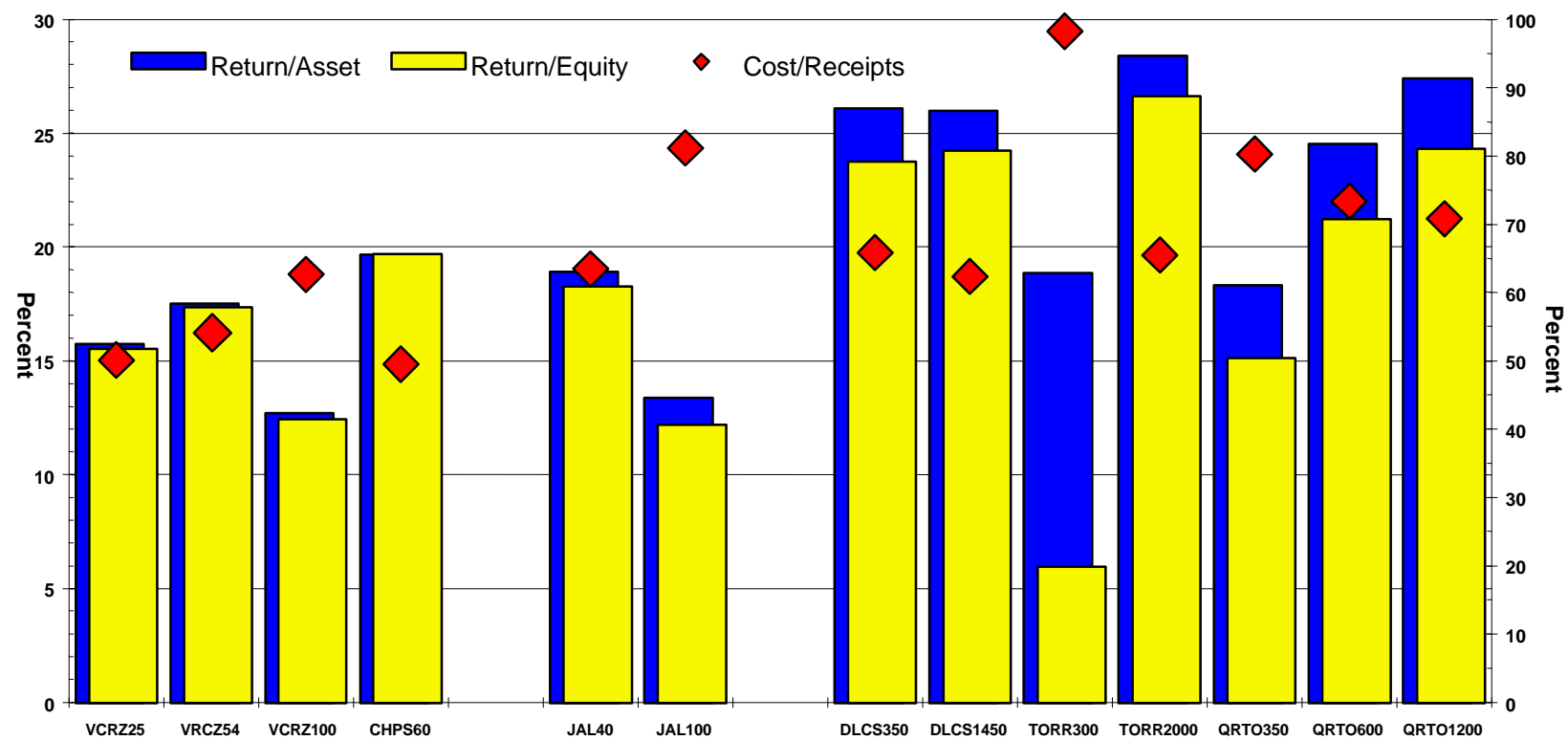
The tropical farms show the lowest average cost to receipts ratio over the 1997-2002 period. On average, their cost to receipts ratio is about 50 percent, with the exception of the large Veracruz farm with an average cost to receipts ratio of 60 percent (Figure 7). However, the low productivity of the tropical farms does not help them to be as profitable as the specialized dairies in Northern Mexico.

The low debt level assumed for the tropical farms makes their return on assets and equity more similar to the specialized and family dairies (Table 4). The lowest returns were on the large Veracruz farm which, on average, obtained a 12 percent return on assets. The small and moderate Veracruz and Chiapas farms averaged rates of return on assets of 15, 18, and 20 percent over the 1997-2002 period, respectively. The moderate size tropical farms have higher levels of production intensification because of their breed of cattle and level of technology utilization. These factors increase their economic viability and make these farms more profitable. The large Veracruz farm is largely dependent on beef sales; milk is just a small part of their income and it is extremely seasonal. However, the tropical farms are not nearly as dependent on purchased inputs as the specialized farms, which gives them an economic advantage to operate under the unstable economic situations in Mexico.

**Figure 6. 1997-2002 Cash Receipts, Cash Expenses, and Cash Balance for the Tropical Farms in Mexico**



**Figure 7. 1997-2002 Average Annual Returns for Mexican Dairy Panels**





**Figure 8. 1997-2002 Average Net Worth for Mexican Dairy Panels**

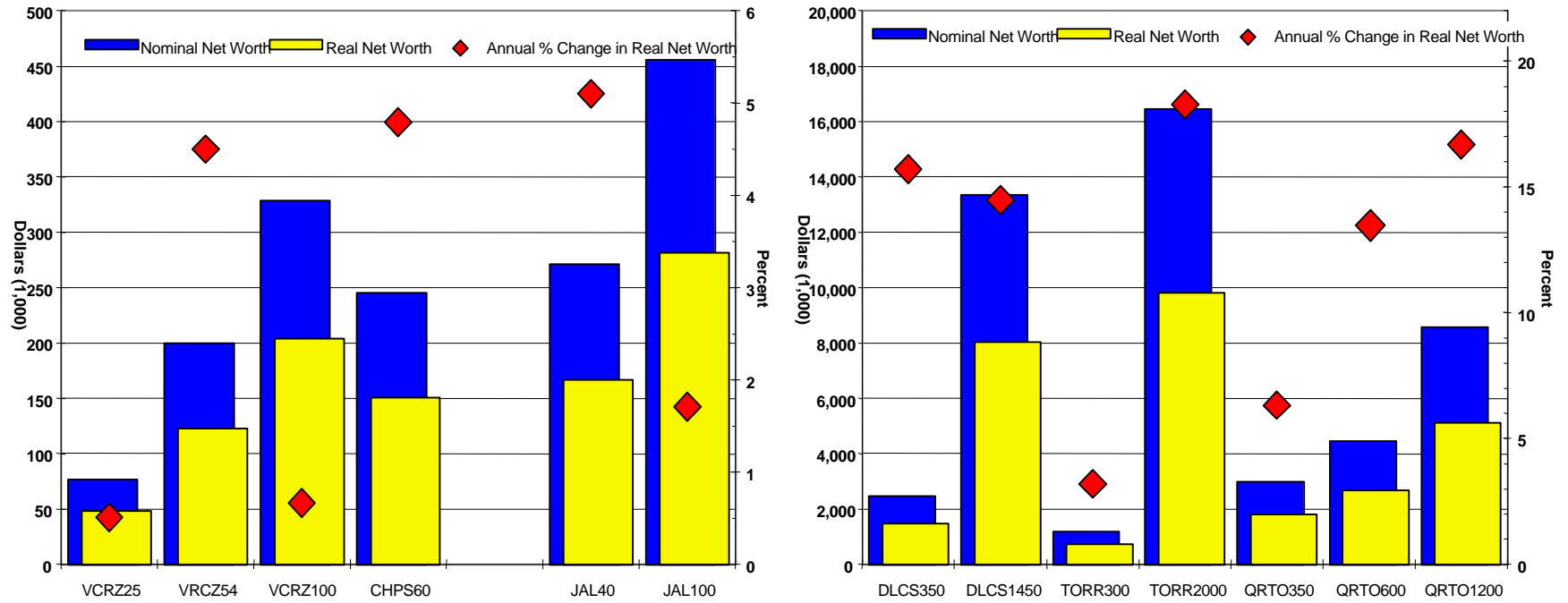
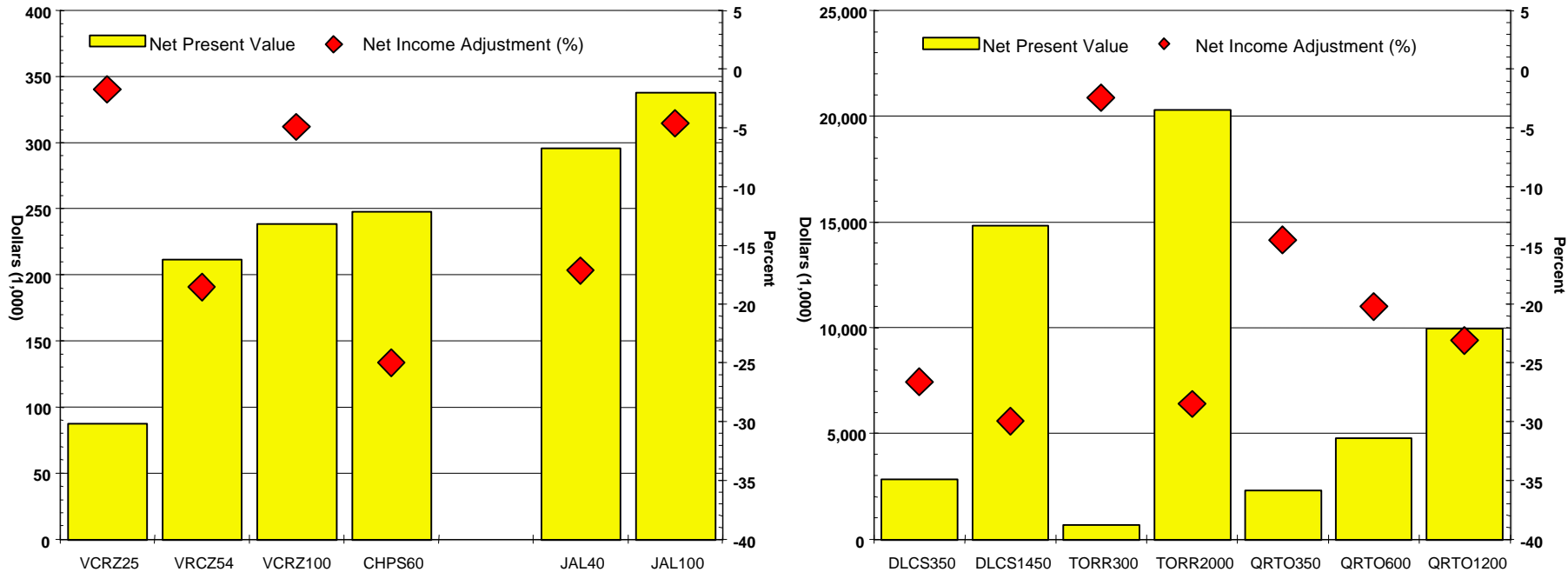


Figure 9. 1997-2002 Average Net Present Value and Net Income Adjustment for Mexican Dairy Panels



## Summary

- A clear indication of economies of size can be found among the corporate dairies. This is particularly evident in the performance among the dairies located in Queretaro.
- The performance of the moderate size Torreon dairy is typical of those dairies that barely survived the 1994-1995 economic crisis in Mexico. They still show some economic and financial problems, but they also show clear signs of recovery and a positive performance trend under the baseline.
- The milk price predicted for this study allows the corporate dairy farms to rapidly build cash and payoff their debt. In fact, since no growth was allowed for the farm panels under study, in some instances, accumulated cash comprised up to one half of the ending nominal net worth for the corporate dairy farms.
- The specialized production system is characterized as being highly dependent on imported inputs such as germplasm, machinery, equipment, veterinary products, and some feed ingredients. This situation make the specialized system sensitive to fluctuations in macroeconomic conditions such as exchange and interest rates, as well as the economic policies of the Mexican government and its trading partners.
- There is a great potential for improvement in the specialized family herds through better management in nutrition and health. Genetics, through semen quality as well as the selection and rearing of replacements, should play an important role in the improvement of these herds.
- Tropical farms show a lesser dependence on imported and domestic inputs than the specialized farms. However, they also show a lower output and a marked seasonality in their production patterns.

- The lack of infrastructure and marketing outlets represent a major deterrent for the expansion of milk production in the tropics. Development of tropical milk production would be enhanced with the development of infrastructure, as well as the expansion and assurance of the markets in the region.
- Expansion of tropical milk production would require improving the management of both the cattle and the tropical forage species. This represents a unique opportunity for the industries in the areas of feeds, seeds, agro-chemicals, veterinary products, genetics, and machinery to expand and fulfill an increasing demand for these products in the tropics.
- The data for the Chiapas farm was developed prior to the social unrest in the region. For the present study, these data were updated to 1996 levels using economic indexes without carrying out a panel meeting. The results shown in this document for this farm do not reflect the economic impact of the current social unrest in the State of Chiapas. Data for the farm assumed the region was under normal social and political conditions. Social and political conditions currently existing in the State of Chiapas would definitely have an effect on important factors such as land value, marketing of agricultural products, loan procurement, and infrastructure which may cause somewhat different results than those obtained in this study.
- The baseline conditions are favorable for the expansion of the Mexican dairy sector. Rapid growth in the industry, mainly in the specialized production systems, will likely be observed over the next few years.

- However, the lack of production capacity, the limited feed supply, and the growing demand for milk products are likely to require that Mexico continue importing dairy products in the near and intermediate future.
- This study was intended to provide insight into the Mexican dairy sector. It should help the dairy industry in Mexico to understand the advantages and shortcomings of their production sector and the comparative advantages across regions and production systems. Also, this report should also help Mexico's commercial partners find ways to complement the growing demand for dairy products and dairy-related industries.

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## **APPENDIX A: Characteristics of Representative Farms**

### **Specialized Intensive (Corporate) Dairy Panels**

- DLCS350** A 350-cow North Mexico (Delicias, Chihuahua) moderate size dairy that produces 7,878 Kg. (17,368 pounds) of milk per cow. The farm plants 166 ha (410 acres) of alfalfa, 18 ha (45 acres) of corn silage, 17 ha (42 acres) of oat hay, and 18 ha (45 acres) of ryegrass hay. The farm generates 92 percent of its receipts from milk. The farm was updated in 1997.
- DLCS1450** A 1,450-cow North Mexico (Delicias, Chihuahua) large size dairy that produces 9,200 Kg (20,282 pounds) of milk per cow. The farm plants 440 ha (1,087 acres) of alfalfa, 120 ha (297 acres) of corn silage, 45 ha (112 acres) of oat hay, and 115 ha (284 acres) of ryegrass hay. The farm generates 92 percent of its receipts from milk. The farm was updated in 1997.
- TORR300** A 300-cow North Mexico (La Laguna) moderate size dairy that produces 8,900 Kg (19,621 pounds) of milk per cow. The farm plants 100 ha (247 acres) of alfalfa, 15 ha (37 acres) of oat silage, and 92 ha (227 acres) of ryegrass hay. The farm generates 91 percent of its receipts from milk. The farm was updated in 1997.
- TORR2000** A 2,000-cow North Mexico (La Laguna) large size dairy that produces 9,300 Kg (20,503 pounds) of milk per cow. The farm plants 320 ha (791 acres) of alfalfa, 250 ha (618 acres) of corn silage, and 250 ha (618 acres) of oat hay. The farm generates 94 percent of its receipts from milk. The farm was updated in 1997.
- QRTO350** A 350-cow Central Mexico (El Bajio) moderate size dairy that produces 7,000 Kg (15,432 pounds) of milk per cow. The farm plants 90 ha (222 acres) of alfalfa, 25 ha (62 acres) of corn silage, and 74 ha (183 acres) of oat hay. The farm generates 94 percent of its receipts from milk. The farm was updated in 1997.
- QRTO600** A 600-cow Central Mexico (El Bajio) medium size dairy that produces 9,000 Kg (19,842 pounds) of milk per cow. The farm plants 95 ha (235 acres) of alfalfa, 70 ha (173 acres) of corn silage, 42 ha (104 acres) of oat hay, and 85 ha (210 acres) of ryegrass hay. The farm generates 93 percent of its receipts from milk. The farm was updated in 1997.
- QRTO1200** A 1,200-cow Central Mexico (El Bajio) large size dairy that produces 9,000 Kg (19,842 pounds) of milk per. The farm plants 110 ha (272 acres) of alfalfa, 115 ha (284 acres) of corn silage, and 35 ha (87 acres) of oat hay. The farm generates 94 percent of its receipts from milk. The farm was updated in 1997.

### **Specialized Family Dairy Panels**

- JAL40** A 40-cow Central Mexico (Los Altos de Jalisco) medium size dairy that produces 5,913 Kg (13,036 pounds) of milk per cow. The farm plants 26 ha (64 acres) of corn for grain, fodder and stover utilization and 6 ha (15 acres) of pasture for summer grazing. The farm generates 85 percent of its receipts from milk. The farm was updated in 1997.
- JAL100** A 100-cow Central Mexico (Los Altos de Jalisco) large size dairy that produces 4,344 Kg (9,577 pounds) of milk per cow. The farm plants 20 ha (49 acres) of corn fodder. The farm generates 86 percent of its receipts from milk. The farm was updated in 1997.

### **Tropical Dual-purpose Panels**

- VCRZ25** A 25-cow Central Tropical (Central Veracruz) moderate size, intensive dual purpose farm that produces 1,577 Kg (3,477 pounds) of milk per cow. The farm plants 2 ha (5 acres) of Napier grass for cut-and-carry and 18 ha (45 acres) of native pasture grasses. The farm generates 68 percent of its receipts from milk. The farm was updated in 1997.
- VCRZ54** A 54-cow Central Tropical (Central Veracruz) large size, intensive dual purpose farm that produces 1,800 Kg (3,477 pounds) of milk per cow. The farm plants 2 ha (5 acres) of Napier grass for silage and 2 ha (5 acres) of corn silage. The farm generates 58 percent of its receipts from milk. The farm was updated in 1997.
- VCRZ100** A 100-cow Central Tropical (Central Veracruz) large size, extensive dual purpose farm that produces 432 Kg (952 pounds) of milk per cow. The farm plants 150 ha (371 acres) of native grasses. The farm generates 39 percent of its receipts from milk. The farm was updated in 1997.
- CHPS60** A 60-cow Southeast Tropical (Palenque, Chiapas) large size, intensive dual purpose farm that produces 1,744 Kg (3,845 pounds) of milk per cow. The farm plants 138 ha (341 acres) of native grasses. The farm generates 67 percent of its receipts from milk. The farm was updated in 1995.



## **APPENDIX B: List of Panel Farm Cooperators**

### **Martinez de la Torre and Carranza, Veracruz**

Facilitator: Dr. Andres Aluja - Director, CEIEGT-UNAM, Martinez de la Torre, Veracruz

Rebeca Acosta	Cresencio Alarcon
Jorge Alvarez	Raul Armenta
Lautaro Barria	Hector Basurto
Oscar Brauer	Epigmenio Castillo
Manuel Corro	Cristino Cruz
Eduardo Diaz	Vicente Diaz
Francisco Espinoza	Ignacio Flores
Ruperto Huesca	Leticia Galindo
Narciso Gomez	Jesus Jarillo
Ezequiel Lagunes	Manuel Lagunes
Fernando Livas	Isidoro Lopez
Bernardo Marin	Miguel Niembro
Eliazar Ocaña	Cesar Ortiz
Hugo Perez	Oscar Ramirez
Enrique Riaño	Noel Rodriquez
Ms. Ivette Rubio	Isaias Tapia
Braulio Valles	

### **Palenque, Chiapas**

Facilitator: Dr. Rene F. Ochoa - Assistant Research Scientist, Texas A&M University, College Station, Texas

Panel Participants:

Miguel Angel	Javier Bernal
Victor M. Bernal	Francisco Del Carmen
David Garcia	Carlos A. Isla
Heraclio Landera	Aladino Landero
Enrique Lopez	Catalino Jimenez
Alberto Marin	Felipe de la Peña
Jose L. Sanchez	Horacio Vidal

### **Delicias, Chihuahua**

Facilitator: Dr. Rene Villalobos - Assistant Professor, The University of Texas at El Paso, El Paso, Texas.

#### **Panel Participants**

Carlos H. Duran

Juan Jaime Hernandez

Everardo A. Lujan

Cruz J. Ortiz

Ricardo Pineda

Arturo Rodriguez

Ramon Villalobos

### **Torreón, Coahuila**

Facilitator: Dr. Rene F. Ochoa - Assistant Research Scientist, Texas A&M University, College Station, Texas

#### **Panel Participants**

Benjamin Bandera

Eloy Borbolla

Hector Flores

Carlos Martin

Gerardo Martin

Raul Morales

Felix F. Ramirez

### **Querétaro, Querétaro**

Facilitator: Dr. Rene F. Ochoa - Assistant Research Scientist, Texas A&M University, College Station, Texas

#### **Panel Participants**

Juan Carlos Alvarez

Carlos Calzada

Francisco Calzada

Rafael Castillo

Alejandro Gonzalez

Hugo Gutierrez

Armando Paredes

Enrique Rubin

Andres Urquiza

Alejandro Urquiza, Jr.

Alejandro Urquiza, Sr.

Gonzalo Urquiza

### **Acatic and San Miguel El Alto, Jalisco**

Facilitator: Francisco Ramirez - Research Scientist, INIFAP-SARH, Guadalajara, Jalisco

Jose Luis Barba

Abraham Gonzalez

Roberto Janio Gonzalez

Gerardo Hermosillo

Joel Hernandez

Isidro Jimenez

Dioscoro Lopez

Pedro Lopez

Carlos Alberto Mojica

Sergio Muñoz

Sergio A. Navarro

Ramiro Ramirez

Joaquin Rivera

Table A1. Characteristics of Specialized Corporate Representative Farms

	DLCS350	DLCS1450	TORR300	TORR2000	QRT0350	QRT0600	QRT01200
Total Cropland	497	1483	272	1483	405	395	556
Acres Owned	124	1458	247	1483	405	395	556
Acres Leased	373	25	25	0	0	0	0
Pastureland	0	0	0	0	0	0	0
Acres Owned	0	0	0	0	0	0	0
Acres Leased	0	0	0	0	0	0	0
Assets (1,000)							
Total	1334	7512	1369	7925	2463	2750	4608
Real Estate	342	2634	510	2447	1624	1279	1862
Machinery	123	1006	119	270	117	146	166
Other & Livestock	869	3872	740	5208	722	1325	2580
Debt/Asset Ratios							
Total	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Intermediate	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Long Run	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1996 Livestock							
Dairy Cows	350	1450	300	2000	350	600	1200
Cwt Milk/cow	174	203	196	205	154	198	198
1996 Gross Receipts							
Total	951	4556	923	6254	826	1827	3655
Milk	870	4212	843	5874	774	1705	3411
	81.5%	86.8%	81.3%	93.9%	93.7%	93.3%	93.3%
Dairy Cattle	81	344	80	380	52	122	244
	8.5%	13.2%	8.7%	6.1%	6.3%	6.7%	6.7%
1996 Planted Acres	544	1779	339	2027	467	722	642
Hay	499	1482	302	1409	405	549	358
	91.7%	83.3%	89.1%	69.5%	86.7%	76.0%	55.8%
Silage	45	297	37	618	62	173	28.4
	7.3%	16.7%	10.9%	30.5%	13.3%	24.0%	44.2%

Table A2. Characteristics of Specialized Family and Tropical Representative Farms

	JAL40	JAL100	VCRZ25	VCRZ54	VCRZ100	CHPS60
Total Cropland	80	50	5	10	0	0
Acres Owned	30	50	5	10	0	0
Acres Leased	50	0	0	0	0	0
Pastureland	0	247	45	96	371	341
Acres Owned	0	247	45	96	371	341
Acres Leased	0	0	0	0	0	0
Assets (1,000)						
Total	186	383	64	143	270	171
Real Estate	93	250	36	76	205	134
Machinery	23	33	9	19	3	3
Other & Livestock	70	100	19	48	62	34
Debt/Asset Ratios						
Total	0.05	0.05	0.05	0.05	0.05	0.05
Intermediate	0.05	0.05	0.05	0.05	0.05	0.05
Long Run	0.05	0.05	0.05	0.05	0.05	0.05
1996 Livestock						
Dairy Cows	40	100	25	54	100	60
Cwt Milk/cow	130	96	35	40	10	38
1996 Gross Receipts						
Total	76	129	14	41	27	39
Milk	61	110	10	24	11	24
	80.3%	85.3	71.4%	58.5%	41.0%	61.0%
Dairy Cattle	15	19	4	17	16	15
	19.7%	14.7	28.6%	41.5%	59.0%	39.0%
1996 Planted Acres	117	50	5	10	0	0
Hay	32	50				
	29.0%	100.0				
Silage	0			5		
	0			50.0%		
Corn	64					
	58.0%					
Pasture	15					
	13.0%					
Tropical Forage			5	5		
			100.0%	50.0%		

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