# A COST COMPARISON OF COTTON GINS IN THE LOWER RIO GRANDE VALLEY WITH TAMAULIPAS, MEXICO

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## Abstract

The objective of this study was to compare the cost of cotton ginning in the Lower Rio Grande Valley of Texas with the cost of cotton ginning in Tamaulipas, Mexico. GINMODEL, an economic-engineering model, was used to simulate the representative gins from both regions.

The results of the study indicate that the costs per bale of cotton ginning in Tamaulipas are higher than in the Lower Rio Grande Valley. The two major reasons for the higher costs were due to lower ginning volumes and inefficient use of hourly labor in Mexico.

## Introduction

The pursuit of the North American Free Trade Agreement (NAFTA) has focused th. .:tention of many industries on their cost of production relative to Mexico and Canada. Cotton ginning is no exception.

President George Bush and Mexican President Carlos Salinas de Gortari and their respective trade negotiating teams started negotiations on a comprehensive free trade agreement between their two countries in 1990. NAFTA will produce a three country free trade area with a combined gross domestic product of $6 trillion, with over 360 million consumers and combined trade exceeding $1 trillion (Rosson, Davis, Angel and Segarra).

**Mexico**

Ginning infrastructure is important to producing a high volume of quality cotton fiber. As world consumption of cotton continues to rise, opportunities for building new infrastructure should stimulate capital movement across national boundaries.

> "Matamoros is one of the oldest cotton-producing areas in Mexico, and until the early 1960's was often the largest in terms of cotton land planted. This area lies in the state of Tamaulipas along the lower reaches of the Rio Grande. The problems of soil salinity, cotton diseases and insects have become more difficult to control each year, and cotton growers have been encouraged to change to other crops, particularly maize, wheat and sorghum"(Berger).

However, as in the United States, insect pressures forced cotton acreage to move West. Recent technological advancements have eliminated the boll weevil in much of the Southeastern U.S. and acreage is increasing in that part of the U.S.

The same could become true for Mexico. Three important reasons could cause this to occur: 1) Mexican cotton imports are growing because of a growing textile and apparel industry 2) the need for foreign exchange is high in Mexico. 3) new technologies in pest management may increase the possibility of cotton production in the state of Tamaulipas.

Cotton acreage in Mexico tends to be much more variable than in the U.S. because of the lack of government programs that help stabilize prices. Wide swings in acreage significantly hinder the opportunities to invest in capital-intensive, modern gin plants. Other cotton handling infrastructure has been neglected because of production variability.

The area chosen for this study was once Mexico's largest area of cotton acreage and could again become a major producing region. Acreage shifted from this area to western Mexico because the bollworm became resistant to the chemical controls of the in the 1960's and early 1970's. Current concerns over water, grain production, price, marketing structure and capital are major constraints to cotton production in Tamaulipas, Mexico.

## Objectives

The objectives of this study were:

- To compare the cost of ginning cotton in the Lower Rio Grande Valley of Texas with the state of Tamaulipas, Mexico.
- Describe similarities and differences in the cotton ginning systems of the State of Tamaulipas and the Lower Rio Grande Valley of Texas.
- Improve the knowledge of simulating cotton gins in other countries using GINMODEL

## Methodology

GINMODEL was the selected simulation tool used to accomplish the objectives of this research. The model was chosen because it has, over time, been successfully used in many studies involving the simulation of cotton gins. Furthermore, the model is very comprehensive and allows for many "what if" scenarios to be simulated. GINMODEL incorporates the use of a very detailed data set, collected from a gin, into a string of equations which represent the economic-engineering functions of a cotton gin (Schotman).

## Data and Area Studied

The data were collected through interviews and questionnaires. The questionnaire used was an altered version of the question set generated by the Texas A&M personal computer version of GINMODEL. Questions were rearranged or deleted to aid in flow as the gin manager preceded through the questions. Also an attempt was made to add an explanation to certain questions for clarification purposes. The questionnaire was translated into Spanish for use in Mexico. After translation, the document was reviewed by Mexican gin managers to further clarify and correct any translation errors.

The Lower Rio Grande Valley of Texas consists of Hidalgo, Willacy, Cameron and Starr counties. During the 1993 cotton ginning season the four counties had

29 of 31 gins operating (South Texas AGRINEWS). Across the border, Tamaulipas has as many as 26 gins statewide with as many as 19 in the Northern regions of the state. During the 1993 season only four of the 19 were in operation. The gins in southern Tamaulipas will not operate until December.

Seven U.S. gins agreed to fill out the questionnaire with four returning it. Four Mexican gins were sent questionnaires; two were returned. The method used in approaching a gin was to make initial contact by telephone. If they agreed to cooperate, the questionnaire was hand delivered. In some cases, we filled out the questionnaire together, otherwise it was returned by mail. If no response was received by a given date a follow-up call was made.

A conversion rate of 3.111 peso to the dollar was used. This is the rate posted in the *Wall Street Journal* as of the close of trading on Friday, October 22, 1993. The questionnaire was categorized by sub-headings:

- Operating Costs
- Personnel
- Capital Requirements
- Transportation.

The operating costs section provides the most important data--the number of bales ginned for the season, and the ginning efficiency. These two numbers are used repeatedly throughout the model and are the basis for the results.

The U.S. gins normally have a 30-45 day ginning season with most of the days being two shifts of twelve hours each. Normal operation in both countries is seven days per week at 24 hours per day. However, from observation and interviews with the Mexican gin managers the Mexican gins did not operate on this schedule during the 1993 season. Both of the Mexican gins operated one 12 hour shift, 6 or 7 days a week.

One unique aspect of the region on both sides of the boarder is that there is not much time spent operating on half shifts. The season usually starts with the gin operating around the clock until the ginning for the season is completed. This is especially true with the U.S. gins for two reasons: 1) the cotton must be harvested in order to meet the stalk plow up date, and 2) the cotton harvest is rushed because of the onset of hurricane season. These two factors lead to a rushed harvest and one where the gin can start with little time and money wasted paying crews while the gin is idle.

Repair costs were covered in the questionnaire. USA2 did not respond to this question so the average found for the Oklahoma-Texas region of $5.42 was used (Mayfield). While averages can be misleading, this assumption may be less misleading than assuming no cost at all.

Electricity rate structures and billing plans affect the cost of ginning significantly according to power consumption. Choosing the right plan is an important cost cutting avenue. In addition, when comparing two areas it is important to understand the rate structure so that the total charge will be clear and accurate. The U.S. power company offered a choice of two rate structures:

1. A flat rate of $.0790/KWH
2. Alternate plan:
    a. Demand Charge: $15.63/ KW of billing demand but no less than $78.15.
    b. Energy charge: $.0145 / KWH for all KWH used
    c. Fuel adjustment charge: $.01959418/KWH for all KWH used
    d. Gross receipts charge: Sum (a,b,c)x.0176671.

According to Central Power and Light a gin must be running a least 8 hours per day to benefit from the alternate plan. Since all gins do run more than 8 hours per day the plan was used for the study.

The Mexican billing structure was very similar to that of U.S. The firm pays a demand charge of $7.42/ KW and $.0436/ KWH for all KWH consumed. In addition, the gin manager must estimate the amount of electricity needed for the season and sign a contract for this amount with the power company. When the contract is signed, a deposit is paid. The deposits were not disclosed and were not included in the modeling. The $.0436/KWH Mexican energy charge is equivalent to the U.S. energy and fuel adjustment charge combined.

GINMODEL was written for the use of rate blocks, however in both regions studied rate blocks are not used. Therefore, the same price was used for each block.

**Results**

The following reports results from the simulation analysis of the costs excluding depreciation for the gins. The costs of the gins will be evaluated and compared under each of the following scenarios:

- Actual cost of gin operations
- Hypothetical simulation using optimal number of operating hours and the actual labor efficiency (Scenario A)
- Hypothetical simulation using optimal number of operating hours and industry standards for labor use (Scenario B).

Within each of the above scenarios each of the five gins will be evaluated on a cost per bale basis for:

- Total costs;
- Management costs;
- Hourly Labor costs.

The total costs from each gin do not represent total cost because they exclude depreciation, insurance, property taxes and other non-salary fixed costs. However, this partial total cost will be referred to as total costs. When referring to a specific cost, the name of each cost will be given. Although GINMODEL allows for the calculation of the costs excluded from total costs, an adequate set of data for these costs where not attained through the questionnaire. One of the biggest limitations to the accurate use of GINMODEL is the need for the large amount of detailed input data required, as well as making accurate decisions about the gin plant's physical and economic relationships (Shaw, 1978). Given the limitations of the data, total cost, while not all inclusive, will contain variable costs, fixed labor and management costs, fixed working capital interest and miscellaneous fixed costs.

While it might be expected that labor costs in Mexico are lower that in the U.S., this is not necessarily the case. The hourly wage of the seasonal Mexican worker is $1.40/hour to $2.00/hour compared to $4.25/hour to as high as $7.50/hour in the

U.S. Mexican gins have as many as two and one-half times the number of seasonal workers as U.S. gins. While none of the representative gins operates at 900 to 1000 hours per season, the Mexican gins had far more excess capacity than the Rio Grande Valley gins. The Mexican gin managers, cotton classers and extension personnel suggested that 5,000 bales per year is required for Mexican gins to operate profitability. With 5,000 bales per year Mexican gin plants would probably operate as much as 100 days given that they ran about 35 days in 1993 and averaged around 1,600 bales per gin.

The initial comparison (referred to as Actual) of the gins is made using the actual data collected from the gins. As was expected, the Mexican gins have a higher cost per bale than do the U.S. gins. The total costs, management and labor cost combined and separate are shown in figures 1-4. in dollars per bale. There are potentially many reasons for the differences shown. As indicated in the literature, as the bale volume goes down the costs per bale increase (Anthony and Mayfield) The low number of bales ginned by the Mexican firms is the major reason for the higher per unit costs which can be seen in Figure 1.

Another major point is the management. The Mexican management is reportedly new and inexperienced by U.S. standards because cotton acreage in Tamaulipas has been low for almost 25 years. One owner employs experienced managers from Torreon to operate Tamaulipas plants. To further illustrate the point of management and the volume of ginning, notice in Figure 2 that the cost per bale for management is higher for both Mexican gins. Although employee salaries are lower in Mexico, management cost is higher in Mexico. These higher cost are primarily caused from the managers fixed salary being spread across low ginning volumes. The manager of MEX1 had a salary of $8,036/year and the manager of MEX2 had a salary of $23,144/year compared to the lowest U.S. management salary of $29,000/year.

One of the major concerns when discussing Mexico is the cost of labor. It might appear that Mexico has a labor cost advantage when comparing the $1.70 per hour wage rate to the $5-8 per hour wage rate for U.S. gin labor. However, when put on a per bale cost basis the disparity narrows (Figure 3). USA2 does have a higher per bale cost, but both Mexican gins are higher than USA1 and USA3.

The higher labor costs comes from the larger number of people employed at the Mexican gins. Vandergriff suggests, bales per employee per season is key to labor efficiency. MEX1 ginned 52 bales/ hourly employee and MEX2 ginned 74 bales/ hourly employee. The U.S. gins had a considerably higher ratio of bales/hourly employee with: USA1 ginned 633 bales/hourly employee; USA2 ginned 536 bales/hourly employee and USA3 ginned 1,999 bales/hourly employee.

In addition to having higher numbers of employees, Mexican gins typically pay employees for more hours while the gin is idle than are their U.S. counterparts. The older more labor intensive gins have greater need for additional workers. As an example of more intensive labor needs, both Mexican gins in this study accept no less than 80% of their cotton in modules. However, neither gin has a module feeder, and crews manually disassemble the modules and use manual suction tubes to feed the gin. The total cost of employment can be seen in Figure 4.

Scenario A is an simulation of the five gins at optimum ginning levels. For the U.S. gins, 906 hours per season is considered optimal (Shaw, 1984).

> "Gin plant capacity utilization is the ratio of actual bales ginned in a season to a computed seasonal capacity. Computed seasonal capacity in the hourly ginning rate (or engineered hourly ginning rate) times a set number of operating hours. For example, a gin rated at 10 bales per hour would have a computed seasonal capacity of 9,060 (906 x 10), if it processed 5,000 bales in a season, the percent of ginning capacity utilized would be 55 (5000/9060) x 100 for a capacity utilization rate of 55 percent."(Shaw, 1984)

Excess capacity in the Lower Rio Grande Valley is one reason for such low operating hours depicted in the gins studied.

MEX1 was set for optimal operation at 5,004 bales and MEX2 was set at 5,025 bales for the season. Mexican ginners and extension specialists suggested that 5,000 bales per season would be optimal. These bale levels equate to 417 and 625 operating hours per season for MEX1 and MEX2, respectively. The model allows for operating hours and ginning efficiency to be plugged into the model, hence the bales ginned under this scenario are not precisely 5,000 bales. The small increments above 5,000 are from rounding in the formula.

Scenario B reflects the use of U.S. industry standard labor efficiencies combined with the optimal hours of operation. The minimum fixed seasonal crew hours were set at 25% of the operating hours and the expected non-processing hours for the season were set at 13.5% of the total operating hours. Figures 5 and 6 show the comparisons of the total costs for each gin under scenarios A and B. USA1 represents a gin under the actual state , then the A designation (i.e USA1A) is the gin costs per bale at the optimal operating rate. The B designation (i.e. UAS1B) is each gin with optimal operating hours and industry standard labor use efficiencies (Wolfe, Cleveland, Stennis, Slay).

## Summary and Conclusions

An economic-engineering simulation of cotton ginning costs were made using GINMODEL. Each of the five gins will be evaluated under 3 different scenarios.

By analyzing these three scenarios, differences in actual costs were identified and explained. Within the context of each individual gin, the other two scenarios show how each gin's capacity and labor efficiencies compare to the industry standards.

### Conclusions

The gins in the Lower Rio Grande Valley operated at a lower cost per bale in the 1993 season. The lower costs are primarily due to the larger volumes ginned. Additionally, the U. S. gins use seasonal labor more effectively. However, no gin ran at what is considered to the be the optimal number of hours of operation.

Mexican gins require higher volumes to become more cost efficient. More efficient use of the inexpensive labor could result in cost reductions for the Mexican gins.

Even though management salaries were lower in Mexico that in the United States, the per bale costs were higher in Mexico. This is mainly due to the lower volumes ginned by the Mexican gins.

Hourly workers for cotton gins in Mexico are paid $1.40 to $1.80/hour compared to a range of 4.25 to $8/hour in United States. However, this lower hourly rate does not necessarily coincide with lower per bale costs for labor. Two factors contribute to this: 1) Mexican gins have considerable more hourly employees than the Lower Rio Grande Valley gins. 2) The labor at Mexican gins is paid for many more hours while the gin idle than is the hourly labor in the Lower Rio Grande Valley.

**Implications**

The results of this study reveal no immediate threat to the Lower Rio Grande Valley cotton ginning industry from the ginning industry in Tamaulipas, Mexico. However, with adjustments to the domestic cotton program in Mexico, more efficient use of labor and more experienced management, cotton ginning efficiency could improve in Mexico and additional cotton production in Tamaulipas could then occur.

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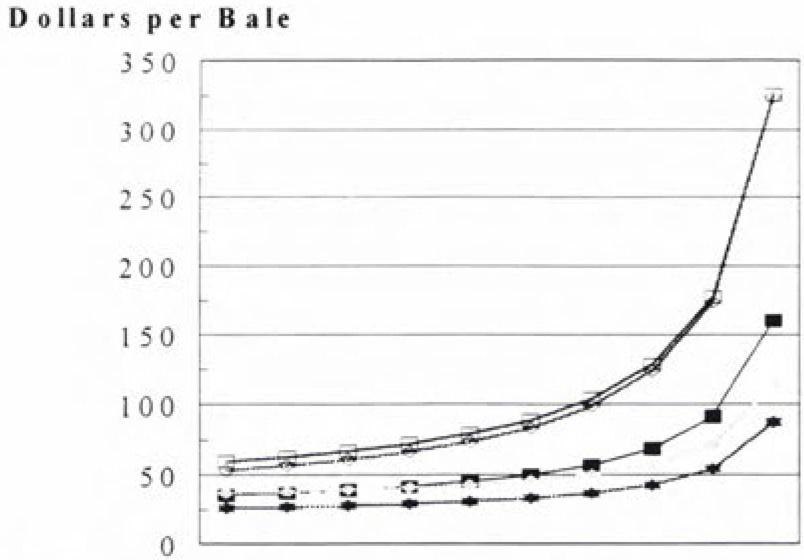



| Percent Utilization | 100 | 90 | 80 | 70 | 60 | 50 | 40 | 30 | 20 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| USA1 | 35.12 | 36.74 | 38.77 | 41.38 | 44.85 | 49.72 | 57.02 | 68.56 | 91.50 | 160.32 |
| USA2 | 36.84 | 37.84 | 39.09 | 40.70 | 42.84 | 45.83 | 50.32 | 57.81 | 72.25 | 113.85 |
| USA3 | 25.97 | 26.75 | 27.74 | 29.00 | 30.69 | 33.06 | 36.59 | 42.49 | 54.27 | 87.63 |
| MEX1 | 59.52 | 62.83 | 66.94 | 72.22 | 79.25 | 89.11 | 103.88 | 128.52 | 177.78 | 325.56 |
| MEX2 | 53.41 | 56.78 | 60.99 | 66.41 | 73.61 | 83.62 | 98.65 | 123.69 | 173.78 | 324.04 |

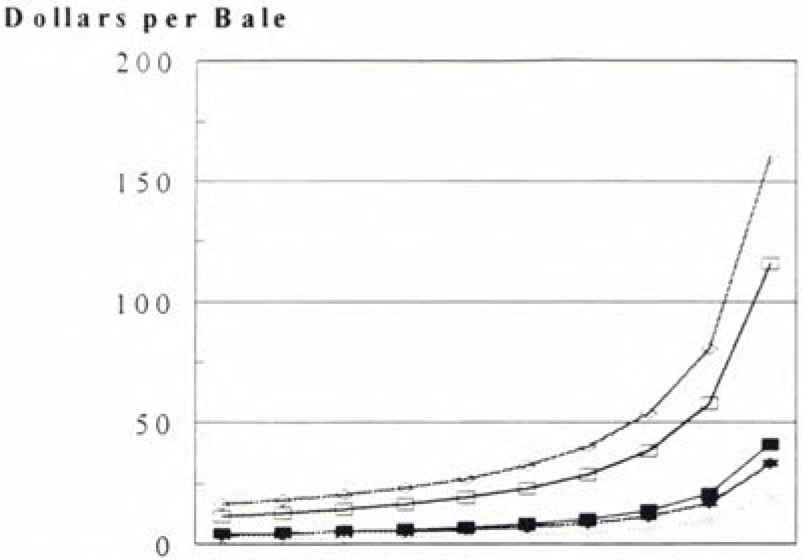
Figure 1. Total per bale costs for each gin studied at selected utilization rates, 1993 ginning season.

[1] Percent utilization = (rated ginning capacity x percentage of rated capacity obtained during the season) x (number of operating hours)

[2] 100 percent utilization is the cost based on the actual volume ginned by each respective gin.

[3] Each ten percent increment is a simulated reduction in volume.

[4] Costs do not include depreciation, taxes, insurance or interest on long term capital.



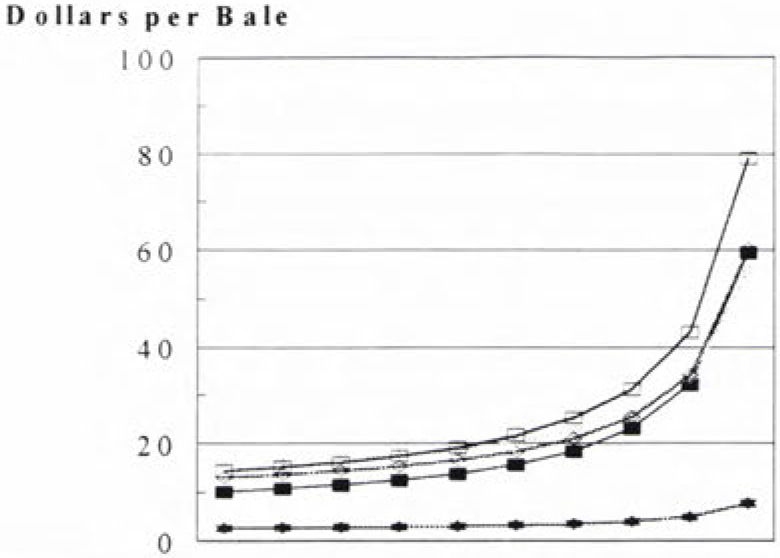

| Percent Utilization | 100 | 90 | 80 | 70 | 60 | 50 | 40 | 30 | 20 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| USA1 | 4.12 | 4.58 | 5.15 | 5.89 | 6.87 | 8.24 | 10.30 | 13.74 | 20.61 | 41.21 |
| USA2 | 1.93 | 2.15 | 2.42 | 2.76 | 3.22 | 3.87 | 4.84 | 6.45 | 9.67 | 19.34 |
| USA3 | 3.78 | 4.15 | 5.60 | 5.19 | 5.97 | 7.06 | 8.71 | 11.44 | 16.91 | 33.32 |
| MEX1 | 11.56 | 12.85 | 14.45 | 16.52 | 19.27 | 23.12 | 28.91 | 38.54 | 57.81 | 115.62 |
| MEX2 | 16.43 | 18.25 | 20.47 | 23.33 | 27.13 | 32.46 | 40.46 | 53.79 | 80.44 | 160.40 |

Figure 2. Management per bale costs for each gin studied at selected utilization rates, 1993 ginning season.

[1] Percent utilization = (rated ginning capacity x percentage of rated capacity obtained during the season) x (number of operating hours)

[2] 100 percent utilization is the cost based on the actual volume ginned by each respective gin.

[3] Each ten percent increment is a simulated reduction in volume.



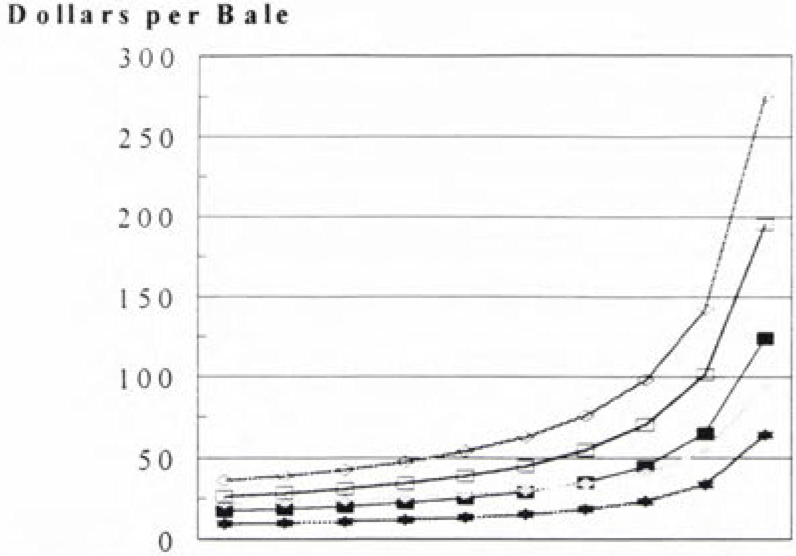

| Percent Utilization | 100 | 90 | 80 | 70 | 60 | 50 | 40 | 30 | 20 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| USA1 | 10.12 | 10.73 | 11.49 | 12.47 | 13.78 | 15.60 | 18.34 | 22.91 | 32.05 | 59.46 |
| USA2 | 15.79 | 16.29 | 16.91 | 17.71 | 18.77 | 20.26 | 22.49 | 26.22 | 33.66 | 56.00 |
| USA3 | 2.74 | 2.80 | 2.88 | 2.98 | 3.11 | 3.29 | 3.57 | 4.03 | 4.96 | 7.74 |
| MEX1 | 14.36 | 15.16 | 16.16 | 17.44 | 19.15 | 21.55 | 25.15 | 31.14 | 43.14 | 79.11 |
| MEX2 | 13.11 | 13.69 | 14.42 | 15.36 | 16.61 | 18.35 | 20.98 | 25.35 | 34.09 | 60.31 |

Figure 3. Hourly wage per bale costs for each gin studied at selected utilization rates, 1993 ginning season.

[1] Percent utilization = (rated ginning capacity x percentage of rated capacity obtained during the season) x (number of operating hours)

[2] 100 percent utilization is the cost based on the actual volume ginned by each respective gin.

[3] Each ten percent increment is a simulated reduction in volume.



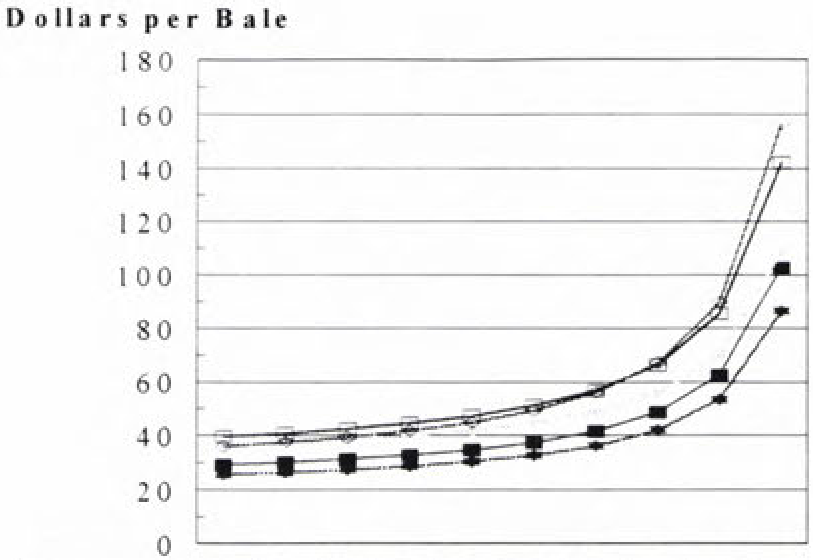

| Per Cent Utilization | 100 | 90 | 80 | 70 | 60 | 50 | 40 | 30 | 20 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| USA1 | 17.20 | 18.52 | 20.17 | 22.30 | 25.13 | 29.09 | 35.03 | 44.93 | 64.73 | 124.13 |
| USA2 | 22.08 | 22.98 | 24.09 | 25.53 | 27.45 | 30.13 | 34.15 | 40.86 | 54.27 | 94.51 |
| USA3 | 9.45 | 10.12 | 10.96 | 12.04 | 13.49 | 15.51 | 18.54 | 23.59 | 33.69 | 63.99 |
| MEX1 | 26.38 | 28.47 | 31.08 | 34.44 | 38.91 | 45.18 | 54.57 | 70.24 | 101.56 | 195.54 |
| MEX2 | 36.07 | 39.02 | 42.71 | 47.46 | 53.79 | 62.65 | 75.94 | 98.09 | 142.40 | 275.31 |

Figure 4. Total wage and salary per bale costs for each gin studied at selected utilization rates, 1993 ginning season.

[1] Percent utilization = (rated ginning capacity x percentage of rated capacity obtained during the season) x (number of operating hours)

[2] 100 percent utilization is the cost based on the actual volume ginned by each respective gin.

[3] Each ten percent increment is a simulated reduction in volume.




| Percent Utilization | 100 | 90 | 80 | 70 | 60 | 50 | 40 | 30 | 20 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| USA1A | 28.93 | 29.87 | 31.04 | 32.54 | 34.54 | 37.34 | 41.55 | 48.56 | 62.58 | 102.52 |
| USA2A | 36.27 | 37.20 | 38.37 | 39.87 | 41.88 | 44.68 | 48.89 | 55.90 | 69.67 | 108.69 |
| USA3A | 25.64 | 26.42 | 27.39 | 28.65 | 30.32 | 32.66 | 36.17 | 42.03 | 53.46 | 86.39 |
| MEX1A | 39.63 | 40.91 | 42.50 | 44.56 | 47.30 | 51.14 | 56.90 | 66.45 | 85.40 | 142.25 |
| MEX2A | 35.94 | 37.44 | 39.31 | 41.71 | 44.91 | 49.40 | 56.13 | 67.34 | 89.68 | 156.47 |

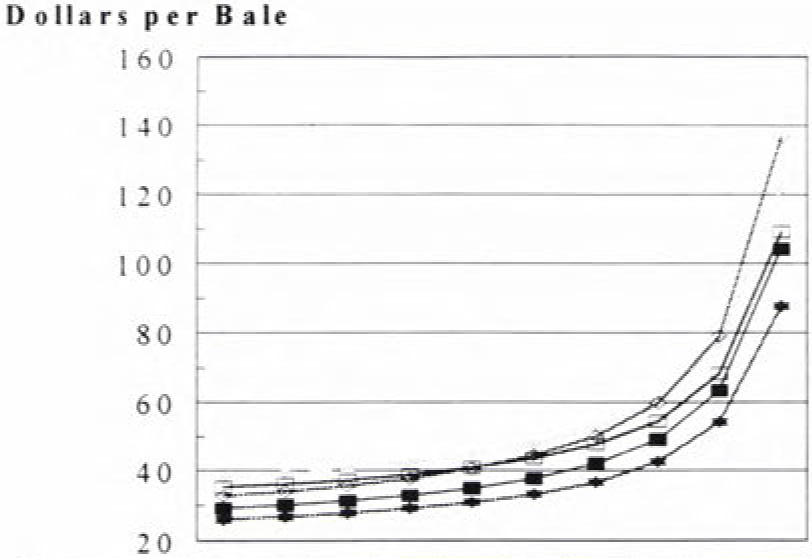
Figure 5. Total per bale costs for each gin studied at selected utilization rates, 1993 ginning season (Scenario A).

[1] Scenario A represent gin operation at 906 hours per season for USA gins and 5,000 bales for Mexican gins.

[2] Percent utilization = (rated ginning capacity x percentage of rated capacity obtained during the season) x (number of operating hours)

[3] Each ten percent increment is a simulated reduction in volume.

[4] Costs do not include depreciation, taxes, insurance or interest on long term capital.




| Percent Utilization | 100 | 90 | 80 | 70 | 60 | 50 | 40 | 30 | 20 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| USA1B | 29.03 | 29.98 | 31.18 | 32.71 | 34.76 | 37.62 | 41.91 | 49.07 | 63.36 | 104.14 |
| USA2B | 38.06 | 39.12 | 40.66 | 42.18 | 44.47 | 47.67 | 52.48 | 60.50 | 76.49 | 121.65 |
| USA3B | 25.97 | 26.75 | 27.74 | 29.00 | 30.69 | 33.06 | 36.59 | 42.49 | 54.27 | 87.63 |
| MEX1B | 35.15 | 36.08 | 37.24 | 38.73 | 40.72 | 43.51 | 47.67 | 54.50 | 68.17 | 109.16 |
| MEX2B | 32.72 | 34.01 | 35.63 | 37.70 | 40.47 | 44.35 | 50.16 | 59.85 | 79.05 | 136.65 |

Figure 6. Total per bale costs for each gin studied at selected utilization rates, 1993 ginning season (Scenario B).

[1] Scenario B represents gin operation at 906 hours per season for USA gins and 5,000 bales for Mexican gins combined with industry labor efficiencies.

[2] Percent utilization = (rated ginning capacity x percentage of rated capacity obtained during the season) x (number of operating hours)

[3] Each ten percent increment is a simulated reduction in volume.

[4] Costs do not include depreciation, taxes, insurance or interest on long term capital.