

**STANDARDIZED PERFORMANCE ANALYSIS  
OF COTTON PRODUCTION: INITIAL RESULTS  
FROM THE TEXAS HIGH PLAINS**

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**Abstract**

Standardized Performance Analysis (SPA) is a management tool designed to assist producers with farm and ranch financial and production analysis. The SPA methodology consolidates farm financial statements and production information for an integrated production and financial performance analysis of a total farming operation. Preliminary field testing of a prototype crop SPA program is currently being conducted in the Texas High Plains. A set of 35 observations from eight farming entities for the 1995 crop year includes dryland and irrigated cotton. Results from the preliminary study show a unit cost of production of 73 cents per pound on irrigated cotton production and 70 cents per pound on dryland cotton production. Research efforts for 1997 will include an expansion of the base of participants and the development of a more comprehensive data base of results.

**Introduction**

Standardized Performance Analysis (SPA) is a management tool designed to enable farmers to determine the financial and production performance of their total operation and specific enterprises within their operation. SPA uses information that the farmer has readily available - production, financial and marketing information - to calculate the cost of production, return on assets, and other useful indicators of profitability. By integrating SPA with the record keeping system that the producers already use, they will be better able to meet their business and marketing objectives and identify possible changes in their operation that may lead to improved performance.

The original SPA methodology was developed in conjunction with a producer advisory committee in response to the National Cattlemen's Association request for a management tool that would help their producers improve performance (National Cattlemen's Association). The goal was to help cattle producers identify areas in which they could make improvements within their operations in order to increase profits and manage their operations more efficiently. In addition, the use of this standardized analysis

has provided a meaningful data base of production and financial information for cow/calf producers. For the first time, producers were able to make meaningful comparisons to producers of different regions, different sizes, and different management and marketing styles. These comparisons are standardized across the industry, making comparisons more meaningful.

After the usefulness of the cow/calf SPA program was realized in providing management information to cow/calf producers and developing a useful data base of actual farm level financial and production results, there developed an interest in expanding the program for operations other than cow/calf operations. With changes in farm programs for cotton and other crops quickly becoming a reality, the development of a crop SPA became a logical step to provide better management information for farms in Texas.

**Development of SPA in Texas**

The Texas State Support Committee and Cotton Incorporated assisted in providing funding for a research project to develop a SPA program for crop production. The Department of Agricultural and Applied Economics at Texas Tech University and the Texas Agricultural Extension Service have begun development and testing of a crop SPA program. With the high concentration of cotton production in the Texas High Plains (THP), this region was selected to begin the field testing of the SPA methodology for crop production. An advisory committee was formed in early 1996 to provide input into the development of the new SPA program. The committee consisted of THP farmers, economists from both Texas Tech University and the Texas Agricultural Extension Service, county extension agents, extension production specialists, agricultural lenders, and accountants. The crop SPA software package was developed after much input from the SPA Advisory Committee. A prototype software titled Standardized Performance Analysis - Multiple Enterprise (SPA-ME) incorporates sufficient information to run a single analysis on a farming operation that contains both crop and livestock enterprises (McGrann and Michalke).

The SPA-ME program facilitates the development of accrual adjusted total farm financial statements of an operation. All accounting and financial statement reconciliation in the SPA-ME program follows the recommendations of the Farm Financial Standards Council (Farm Financial Standards Council). After reconciling the financial statements for the entire operation, the program then allows the user to allocate all financial statements first to an enterprise, usually a crop type, and then to a sub-enterprise, usually a particular farm or field. Table 1 illustrates the enterprise and sub-enterprise set up for SPA-ME. The producer specifies the crop and livestock enterprises that are being analyzed. The enterprises must then be designated as sale or intermediate products. Finally the enterprises are divided into sub-enterprises for the

operation. The SPA-ME program reports data for both the enterprises and the sub-enterprises specified on the operation. Sub-enterprises usually represent different farms or fields. This allows an individual to look at the total performance of a specific crop on a specific farm and identify any problem areas or any exceptional performers.

The SPA-ME program produces a summary table of investment, financial, and economic information for each enterprise and sub-enterprise, as shown in Table 2 (the information shown represents a sample observation and not an actual observation from the study). The SPA Summary lists the production information for the total crop. This includes the crop type and production per acre for the particular enterprise or sub-enterprise. In addition, the SPA Summary shows the investment along with the financial and economic performance. The investment information is broken down into balance sheet formats for both a cost and market valuation basis. The financial and economic performance is then listed in both dollars per pound and dollars per acre. This enables the producer to make comparisons on a per acre and per pound basis not only among his different enterprises and sub-enterprises, but also to the data base. In addition, the SPA report also calculates the return on equity and the equity-to-asset ratios on a cost and market basis. Finally, the program calculates the unit cost of production or break-even price. This unit cost of production is adjusted for the non-primary product revenue, such as government payments and crop insurance proceeds. Thus, this break-even price represents the price that the producer must receive for the primary product to cover total costs less any non-primary revenues.

The SPA-ME program is being field tested in the Texas High Plains Region (Figure 1). Emphasis in this region has been primarily on farms with cotton production due to cotton's large impact on the THP economy and the diversity of THP cotton farms. The information gathered in this testing phase is being used to assist in adapting the SPA methodology to farming operations with crop and livestock production.

Participants in the SPA project have provided production records and financial information, such as balance sheets and income statements, relating to the 1995 crop year. Currently, there have been 35 completed analyses for cotton production from eight separate farming entities. Along with cotton, there have been other crops analyzed as well as livestock operations. However, this report will focus only on dryland and irrigated cotton production in the Texas High Plains.

### **Preliminary Financial, Economic, and Production Analysis**

The SPA methodology allows for financial, economic, and production analysis of an enterprise. The financial analysis

is based on the accrual adjusted financial statements that the SPA-ME program produces. The economic analysis includes all financial costs plus the opportunity cost of capital invested in real estate and non real estate assets as well as a cash lease equivalent for owned land. The results contained in this report are primarily from the financial analysis.

### **Production Information**

The SPA analysis provides information for the comparison of differing production and marketing practices. Information is gathered relating to inputs such as seeding rates, fertilizer, herbicides, and insecticides. Additional information is obtained on tillage and irrigation practices. This information is entered into specialized production programs: Cotton Standardized Performance Analysis - Production (McGrann, Green, Michalke) and Grain Standardized Performance Analysis - Production (McGrann, Green, Michalke). The use of these programs will facilitate the development of a data base with production related information in addition to the financial information.

The limited number of observations from completed analyses reveal similar production practices. Therefore, the reporting of production information is limited in this report. Most of the operations in this set of observations are operated as sole proprietorships, with most of the land being leased under crop share agreements. Table 3 shows observation size and cotton yield information for the observations included in this report. Yields per acre for the irrigated observations was 370 pounds compared to 158 pounds for the dryland observations.

### **Marketing Information**

The majority of the THP cotton producers participating in the SPA project market their cotton crop through the Plains Cotton Cooperative Association (PCCA) Marketing Pool. By using the marketing pool, producers are no longer responsible for directly marketing their product. Producers are paid on the quality of each bale in the same way that they would be had they marketed the cotton themselves. Farmers are paid an initial advance payment for the crop and receive progress payments throughout the following year as the pool cotton is marketed.

### **Income Statement Analysis**

Tables 4 and 5 summarize the income measures for dryland and irrigated cotton farms included in this study. One factor of importance is the amount of government payments and crop insurance proceeds to the average THP farm. Almost 18% of dryland cotton gross accrual revenue and 7% of irrigated cotton gross accrual revenue were comprised of these two payments. Government payments alone represent 7.8% and 4.8% of gross accrual revenues to dryland and irrigated cotton farms, respectively. Therefore, government payments appear to be a more significant source of revenue for dryland cotton farms versus irrigated cotton farms.

Farmers who rely heavily on these two sources of revenue may need to adjust some management and marketing practices as farm program payments are reduced under the Federal Agricultural Improvement and Reform Act of 1996.

Other revenue sources that are important to THP cotton farms include hedging income, interest income, and cooperative distributions that can be traced directly to the cotton operations. These items appear to be as important a source of revenue as governments payments and crop insurance proceeds. These sources of revenue contribute almost 8% of total revenue to dryland cotton farms and almost 4% to irrigated cotton farms. Thus, these sources of other revenue are financially beneficial to the THP cotton operations as a whole.

The cost analysis of THP cotton operations shows that irrigated cotton farms had cash expenses of \$186/ac compared to \$88/ac for dryland cotton farms. Cash expenses for irrigated farms are higher due to irrigation and associated expenses. In addition to cash expenses, irrigated farms have higher per acre cost on such items as owner labor and management (family living withdrawals as it is more commonly known) and interest expense. However, depreciation expense is only \$1.69/ac higher on irrigated cotton farms compared to dryland cotton farms.

The data indicate that 16% to 22% of total costs per acre for both dryland and irrigated farming systems can be attributed to owner labor and management. Traditionally, most producers do not view owner labor and management as a true cost of production. Owner labor and management expense is included for the sole proprietorship so that a comparison can be made to corporations or partnerships that pay owner labor as a salary expense. Another consideration for the inclusion of owner labor and management expense in the total cost of production is that the compensation of owner labor and management is a necessary expense that will be paid if the farm is the major source of family income.

The data also show more borrowing and debt financing among irrigated cotton farms than among dryland cotton farms. This is shown by the interest cost to the operations and confirmed in the respective balance sheets (Tables 6 and 7). Irrigated cotton farms pay an average of \$12.08/ac in interest expense compared to \$2.16/ac for dryland cotton farms.

Comparisons of net income from the observations contained in the data show that the average net income for dryland cotton farms is \$11.05/ac and \$0.005/lb compared to -\$0.56/ac and -\$0.075/lb for irrigated cotton farms. However, dryland cotton farms have a greater variability in net income, which may be attributed to more uncertain growing conditions when compared to irrigated cotton farms. In 1995, dryland and irrigated cotton production in

the THP was subject to adverse weather conditions that greatly affected total production.

The total unit cost-of-production on a per pound basis for dryland cotton production was \$0.70/lb, with average cotton lint production of 158 lbs/ac. For irrigated cotton production, the total unit cost-of-production on a per pound basis was \$0.73/lb, with average cotton lint production of 370 lbs/ac. The per pound cost-of-production may be greatly influenced by the yield level. This is indicated in the range of \$0.26/lb to \$2.68/lb for dryland cotton production and \$0.26/lb to \$1.21/lb for irrigated cotton production.

### **Balance Sheet and Profitability Measures**

The balance sheet and profitability measures for irrigated and dryland cotton production are given in Tables 6 and 7.

These tables present the balance sheet and profitability measures on both a cost valuation and market valuation basis. The following discussion focuses on the cost basis.

Investment in the two farming systems varies dramatically across operations. On average, the investment per acre for irrigated cotton farms is 41% higher compared to dryland cotton farms. However, average liabilities per acre are over twice the amount for dryland operations. Thus, irrigated cotton farmers appear to be debt financing much more of their investment than dryland cotton farmers. Also, this added debt financing increases the total interest expense of the operation as previously discussed. Total owner equity on irrigated cotton farms is 27% lower compared to dryland cotton farms.

Financial ratio analysis shows that the equity-to-asset ratio is 36.81% for irrigated cotton farms and 66.33% for dryland cotton farms. The lower equity-to-asset ratio for irrigated cotton farms implies that these farms are investing less equity in assets compared to dryland cotton farms. In addition, the equity-to-asset ratio below 50% on the irrigated cotton farms is an indication that lenders have more invested in the business than the owner. The debt-to-equity ratios (leverage ratios) reveal once again that irrigated farms on the average are debt financing a larger portion of their operation. Irrigated cotton farms have \$1.72 of debt for every dollar in equity, while dryland cotton farms have \$0.51. This ratio implies that for irrigated cotton farms, lenders have more invested in the operation than the farmer. On the other hand, dryland cotton farms have more invested in their operations than their lenders. The relative use of debt by irrigated and dryland cotton farms is consistent with expectations when relative production risks are considered.

Two measures of profitability calculated by SPA-ME are return on assets (ROA) and return on equity (ROE). A comparison of the ROA ratio and the ROE ratio shows that ROE is less than ROA for both irrigated and dryland farms, meaning that these farms are paying more interest on borrowed money than is earned by borrowing this money. This indicates a potential long-run problem for producers if

this relationship continues over a period of years. Averages appear to indicate that producers may need to reconsider the use of debt to finance their operations. However, when comparing ROA to ROE, information for more than one crop year should be used if available. Comparisons based on only one crop year may not reflect the long-run relationship between debt and profitability. Additionally, the use of a larger group of historical data can help to insure that comparisons of profitability measures reflect the true financial picture of the farm and not an extreme observation.

### **Deferred Tax Liabilities**

Balance sheet comparisons based on the cost valuation basis ignore the importance of deferred income tax liabilities. Deferred income taxes are of two types: current and non-current. Current deferred taxes represent a tax liability on the sale of current assets held in inventory and will be accrued upon the sale of these assets. Non-current deferred taxes represent a contingent tax liability that would result from capital gains on the liquidation of non-current assets. It is assumed that the balance sheets reflect this true market value and that assets are not overvalued.

Many producers do not recognize the importance of deferred tax liability. The SPA-ME program estimates deferred taxes on current and non-current assets in the balance sheet and makes the necessary accrual adjustments to the income statement. The inclusion of deferred taxes gives the farm owner a more accurate estimate of owner equity. However, many producers do not make a distinction between a cost and market value of assets on the balance sheet. The operations that do not make a distinction between these values do not have a concise estimate of net worth. In this set of observations, deferred taxes account for 25% to 100% of total liabilities for those entities that distinguished between cost and market valuation of assets.

### **Summary**

A prototype SPA program is currently being field tested on cotton farms in the Texas High Plains (THP) region to adapt SPA methodology to crop production. SPA is a management tool designed to assist producers in financial, economic, and production analysis of their farm and ranch operations. The initial field testing was conducted using information for the 1995 crop year. A set of 35 cotton observations from eight farming entities has been produced using the SPA-ME program. Preliminary results show that the SPA-ME program produces useful financial management information for producers. Continued analysis of a farming operation over several crop years will produce more meaningful results for the user of the SPA-ME program. The program also provides useful management information to help farmers in financial and production management decisions.

Valuable comparisons of dryland and irrigated cotton farms have been obtained in the initial study from the THP. From a production standpoint irrigated cotton farms tend to have substantially higher yields per acre compared to dryland cotton farms, 370 lbs and 158 lbs, respectively. There are also important differences with respect to income items across the irrigated and dryland cotton farms in the region. The average price per pound received was higher on dryland cotton farms compared to irrigated cotton farms, \$0.66/lb and \$0.68/lb, respectively. Average cost per pound on dryland cotton farms was \$0.14/lb higher compared to irrigated cotton farms despite the fact that irrigated cotton farms had higher interest expense and non-cash costs than dryland cotton farms. However, dryland cotton farms tended to have higher owner labor and management per pound, but less on a per acre basis compared to irrigated cotton farms.

The irrigated cotton farms are more highly leveraged than the dryland cotton farms in the THP. For the 1995 crop year, debt financing was not used profitably by dryland or irrigated cotton farms as indicated by a comparison of ROA and ROE. With regard to profitability, dryland cotton farms returned a net farm income of \$11.05/ac, while irrigated cotton farms returned a net farm income of -\$0.56/ac.

### **Limitations**

The results reported are from eight cooperating producers and include only 1995 crop data. The expansion of the SPA analysis to larger groups of participants will improve the aggregated information and results of the analysis. In addition, there may be some selection bias in the reported observations due to the process used to select the first group of participants.

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Table 1. Enterprise Selection for Standardized Performance Analysis<sup>1</sup>

Name	Type	Product Type	Sub-Ent
Dryland Cotton	Sale	Sale	Farm East
Irrigated Cotton	Sale	Sale	Farm East
Wheat	Grazing	Intermediate	Farm West
Livestock	Cow/Calf	Sale	Farm West

<sup>1</sup>The SPA-ME Program allows the user to define 10 enterprises. Enterprise refers to crop type or livestock. The user may define up to fifteen sub-enterprises in the analysis. Sub-enterprises consist of the farm or field number or description.

Table 2. SPA Investment, Financial & Economic Summary

Sample 1995 Dryland Enterprise Fiscal Year: 1995		
<b>PRODUCTION SUMMARY</b>		
Primary Product: Cotton Lint	Secondary Product: Cotton Seed	
Units: Pounds	Units: Pounds	
Units Per Acre: 100.00	Units Per Acre: 166.000	
<b>INVESTMENT PER ACRE (Average Asset Values)</b>		
	<b>Cost Basis \$/Acre</b>	<b>Market Value \$/Acre</b>
Total Current Assets	\$ 89	\$ 90
Non-Current Assets		
Livestock		
Machinery & Equip	\$ 71	\$105
Land/ Improvements	\$114	\$154
Other Assets	\$ 41	\$ 36
Total Investment	\$315	\$385
Current liabilities	\$ 45	\$ 46
Non-Current Liabilities	\$ 60	\$ 71
Total Liabilities	\$105	\$117
Equity to Asset or Percent Equity (%)	66.33%	69.81%

**FINANCIAL PERFORMANCE**

	<b>Financial \$/Acre</b>	<b>\$/Pounds*</b>
Gross Accrual Revenue	\$151	\$0.957
Primary Product	\$112	\$0.683
Non-Primary Product**	\$ 39	\$0.274
Secondary Product	\$ 0	\$0.000
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Total Cash Costs	\$120	\$0.834
Total Non-cash Costs	\$ 20	\$0.144
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Gross Accrual Revenue	\$151	\$0.984
Total Operating Cost	\$140	\$0.977
Total Financing Cost and Economic Return	\$ 2	\$0.012
Total Cost***	\$140	\$0.977
Net Income****	\$ 11	\$0.005

Percent return on Enterprise Assets (ROA)

Cost Basis	- 5%
Market Value	- 4%

**UNIT COST OF PRIMARY PRODUCT**

Total Non-Primary Product Revenue	\$0.274
Unit Cost of Production*****	\$0.703

\* Based on number of units of primary product sold plus inventory adjustments.

\*\* Non-primary product revenue includes government payments.

\*\*\* These are pre-tax costs; thus they do not include income tax payments. Withdrawals are included in the cost calculations.

\*\*\*\* The net income is pre-tax income, but is not equal to IRS taxable income.

\*\*\*\*\* Adjusted for non-primary product revenue.

**Table 3. Production Information from Texas High Plains Observations**

	Dryland		
	High	Low	Average
Acres per Observation	1003	11	309
Lint Yield per Acre	293	92	158
	Irrigated		
	High	Low	Average
Acres per Observation	308	53	133
Lint Yield per Acre	582	195	371

**Table 4. Income Measures - Dryland Cotton**

	\$/Acre		
	High	Low	Avg.
Gross Accrual Revenue	318.85	81.40	151.32
Primary Product Sales	273.05	60.27	112.49
Government Payments	35.95	0	11.68
Crop Insurance Proceeds	40.13	0	15.17
Other Revenue*	39.26	- 4.19	11.85
Total Operating Cost	362.94	73.97	140.02
Cash Operating Expense	226.49	52.80	87.99
Depreciation	34.36	6.46	20.74
Non-cash Costs**	3.36	- 6.20	- 1.23
Interest Expense	23.73	0	2.16
Owner labor and management	92.25	13.22	30.26
Net Income	103.27	-231.35	11.05
	\$/Pound		
	High	Low	Avg.
Gross Accrual Revenue	1.78	.61	.98
Primary Product Sales	1.53	.46	.68
Government Payments	.36	0	.09
Crop Insurance Proceeds	.25	0	.11
Other Revenue*	.22	- .04	.07
Total Operating Cost	2.91	.45	.98
Cash Operating Expense	2.01	.20	.62
Depreciation	.31	.04	.15
Non-cash Costs**	.03	- .06	-.01
Interest Expense	.12	0	.01
Owner labor and management	.56	.08	.20
Net Income	.46	- 2.06	.01
<b>Unit Cost of Production***</b>	<b>2.68</b>	<b>.26</b>	<b>.70</b>

\* Other revenue includes cooperative distributions, interest income, hedging income, etc.

\*\* Includes only accrual adjustments

\*\*\* Adjusted for non-primary product revenue

**Table 5. Income Measures - Irrigated Cotton**

	\$/Acre		
	High	Low	Avg.
Gross Accrual Revenue	358.71	169.89	271.58
Primary Product Sales	353.01	121.19	242.70
Government Payments	22.07	3.67	13.17
Crop Insurance Proceeds	14.10	0	5.50
Other Revenue*	28.09	- 18.64	10.42
Total Operating Cost	382.30	174.11	272.14
Cash Operating Expense	263.16	136.16	185.68
Depreciation	29.56	11.45	22.43
Non-cash Costs**	31.90	- .30	9.23
Interest Expense	27.55	0	12.08
Owner labor and management	73.38	23.80	42.71
Net Income	181.28	-92.72	-.56
	\$/Pound		
	High	Low	Avg.
Gross Accrual Revenue	.97	.61	.76
Primary Product Sales	.79	.54	.66
Government Payments	.08	.01	.04
Crop Insurance Proceeds	.07	0	.02
Other Revenue*	.13	- .04	.05
Total Operating Cost	1.42	.31	.84
Cash Operating Expense	.87	.24	.56
Depreciation	.12	.02	.07
Non-cash Costs**	.07	0	.02
Interest Expense	.07	0	.03
Owner labor and management	.36	.04	.15
Net Income	.43	- .45	-.08
<b>Unit Cost of Production***</b>	<b>1.21</b>	<b>.26</b>	<b>.73</b>

\* Other revenue includes cooperative distributions, interest income, hedging income, etc.

\*\* Includes only accrual adjustments

\*\*\* Adjusted for non-primary product revenue

**Table 6. Balance Sheet and Performance Measures - Dryland Cotton**

	Cost Basis (\$/Acre)		
	High	Low	Avg.
Total Investment	606	0	314.52
Current Assets	163	15	88.76
Machinery/Equipment	150	0	70.76
Land/Improvements	390	0	113.66
Other Non-current Assets	83	0	41.33
Total Liabilities	363	0	105.90
Current Liabilities	184	0	45.43
Non-current Liabilities	180	0	60.48
Total Owner Equity	511	- 83	208.62
Equity/Asset or % Equity			66.33%
Debt/Equity Ratio			50.76%
Return on Assets			- 5%
Return on Equity			- 9%

	Market Basis (\$/Acre)		
	High	Low	Avg.
Total Investment	1296	126	385.81
Current Assets	163	15	90.38
Machinery/Equipment	175	55	104.90
Land/Improvements	913	0	154.43
Other Non-current Assets	83	0	36.43
Total Liabilities	396	0	116.48
Current Liabilities	184	0	45.66
Non-current Liabilities	224	0	70.86
Total Owner Equity	1201	0	269.33
Equity/Asset or % Equity			69.81%
Debt/Equity Ratio			43.25%
Return on Assets			- 4%
Return on Equity			- 7%

**Note:** All ratios are based on average balance sheet values.

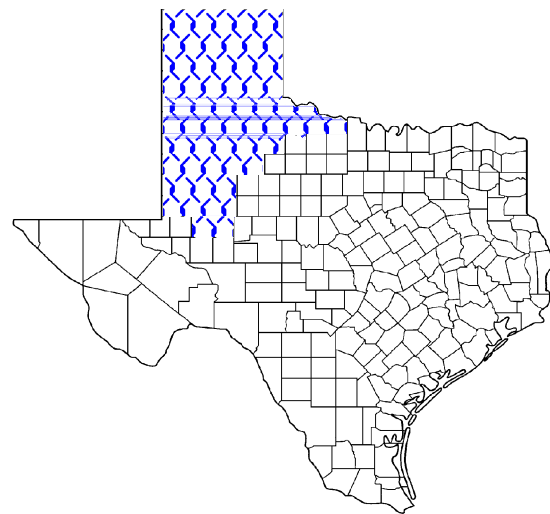
**Table 7. Balance Sheet and Performance Measures - Irrigated Cotton**

	Cost Basis (\$/Acre)		
	High	Low	Avg.
Total Investment	706	255	445.00
Current Assets	218	148	190.71
Machinery/Equipment	209	14	101.64
Land/Improvements	285	0	61.29
Other Non-current Assets	190	29	91.43
Total Liabilities	1337	71	281.21
Current Liabilities	149	6	75.50
Non-current Liabilities	1331	2	205.71
Total Owner Equity	444	- 631	163.79
Equity/Asset or % Equity			36.81%
Debt/Equity Ratio			171.69%
Return on Assets			- 7%
Return on Equity			- 26%

	Market Basis (\$/Acre)		
	High	Low	Avg.
Total Investment	778	320	504.29
Current Assets	251	160	202.43
Machinery/Equipment	209	99	146.86
Land/Improvements	285	0	61.29
Other Non-current Assets	224	29	91.50
Total Liabilities	1337	88	300.86
Current Liabilities	149	6	79.79
Non-current Liabilities	1331	19	220.93
Total Owner Equity	508	- 631	203.43
Equity/Asset or % Equity			40.34%
Debt/Equity Ratio			147.89%
Return on Assets			- 6%
Return on Equity			- 21%

**Note:** All ratios are based on average balance sheet values.



**Figure 1.** Texas High Plains Region