

4. Efficiency of No-Till Production in Central Kansas

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Abstract/Summary

This presentation will compare the efficiency and profitability of no-till and tillage farms in Central Kansas. Efficiency and profitability will be compared using both enterprise and whole-farm data.

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Introduction

There are many changes taking place in production agriculture. One of the changes taking place is the adoption of no-till production systems. Along with the adoption of no-till, there have been some shifts in crop acreage on Kansas farms. These shifts have occurred for a variety of reasons that might include or be related to cost efficiencies, economies of size, labor availability, crop prices, technological advances, improved crop hybrids, and/or conservation practices.

This paper has two primary objectives. The first objective is to examine changes in acreage that have occurred in Kansas and more specifically central Kansas from 1990 to 2009. The second objective is to quantify efficiency and financial performance gains associated with the adoption of no-till production systems. To accomplish the second objective, comparisons were made between central Kansas no-till and mixed tillage farms.

Crop Acreage Trends

There have been some interesting recent trends concerning crop acres across Kansas. The traditional landscape of Kansas crop acres has changed dramatically in some areas of the state with relatively more acres being planted to both corn and soybeans. While the number of acres devoted to corn and soybeans has increased, the number of acres planted to grain sorghum and wheat has decreased. Wheat is still the most widely planted crop in Kansas, but there seems to be change taking place in agricultural landscape of Kansas.

Table 1 quantifies the acreage shifts that have occurred over the last 20 years in Kansas regarding the four major cash grain crops. In 2009, there were 3.86 million acres of corn

harvested in Kansas. On an annualized basis, corn acres have been increasing at a rate of 4.48 percent since 1990. This is the most dramatic increase from a percentage standpoint of the four crops. From 1990 to 1994, an average of 1.74 million corn acres was harvested each year in Kansas. From 2005-2009, an average of 3.52 million acres of corn was harvested, more than doubling over that time period. Soybean acreage has also grown at a fairly rapid pace over the last 20 years. Soybean acres grew at a rate of 3.04 percent annually from 1990 to 2009. It is important to note, that double crop soybeans have been an increasingly popular crop in Kansas, especially in the eastern one-third of Kansas over the last few years. The acreage reported in Table 1 includes all soybean acres. Therefore, double crop soybeans are included in the harvested acres.

While corn and soybean acres increased from 1990-2009, wheat and grain sorghum acres trended downward over the same time period. On an annualized basis, grain sorghum acres have been decreasing at a rate of 1.01 percent since 1990. The trend in grain sorghum acres from 1990 to 2009 changed midway through the time period. Though grain sorghum acres trended downward over the whole 20-year time period, grain sorghum acres actually trended upward at an annual rate of 2 percent from 1990-2001.

Kansas has traditionally been called the “Wheat State” for the simple fact that the state has traditionally planted substantially more wheat than any other state. Even though this remains true, the number of acres devoted each year to wheat in Kansas is decreasing. From 1990-2009, winter wheat acres decreased annually at a rate of 1.54%. From 1990-1994, an average of 11.2 million acres of wheat was harvested each year. The average harvested wheat acres dropped to 8.98 million from 2005-2009.

In 2009, corn and soybean acres combined for a total of 7.51 million harvested acres. There were 8.8 million acres of wheat harvested in 2009. If the trends in the respective crops continue the total combined corn and soybean harvested acres will essentially equal harvested wheat acres in 2012.

The data above illustrated acreage trends for the state of Kansas. This paper is primarily interested in central Kansas. KFMA data for farms with continuous data from 1990 to 2009 is used to illustrate trends in crop acres in central Kansas over the last 20 years. In 1990, the average central KFMA farm had 1,068 crop acres which consisted of 581 acres of wheat, 177 acres of grain sorghum, 83 acres of hay, 55 acres of soybeans, 43 acres of corn, and 28 acres of silage. In 2000, the average central KFMA farm had 1,262 crop acres which consisted of 607 acres of wheat, 270 acres of grain sorghum, 130 acres of soybeans, 82 acres of hay, 79 acres of corn, and 14 acres of silage. In 2009, the average central KFMA farm had 1,364 crop acres which consisted of 672 acres of wheat, 237 acres of soybeans, 199 acres of grain sorghum, 139 acres of corn, 98 acres of hay, and 14 acres of silage.

Because the size of an average KFMA farm has increased over time, it is difficult to identify crop acreage trends for a specific crop by simply observing trends in acreage on an acre per farm basis. Another way to identify crop acreage trends is to calculate individual crop acres per farm as a percentage of total acres. A summary of this data can be seen in Table 2.

Unlike that for the state of Kansas, wheat acres for the average farm did not decline over the last 20 years. However, the trend in the growth of wheat acres was much lower than the trend in corn and soybean acres. The trend in acres for the average central KFMA farm from 1990 to 2009 for corn, grain sorghum, soybeans, and wheat were 5.63 percent, 0.71 percent, 8.39 percent, and 1.13 percent, respectively. It is important to note that over this time period, crop

acres increased 1.35 percent per year and harvested acres increased 2.01 percent per year. Thus, the growth in grain sorghum and wheat acres was below the growth in both crop and harvested acres. It is also important to note that the percentage of crop acres devoted to other crops including hay and silage has decreased over time from around 20% in 1990 to 9% in 2009.

Table 2 also includes data concerning cropping intensity. Cropping intensity is calculated by dividing harvested acres by initial crop acres. Increases in double crop soybean acres is the primary driving force behind increased cropping intensity on central Kansas farms. Until 2007 cropping intensity was less than 100%, only recently has the cropping intensity increased to the point that more crop acres are being harvested than what the producer initially owns or operates.

Why has the acreage for corn and soybeans increased over the last couple of decades? Though relative prices were obviously important, another factor is related to changes in tillage practices. Specifically, reduced tillage and no-till production systems have enabled producers to more readily conserve moisture and grow these crops. Given the increase in these tillage practices, it is important to examine the relative cost efficiency and financial performance of farms with different tillage systems.

Data and Methods

The data were obtained from the Kansas Farm Management Association (KFMA) databank. Information pertaining to the variables available in the KFMA databank can be found in Langemeier (2003) and on the KFMA web site (KFMA, 2010). To be included in this study, a farm had to have continuous data from 2005 to 2009 and be located in central Kansas. Specialized livestock farms were also excluded from the analysis. Economists working with KFMA farms in central Kansas have been designating farms as no-till or mixed tillage for the

last several years. Thus, this study focused on this region of Kansas. To be designated as a no-till farm, a farm had to utilize a no-till production system for all of their crops.

On average, the farms had a value of farm production of \$365,038 and a net farm income of \$81,469. Average crop and total acres were 1,845 and 1,401, respectively. Approximately 86 percent of the farm operators' time allocated to the farm operation was devoted to producing crops. Of the 365 farms, 85 farms were designated as no-till farms. On average, 49 percent, 23 percent, and 16 percent of the crop acres were devoted to wheat, feed grains, and oilseeds, respectively. Crop intensity was computed by dividing total harvested acres by total crop acres and averaged 1.02. A relatively higher crop intensity index indicates that a farm or group of farms utilizes double crop production systems to a greater extent.

Several financial ratios and crop financial benchmarks were computed and compared between mixed tillage and no-till farms. Labor efficiency and productivity were measured by dividing total labor cost (includes hired as well as unpaid family and operator labor cost) by value of farm production, and by dividing value of farm production by the number of workers (includes hired and family workers, and unpaid operators). The average labor efficiency ratio was 16.1 percent. The average labor productivity measure was \$266,958. The operating profit margin ratio was computed by adding interest and subtracting unpaid family and operator labor from net farm income and dividing the result by value of farm production. The average operating profit margin ratio was 0.1427 or 14.27 percent. Approximately 27 percent of the farms had an operating profit margin ratio below zero. The asset turnover ratio was computed by dividing value of farm production by total farm assets. The average asset turnover ratio was 0.3604. The economic total expense is computed by dividing total economic expense (accrual expenses plus unpaid family and operator labor plus opportunity charge on net worth) by value

of farm production. If this ratio is below one, a farm or group of farms is earning an economic profit. The average economic total expense ratio was 1.06. Approximately 28 percent of the farms were earning an economic profit.

Crop machinery investment and crop machinery cost per acre are commonly used crop financial benchmarks used by KFMA members. Crop machinery investment represents the average investment in machinery and equipment used to produce crops. The average value for crop machinery investment per acre was \$151.11. Crop machinery cost includes the crop share of repairs, gas, depreciation, machine hire, and the interest charge on machinery investment. The average crop machinery cost per acre was \$64.21. Gross crop value, which represents both the operator's and landlord's share of production, averaged \$280.62 per acre.

Results

Table 3 presents a comparison of farm size, crop acreage, financial performance, and crop financial benchmarks between no-till farms and mixed tillage farms using all 365 farms. All of the variables were significantly different between the two groups of farms except for machinery investment per acre and the percent of labor devoted to crop production. The no-till farms tended to be larger, had a lower percent of crop acres planted to wheat, had a higher percent of acres planted to feed grains and oilseeds, had higher financial performance, had a higher gross crop value per acre, and had a lower crop machinery cost per acre. The operating profit margin ratio was 0.1861 for the no-till farms and 0.1232 for the mixed tillage farms. Moreover, the percentage of no-till farms with a negative operating profit margin ratio (13 percent) was substantially lower than the percentage of mixed tillage farms with a negative operating profit margin ratio (31 percent). The economic total expense ratio for the no-till farms,

0.987, was approximately 10 percent lower than the economic total expense ratio for the mixed tillage farms.

It is important to note that there are large differences in the economic total expense ratio between farms within the no-till and the mixed tillage categories. Figure 1 illustrates the economic total expense ratio for each farm. The red line represents the average ratio for the sample of the farms. Obviously, there are mixed tillage farms with below average per unit costs as well as no-till farms with above average per unit costs.

Because the no-till farms are substantially larger than the mixed tillage farms, it is interesting to also compare no-till and mixed tillage farms excluding smaller farms. Table 4 presents these comparisons for all of the farms with average value of farm production above \$100,000 from 2005 to 2009 while table 5 presents the comparisons for all farms with average value of farm production above \$500,000 from 2005 to 2009. The results presented in table 4 are similar to those presented in table 3. In contrast, the results presented in table 5 are vastly different than the results in tables 3 and 4. The only variables that were not significantly different between the two groups of farms in table 4 were the asset turnover ratio, machinery investment per acre, and the percent of labor devoted to crop production. The only variables that were significantly different between the two groups of farms in table 5 were the crop intensity index, the percent of crop acres planted to oilseeds, the economic total expense ratio, and machinery cost per crop acre. The economic total expense ratio for the no-till farms with an average value of farm production above \$500,000 at 0.936 was approximately 7 percent lower than the economic total expense ratio for the mixed tillage farms with an average value of farm production above \$500,000. At a value of farm production of \$850,000, this difference in the

economic total expense ratio would translate into a difference of approximately \$60,000 in total economic cost.

It is also noteworthy from the results in table 5 that the no-till farms were more efficient in utilizing labor and had higher operating profit margin and asset turnover ratios. However, these variables were not significantly different between the two groups of farms.

The results in table 5 strongly suggest that economies of size are extremely important in explaining financial performance differences. Once economies of size are accounted for, as in table 5, the difference in financial performance between no-till and mixed tillage farms is not markedly different. This does not mean that the adoption of no-till production will not improve financial performance. It just means that doing so is not a panacea.

Conclusions

The objective of this study was to examine the relative cost efficiency and financial performance of no-till farms in central Kansas. Data for KFMA farms that have adopted a no-till system and for KFMA farms with a mixed tillage system were utilized. Using all farms with continuous data from 2005 to 2009, the no-till farms were found to be larger, to utilize wheat less and feed grain grains and oilseeds more, and to have higher financial performance. However, it is very important to note that after accounting for farm size, the differences between the two groups of farms was much smaller. This result suggests that economies of size are extremely important in explaining differences among farms.

Results of this study have implications on the future adoption of no-till production systems. Though the financial performance between the no-till and mixed tillage farms was not markedly different after accounting for farm size, it was evident that a no-till production system increases crop mix flexibility and crop intensity. The no-till farms in central Kansas have used

the no-till production system to add feed grains and/or oilseeds to their rotations. It is also important to note that no-till is a relatively new technology. As cost efficiencies in no-till production systems improve over time, there may be additional cost advantages associated with no-till. No-till farms are also more likely to use double cropping which allows producers to increase farm size in terms of value of farm production without increasing land base. Even though labor efficiency gains for no-till farms were not statistically prevalent in this study, it may still be advantageous for producers to adopt a no-till production system. By adding oilseeds and feed grains to their rotation, a producer should theoretically be able to spread labor over different harvest and planting seasons. On farms where labor availability is an issue, or off farm employment is a factor, no-till systems may be an attractive alternative. In summary, the combination of lower per unit costs and added crop mix flexibility will certainly attract the attention of farms that currently have conventional or reduced tillage systems.

References

Kansas Farm Management Association web site, www.agmanager.info/kfma, accessed on August 13, 2010.

Langemeier, M. "Kansas Farm Management Association SAS Data Bank Documentation." Staff Paper No. 03-02, Department of Agricultural Economics, Kansas State University, June 2003.

United States Department of Agriculture, National Agricultural Statistical Service, www.nass.usda.gov, accessed on August 13, 2010.

Figure 1. Economic Total Expense Ratio

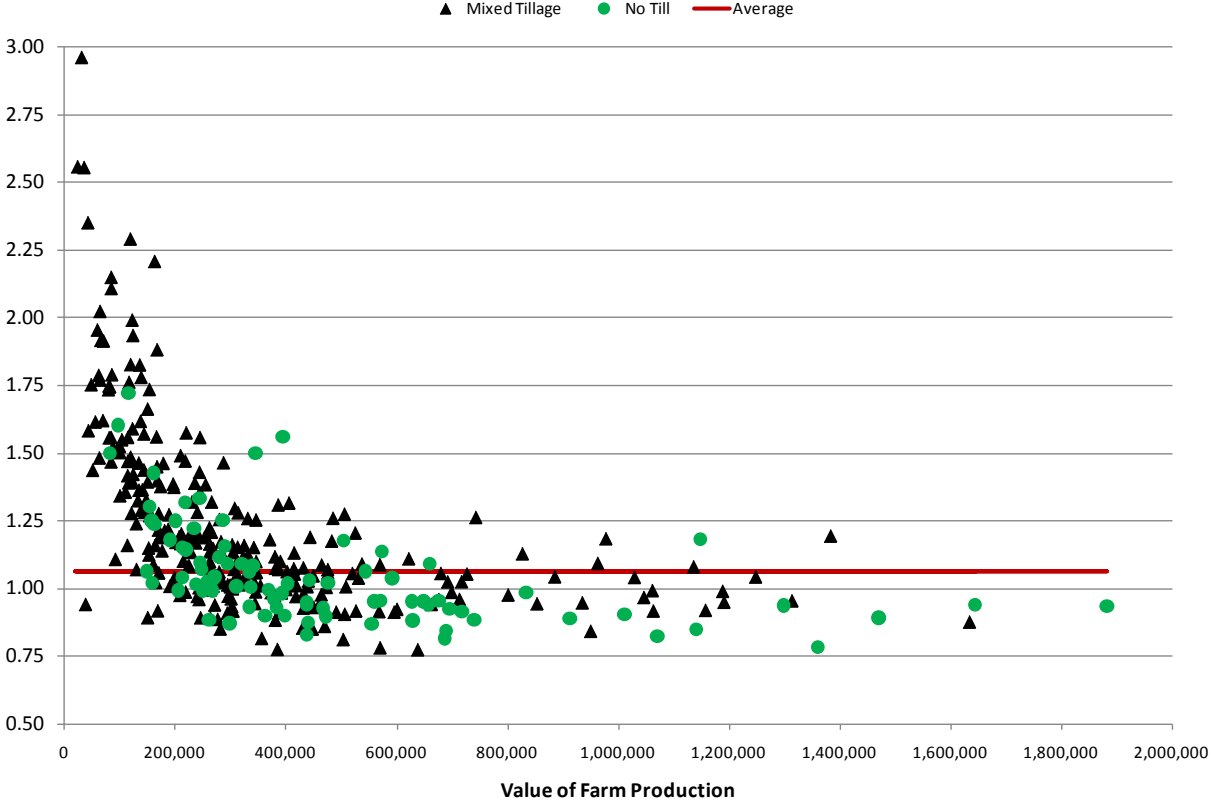


Table 1. Harvested Crop Acres in Kansas, 1990 to 2009.^a

Year	Corn	Grain Sorghum	Soybeans	Wheat ^b
1990	1,450,000	2,800,000	1,950,000	11,800,000
1991	1,650,000	3,150,000	1,900,000	11,000,000
1992	1,730,000	3,050,000	1,850,000	10,700,000
1993	1,800,000	2,800,000	1,900,000	11,100,000
1994	2,100,000	3,000,000	2,100,000	11,400,000
1995	1,970,000	3,100,000	2,050,000	11,000,000
1996	2,350,000	4,600,000	2,000,000	8,800,000
1997	2,600,000	3,400,000	2,350,000	10,900,000
1998	2,850,000	3,300,000	2,500,000	10,100,000
1999	2,980,000	3,400,000	2,800,000	9,200,000
2000	3,170,000	3,200,000	2,500,000	9,400,000
2001	3,050,000	3,750,000	2,730,000	8,200,000
2002	2,600,000	3,000,000	2,540,000	8,200,000
2003	2,500,000	2,900,000	2,480,000	10,000,000
2004	2,880,000	2,900,000	2,710,000	8,500,000
2005	3,450,000	2,600,000	2,850,000	9,500,000
2006	3,000,000	2,500,000	3,080,000	9,100,000
2007	3,680,000	2,650,000	2,610,000	8,600,000
2008	3,630,000	2,750,000	3,250,000	8,900,000
2009	3,860,000	2,550,000	3,650,000	8,800,000
Trend	4.48%	-1.01%	3.04%	-1.54%

^a Source: National Agricultural Statistical Service.

^b Wheat acres represent year in which crop was harvested.

Table 2. Central Kansas Crop Mix and Crop Intensity, 1990 to 2009.^a

Year	% Corn	% Grain Sorghum	% Soybeans	% Wheat	% Other Crops	Crop Intensity
1990	4.0%	16.6%	5.1%	54.4%	19.9%	91.8%
1991	4.6%	17.3%	4.5%	49.9%	23.7%	86.6%
1992	4.8%	18.7%	3.8%	53.2%	19.5%	89.7%
1993	4.8%	18.4%	4.4%	54.1%	18.3%	90.9%
1994	5.3%	18.7%	5.3%	52.8%	17.8%	91.6%
1995	4.4%	19.7%	5.1%	54.7%	16.1%	93.1%
1996	5.2%	25.2%	5.4%	51.6%	12.6%	96.9%
1997	5.2%	23.4%	7.2%	49.5%	14.7%	95.5%
1998	5.9%	21.7%	9.1%	50.0%	13.4%	95.6%
1999	6.1%	22.0%	10.6%	46.0%	15.3%	94.4%
2000	6.3%	21.4%	10.3%	48.1%	13.9%	96.0%
2001	7.9%	20.3%	11.0%	45.5%	15.3%	95.3%
2002	7.2%	21.1%	9.7%	48.7%	13.3%	97.9%
2003	6.9%	21.4%	8.8%	49.4%	13.5%	96.3%
2004	7.0%	20.8%	10.4%	50.4%	11.3%	98.5%
2005	8.6%	19.5%	10.2%	50.2%	11.5%	98.2%
2006	7.6%	16.4%	12.5%	51.1%	12.4%	99.3%
2007	7.9%	15.9%	12.5%	56.0%	7.7%	101.2%
2008	9.2%	16.2%	14.6%	52.9%	7.1%	101.7%
2009	10.2%	14.6%	17.4%	49.3%	8.6%	100.8%

^a Source: Kansas Farm Management Association Databank, 1990-2009

Table 3. Characteristics of No-Till and Mixed Tillage Farms in Central Kansas, All Farms.^a

Item	No-Till Farms	Mixed Tillage Farms	Significantly Different
Number of Farms	85	280	
Total Acres	2,213	1,734	yes
Crop Acres	1,724	1,303	yes
Harvested Acres	1,840	1,304	yes
Crop Intensity Index	1.067	1.001	yes
Percent of Crop Acres Planted to Wheat	41.94%	52.65%	yes
Percent of Crop Acres Planted to Feed Grains	30.63%	23.25%	yes
Percent of Crop Acres Planted to Oilseeds	23.84%	13.20%	yes
Value of Farm Production (VFP)	\$485,682	\$328,414	yes
Net Farm Income (NFI)	\$121,743	\$69,244	yes
Labor Cost as a Percent of VFP	13.80%	17.07%	yes
Value of Farm Production per Worker	\$309,549	\$251,466	yes
Economic Total Expense Ratio (ETER)	0.987	1.098	yes
Percent of Farms with ETER less than 1.000	48.24%	22.50%	yes
Operating Profit Margin Ratio	0.1861	0.1232	yes
Percent of Farms with Negative Profit Margin	12.94%	31.07%	yes
Percent of Farms with Above Average Profit Margin	60.00%	38.21%	yes
Asset Turnover Ratio	0.4284	0.3365	yes
Gross Crop Value per Acre	\$303.87	\$271.18	yes
Machinery Investment per Crop Acre	\$150.06	\$151.47	no
Machinery Cost per Crop Acre	\$57.25	\$66.98	yes
Percent of Labor Devoted to Crop Production	86.54%	85.81%	no

^a Source: Kansas Farm Management Association Databank, 2005-2009.

Table 4. Characteristics of No-Till and Mixed Tillage Farms in Central Kansas, Farms with VFP Greater than \$100,000.^a

Item	No-Till Farms	Mixed Tillage Farms	Significantly Different
Number of Farms	83	246	
Total Acres	2,245	1,884	yes
Crop Acres	1,756	1,428	yes
Harvested Acres	1,875	1,435	yes
Crop Intensity Index	1.068	1.005	yes
Percent of Crop Acres Planted to Wheat	42.03%	52.52%	yes
Percent of Crop Acres Planted to Feed Grains	30.64%	23.74%	yes
Percent of Crop Acres Planted to Oilseeds	23.86%	13.38%	yes
Value of Farm Production (VFP)	\$495,226	\$364,796	yes
Net Farm Income (NFI)	\$124,807	\$78,043	yes
Labor Cost as a Percent of VFP	13.69%	16.27%	yes
Value of Farm Production per Worker	\$312,052	\$265,499	yes
Economic Total Expense Ratio (ETER)	0.984	1.080	yes
Percent of Farms with ETER less than 1.000	49.40%	25.20%	yes
Operating Profit Margin Ratio	0.1880	0.1343	yes
Percent of Farms with Negative Profit Margin	10.84%	23.17%	yes
Percent of Farms with Above Average Profit Margin	61.45%	42.68%	yes
Asset Turnover Ratio	0.4296	0.3458	no
Gross Crop Value per Acre	\$304.18	\$274.43	yes
Machinery Investment per Crop Acre	\$149.89	\$152.19	no
Machinery Cost per Crop Acre	\$57.10	\$67.22	yes
Percent of Labor Devoted to Crop Production	86.99%	86.25%	no

^a Source: Kansas Farm Management Association Databank, 2005-2009.

Table 5. Characteristics of No-Till and Mixed Tillage Farms in Central Kansas, Farms with VFP Greater than \$500,000.^a

Item	No-Till Farms	Mixed Tillage Farms	Significantly Different
Number of Farms	29	45	
Total Acres	3,304	3,292	no
Crop Acres	2,738	2,769	no
Harvested Acres	3,021	2,832	no
Crop Intensity Index	1.103	1.023	yes
Percent of Crop Acres Planted to Wheat	43.24%	48.75%	no
Percent of Crop Acres Planted to Feed Grains	31.45%	29.40%	no
Percent of Crop Acres Planted to Oilseeds	26.63%	15.17%	yes
Value of Farm Production (VFP)	\$865,130	\$816,455	no
Net Farm Income (NFI)	\$217,177	\$158,998	no
Labor Cost as a Percent of VFP	11.60%	12.05%	no
Value of Farm Production per Worker	\$381,283	\$365,304	no
Economic Total Expense Ratio (ETER)	0.936	1.003	yes
Percent of Farms with ETER less than 1.000	79.31%	53.33%	no
Operating Profit Margin Ratio	0.2116	0.1735	no
Percent of Farms with Negative Profit Margin	3.44%	0.00%	no
Percent of Farms with Above Average Profit Margin	79.31%	73.33%	no
Asset Turnover Ratio	0.4972	0.4104	no
Gross Crop Value per Acre	\$333.85	\$319.55	no
Machinery Investment per Crop Acre	\$169.08	\$174.33	no
Machinery Cost per Crop Acre	\$59.68	\$73.76	yes
Percent of Labor Devoted to Crop Production	91.54%	88.34%	no

^a Source: Kansas Farm Management Association Databank, 2005-2009.