The Effects of Sex-Sorted Semen on Southern Dairy Farms

Brian K. Herbst
Research Associate
Department of Agricultural Economics
Texas A&M University
College Station, Texas 77843-2124
herbst@tamu.edu

David P. Anderson
Associate Professor and Extension Economist
Department of Agricultural Economics
Texas A&M University
College Station, Texas 77843-2124
danderson@tamu.edu

Joe L. Outlaw
Professor and Extension Economist
Department of Agricultural Economics
Texas A&M University
College Station, Texas 77843-2124
joutlaw@tamu.edu

James W. Richardson
Regents Professor and TAES Senior Faculty Fellow
Department of Agricultural Economics
Texas A&M University
College Station, Texas 77843-2124
jwrichardson@tamu.edu

Todd Bilby
Texas AgriLife Extension
1229 North US Highway 281
Stephenville, TX 76401
trbilby@ag.tamu.edu

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This paper examines the impact of sex-sorted semen adoption on dairy farm level economics. Representative dairies are used to simulate the financial impacts of moving to this new technology. Key economic, financial and herd dynamics will be compared among dairies to show how the uses of sex-sorted semen will affect dairy farms. All seven of the representative dairies that were analyzed sold surplus replacement heifers using sex-sorted semen. The increase use of sex-sorted semen can have very positive impacts on dairies throughout the Southern United States.

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High milk prices over the last few years and increased herd turnover rates have resulted in an increase in demand for quality replacement heifers. Sex-sorted semen is a technological innovation that holds the potential to allow dairies to increase the number of heifers born. Over the past few years the use of sex-sorted semen has been increasing in dairies across the country.

Growth in the use of sex-sorted semen has a number of potential implications for the dairy and cattle industry. Increasing the number of heifers born may allow a dairy to more quickly expand. It may allow efficiency increases as resources are expended on productive animals. Dairies may be able to reduce or eliminate replacement purchases. More heifers may result in faster herd turnover affecting the economics of dairy production. Broader industry implications are that fewer bull calves may effect beef supplies. Replacement heifer prices may collapse as the supply increases. Fewer replacement heifers may be imported from Canada as a result of larger supplies.

This paper examines the impact of sex-sorted semen adoption on dairy farm level economics. The broader market implications are not addressed in this paper. A brief literature review is followed by a description of the methodology and data used for the research. Research results and implications for broader impacts conclude the paper.

Background

Sex sorting semen has only really been possible for the last 20 years. It became commercially available in 2005.

Sex sorted semen is normally used on first calf heifers. It is more common for first calf heifers to have a higher first use conception rate than mature, lactating dairy

cows. Conception rates have been shown to be lower for sex sorted semen than non-sorted due to sperm injury during the sorting and handling process. Some common sense also suggests that a delay in breeding back of lactating cows is more costly than delayed breeding of first calf heifers. That cost is increased further given the higher cost of sex-sorted semen. The combination of higher straw cost, reduced conception rate, and higher opportunity costs for lactating cows indicates that heifers would be the preferred strategy for this technology.

Given past research on sex-sorted semen this research examines the farm level economics of sex-sorted semen adoption. The common management strategy of using the technology only on first calf replacement heifers is evaluated versus a baseline management strategy of no sex-sorted semen.

Objectives

This study will quantify the farm level economic affects of using sex-sorted semen on dairies in the South. Representative dairies are used to simulate the financial impacts of moving to this new technology. Key economic, financial and herd dynamics will be compared among dairies to show how the uses of sex-sorted semen will affect dairy farms.

Data

This study uses economic and production data for 7 representative dairy operations that have been developed and maintained by the Agricultural and Food Policy Center (AFPC) at Texas A&M University. The representative dairies range from 450 to 3,000 head of milking cows. All information about the operations is obtained in interviews of the 3-6 member panels and the interviews are repeated every two to three

years. Table 1 presents characteristics of the dairies included in this study. The dairies are named by state (TX = Texas dairy), region (TXC = Central Texas dairy), and the number is the size of the dairy in terms of milk cows (TXC1300 = Central Texas 1300 head dairy)

To facilitate comparison across dairies, key assumptions are imposed across the set. Dairy herd sizes are held constant over the planning horizon. No off farm income, including family employment, is included in the analysis. Each dairy started 2007 with 30 percent debt on land and equipment.

Assumptions

These key assumptions were made on the dairies:

- Increased heifer breeding cost by 30 percent to cover the increase in number of straws that will be required due to the decrease in conception rate from the sex-sorted semen. The cost is then doubled to reflect the higher cost of the sex-sorted semen;
- Increased age of first calving by one month to represent the lower conception rate;
- Increased feeding cost as heifers are now calving 1 month later and more heifers are now being raised on the farm;
- Decreased bull calves sold at 2 days to represent the 85 percent heifers born to the replacement heifers. The extra heifer calves resulting from sex-sorted semen were retained and raised as replacements for the milking herd;
- Held cull and death rates for heifers and cows were constant over the 2 scenarios;
- FLS1500 ships its heifers of to be raised at a calf ranch. There are an additional 211 heifers shipped to the calf ranch and 170 return as springers to calf annually.

Methods

The effects of the sex-sorted semen on replacement heifers was analyzed using the farm level income and policy simulation model (FLIPSIM) developed by Richardson and Nixon (1986). The FLIPSIM model draws random crop yields, livestock production variables, and prices from a multivariate empirical probability distribution allowing projections to incorporate production and price risk using the procedures described by Richardson, Klose, and Gray (2000). Under a set of standard assumptions, each dairy is compared using macro level projections of prices, inflation rates, and yield growth in the December 2008 FAPRI Baseline using the scenarios of no sex-sorted semen and 100 percent sex-sorted semen on replacement heifers.

The key variables being analyzed are average annual net cash farm income and average annual ending cash. Other variables that are analyzed are in terms of herd management (replacements bought and sold, baby calves sold) and production costs (breeding costs and feed costs).

Results

All seven of the representative dairies that were analyzed sold surplus replacement heifers using sex-sorted semen (Table 2). Using conventional unsorted semen, TXE450, TXC1300, and TXN3000 sold 10, 6, and 13, replacement heifers respectively. Using sex-sorted semen on all of their replacement heifers, they sold 47, 143, and 321, respectively. Using conventional unsorted semen, TXE1000, FLN550, and FLS1500 bought 37, 11, and 137, replacement heifers respectively. Using sex-sorted semen on all of their replacement heifers, they sold 60, 51, and 33, respectively. TXC550

did not purchase or sell any replacements heifers under the conventional unsorted semen but sold 63 using sex-sorted semen.

Table 2 contains the herd dynamics for the seven dairies under conventional unsorted semen and the sex-sorted semen scenarios. The number of cows, replacements needed to maintain the herd size, calves sold at 2 days old, replacements raised under the scenario, replacements bought or sold under each scenario, and the change in replacement purchases/sales are included in the table. Table 3 contains financial information for the two scenarios for each dairy. The financials that were reported for the results in the analysis are average annual net cash farm income (2007-2013), average annual dairy and livestock costs (2007-2013) and ending cash reserves in 2013.

The dairies broke down into three categories using the conventional unsorted semen: selling extra replacements, buying extra replacements to maintain herd size, and maintaining status quo by neither buying nor selling replacement heifers. The TXC550 dairy was in the maintaining status quo group. Under the conventional method, their average annual NCFI was $450,000 and using sex-sorted semen it increased to $516,000 because they were able to sell 63 replacement heifers. Their average annual dairy and livestock costs increased by $72,000 to cover the additional feed and increases in breeding costs; however, there was still an increase in ending cash reserves in 2013 of $366,000.

The TXN3000 dairy was selling 13 extra replacement heifers a year using conventional unsorted semen and using the sex-sorted semen they were able to sell 321 replacement heifers. Under the conventional method, their average annual NCFI was $1,157,000 and using sex-sorted semen it increased to $1,396,000. Their average annual

dairy and livestock costs increased by $438,000 to cover the additional feed and increases in breeding costs; however, there was still an increase in ending cash reserves in 2013 of $1,232,000.

The TXE450 dairy was selling 10 extra replacement heifers a year using conventional unsorted semen and using the sex-sorted semen they were able to sell 47 replacement heifers. Under the conventional method, their average annual NCFI was $220,000 and using sex-sorted semen it increased to $249,000. Their average annual dairy and livestock costs increased by $52,000 to cover the additional feed and increases in breeding costs; however, there was still an increase in ending cash reserves in 2013 of $128,000.

The TXE1000 dairy was buying 37 extra replacement heifers a year using conventional unsorted semen and using the sex-sorted semen they were able to sell 60 replacement heifers. Under the conventional method, their average annual NCFI was $582,000 and using sex-sorted semen it increased to $667,000. Their average annual dairy and livestock costs increased by $38,000 to cover the additional feed and increases in breeding costs; however, there was still an increase in ending cash reserves in 2013 of $332,000.

Discussion

The increase use of sex-sorted semen can have very positive impacts on dairies throughout the Southern United States. By increasing the heifer crop, a dairy would be able to maintain its herd size or grow in most cases. The increase in costs are easily covered by the savings of a home grown replacement over a high dollar purchased heifer

and revenues of sales of high dollar replacements. Three of the 7 representative dairies that were analyzed were able to go from buying replacements to selling replacements.

With the higher prices of sex-sorted semen and the increase in straws needed per heifer, it is more expensive for the dairy to use. These higher costs should be offset by the positive results of more heifer calves.

Beyond the farm level economics of the adoption decision there will be industry wide changes due to the broader adoption of the technology. Some of those impacts can be expected to include:

- Sharply lower replacement heifer prices as the supply available on the market expands.
- Reduced imports of Canadian heifers.
- Milk production productivity gains as more heifers are available to choose from allowing producers to only choose the best.
- Ability to more rapidly expand an individual herd or the national herd due to market conditions.
- Ability to cope with more rapid herd turnover, if necessary.
- Fewer bull/steer calves available for feeding for beef production.
- Continued consolidation as herds are able to grow faster.

The economic implications of widespread adoption of the technology on the industry is a subject for further research.

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Table 1. Description of Representative Ranches Included in this Study.

Dairy Name	Location	Description
TXC550	Erath County, Texas	A 550-cow, moderate-sized central Texas (Erath County) dairy. TXC550 plants 1,100 acres of hay each year. Milk sales represented 94 percent of this farm's 2007 gross receipts.
TXC1300	Erath County, Texas	A 1,300-cow, large-sized central Texas (Erath County) dairy. TXC1300 plants 680 acres of silage and 440 acres of hay annually. During 2007, milk sales accounted for 94 percent of receipts.
TXE550	Hopkins County, Texas	A 450-cow, moderate-sized northeast Texas dairy. This farm has 850 acres of improved pasture and 50 acres of hay. During 2007, milk sales represented 91 percent of annual receipts.
TXE1000	Hopkins County, Texas	A 1,000-cow, large-sized northeast Texas dairy. This farm plants 1,025 acres of hay/silage. This farm generated 95 percent of 2007 receipts from milk sales.
TXN3000	Bailey County, Texas	A 3,000-cow, large-sized dairy located in the South Plains of Texas. This farm plants 180 acres of sorghum for silage annually. Milk sales account for 93 percent of 2007 gross receipts.
FLN500	Lafayette County, Florida	A 550-cow, moderate-sized north Florida dairy. The dairy grows 130 acres of hay each year. All other feed requirements are purchased in a pre-mixed ration. Milk sales accounted for 94 percent of the farm receipts.
FLS1500	Okeechobee County, Florida	A 1,500-cow, large-sized south central Florida dairy. FLS1500 plants 100 acres of hay and 400 acres of silage annually. Milk sales represent 94 percent of 2007 total receipts.

Table 2. Herd dynamics using conventional and sex-sorted semen on the replacement heifers.

	TXC550		TXC1300		TXE450		TXE1000	
	Conventional	Sex-Sorted	Conventional	Sex-Sorted	Conventional	Sex-Sorted	Conventional	Sex-Sorted
Number of Milking Age Cows	550	550	1300	1300	450	450	1000	1000
Replacements Heifers Needed	193	193	470	470	135	135	330	330
Calves sold 2 @ days old	240	172	622	458	225	168	475	360
Replacements Heifers Raised	193	256	476	613	145	182	293	390
Replacement Heifers Bought(-) or Sold(+)	0	+63	+6	+143	+10	+47	-37	+60
Change in Replacements Bought/Sold		63		137		37		97

Table 2 Continued. Herd dynamics using conventional and sex-sorted semen on the replacement heifers.

	TXN3000		FLN550		FLS1500	
	Conventional	Sex-Sorted	Conventional	Sex-Sorted	Conventional	Sex-Sorted
Number of Milking Age Cows	3000	3000	550	550	1500	1500
Replacements Heifers Needed	1100	1100	187	187	600	600
Calves sold 2 @ days old	1395	1010	285	220	578	368
Replacements Heifers Raised	1113	1421	176	238	463	633
Replacement Heifers Bought(-) or Sold(+)	+13	+321	-11	+51	-137	+33
Change in Replacements Bought/Sold		308		62		170

Table 3. Financial Statistics for the dairies using conventional and sex-sorted semen on replacement heifers.

	TXC550		TXC1300		TXE450		TXE1000	
	Conventional	Sex-Sorted	Conventional	Sex-Sorted	Conventional	Sex-Sorted	Conventional	Sex-Sorted
Net Cash Farm Income ($1000) 2007-2013 Average	450.75	516.20	667.39	849.55	220.92	249.34	582.95	667.83
Dairy & Livestock Costs ($1000) 2007-2013 Average	1,091.99	1,164.31	3,017.46	3,166.99	975.80	1,028.23	2,400.04	2,438.57
Ending Cash Reserves in 2013 ($1,000)	674.20	1,040.75	729.00	1,529.16	70.67	198.73	64.70	397.45

Table 3 Continued. Financial Statistics for the dairies using conventional and sex-sorted semen on replacement heifers.

	TXN3000		FLN550		FLS1500	
	Conventional	Sex-Sorted	Conventional	Sex-Sorted	Conventional	Sex-Sorted
Net Cash Farm Income ($1000) 2007-2013 Average	1,157.75	1,396.19	488.55	537.04	539.05	479.09
Dairy & Livestock Costs ($1000) 2007-2013 Average	9,163.65	9,602.20	1,456.43	1,509.49	3,341.14	3,140.69
Ending Cash Reserves in 2013 ($1,000)	2,407.11	3,640.05	796.42	1,085.04	-48.81	-67.52