Sexed Semen in Dairy Farming

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Why to use sexed semen?

Use of sexed semen could be economically attractive

Increases desired gender
More valuable offspring

Decreases fertility
Compromised efficacy of sex-sorted semen

More expensive
Technology is costly

Decision should be economic

What's going on in Wisconsin

Sexed semen on dairy farms

Usual recommendation

On virgin heifers

Why they use sexed semen

Nearly 350 producers and heifer growers shared thoughts on sexed semen. Follow-up research looked at its on-farm payback.

by Ryan Sterry, Denise Brusveen, Victor Cabrera, Kent Weigel, and Paul Fricke

THE technology to produce sexed semen has been around for decades. But, it was not until recently that commercial application became a reality.

We know that the sex-sorting technology can reliably raise the percentage of heifer calves to over 90 percent in many cases. But, the downside is a significant reduction in fertility. While researchers are still hashing out the best places to use sexed semen and the economics involved with the product, we wanted to get a better perspective on producers' value of the product.

Last winter, 17 Wisconsin Extension ag agents distributed a survey on the use of sexed semen. A total of 347 surveys were returned. Responses received reflected the state's distribution of herd sizes. Of the completed surveys, there were 309 dairy farmers and 38 custom heifer growers.

Who is using sexed semen, and where are they getting it?

Nearly half of those surveyed purchased sexed semen from Select Sires, while similar proportions (10 to 15 percent) buy it from Accelerated Genetics, Genex, and ABS. Semex, Alta, and other studs rounded out the group. Far more heifer growers, nearly two-thirds, are using sexed semen compared to only 39 percent of dairy farmers. Nearly half of the dairy farmers surveyed have never tried sexed semen versus 30 percent of heifer growers . . . 8 percent in each group tried it but discontinued use.

It was important for us to know which studs producers were purchasing sexed semen from because, at the time of our survey, Accelerated Genetics was marketing a gender-biased product which results in a smaller increase in the percentage of female calves but does not compromise fertility.

Why are people using sexed semen?

Nearly two-thirds of dairy producers surveyed plan to grow their herds over the next five years, while one-third plan to maintain herd size. Of those planning to boost cow numbers, 12 percent plan to grow their herd over 50 percent, one-third plan to add 10 to 50 percent to their current herd size, and 21 percent plan to boost cow numbers 1 to 10 percent. When asked the number one reason for using sexed semen, nearly half (48 percent) said that it was to expand the herd from within. The second most important reason was to produce more females from their best cows (24 percent).

What was the selection criteria?

Service number was the number one criteria at 30 percent. Not far behind was genetic merit of female (29 percent), followed by type of breeding — detected heat versus timed A.I. at 15 percent.

For optimum results, sperm-sorted sexed semen is best used on first-service, virgin heifers in good standing heat. A high percentage of producers are using sexed semen on both first and second service for both heifers and cows. It is important to note that, while producers are experimenting with sexed semen on their lactating cows, it is used on only a small percentage, less than 25 percent, of their cows.

What was their satisfaction level?

Farmers using sexed semen were asked to rank their satisfaction level on a scale of 1 (very dissatisfied) to 5 (very satisfied). Farmers were most satisfied (3.87) with the percentage of female calves born. Intermediate satisfaction levels were achieved for conception rate (3.10) and sire availability (3.09). The biggest dissatisfaction with sexed semen came from the higher price (2.92).

What were reasons for discontinuing its use?

Many producers (42 percent) had reasons other than semen price, dissatisfaction with sex ratio, or poor fertility for discontinuing the use of sexed semen. Nearly one-third (31 percent), though, quit because of poor fertility.

Does it pay?

After the survey, we calculated the economic value (EV) of reproduction programs for virgin heifers. This was assessed as the difference between the net present value (NPV) of conventional, unsexed semen and various sexed semen programs.

The NPV was calculated by totaling the discounted monetary values of successive services in virgin heifers starting at 14 months of age. We also considered the discounted value of the probability a heifer could be culled and replaced if not pregnant after five consecutive services.

The cost of conventional and sexed semen, including insemination fees, was set at $15 and $45, respectively. Heifer calf value was considered to be $562, and bull calves were $48. The maintenance of nonpregnant 1,114-pound heifers 15 to 20 months of age was set to $2.40 per day. The culling value of 20-month open heifers was 81 cents per pound, while the replacement value of an equal weight pregnant heifer was $1,200. An annual interest rate of 12 percent was used for discounting purposes.

A baseline conception rate (CR) for heifers was set between 65 percent (high) and 55 percent (low). The CR for sexed semen was 52 percent (high) and 27.5 percent (low). CR dropped 2.5 percent for each successive service after the first service. Resulting live births were set at 46.7 percent females with conventional semen and 87 percent with sexed.

Five semen programs were studied. These programs used sexed semen in one, two, three, four, and all five services, along with simply conventional semen.

It pays, but . . .

Based on our model, sexed semen programs have an economic benefit but only if the CR of sexed semen service is high (80 percent of the conventional).

When both CR of conventional and sexed semen were high (65 percent and 52 percent, respectively), the economic value of the reproductive programs was always positive, varying between $27 (five sexed services) and $77 (two sexed services).

- When the conventional CR was low (55 percent), but the sexed semen was high (44 percent), the EV were again positive but lower than before, varying between $3 and $54. Programs with two, three, and one sexed services outperformed the four and five services programs.
- When the CR of sexed semen services was low (32.5 and 27.5 percent, respectively), the EV of sexed semen was always negative, indicating that a conventional reproductive program will be more profitable. The negative spread widened as sexed semen was used for additional services.

Run your own numbers

Sexed semen programs will greatly depend on the particular farm and market conditions. To help you out, we have created a web-based tool that allows A.I. users to estimate the returns on sexed semen. The tool is free of charge and can be used directly from a web browser at the following website: www.uwex.edu/ces/dairymgt/ under the section "Management Tools" and title "Economic Value of Sexed Semen Programs."

Age of heifers at first breeding - only Beltsville

Conventional (n=119)

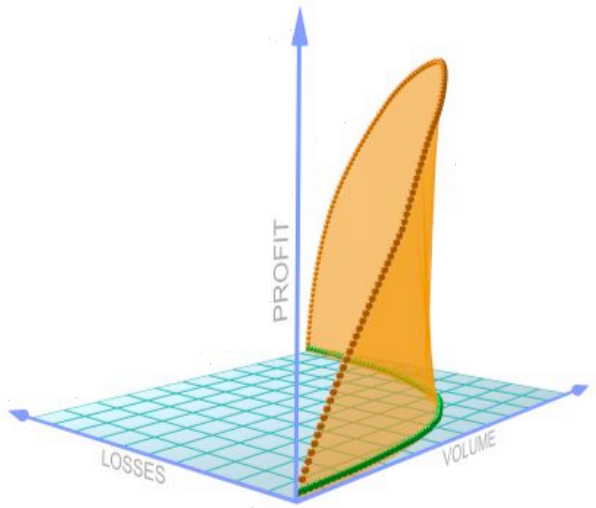
Sexed (n=118)

Survey in Wisconsin

Farmers are using it on heifers in 1st and 2nd services

Objectives

Assess the economic value of using sexed-semen



Define bio-economic parameters

Very important to include all the right variables in the model

Illustrate metodology

Solid calculation

Demonstrate user-friendly application

Online decision support system openly and freely available to you!

Discuss results

Baseline and alternative scenarios

Methodology

Partial budgeting

Additional revenues

- Gender-selected calves

Additional expenses

- Sex-sorted semen

Costs savings

- Dystocia cost

Revenues foregone

- Lower conception rate
- Days open

Methodology

Expected Value

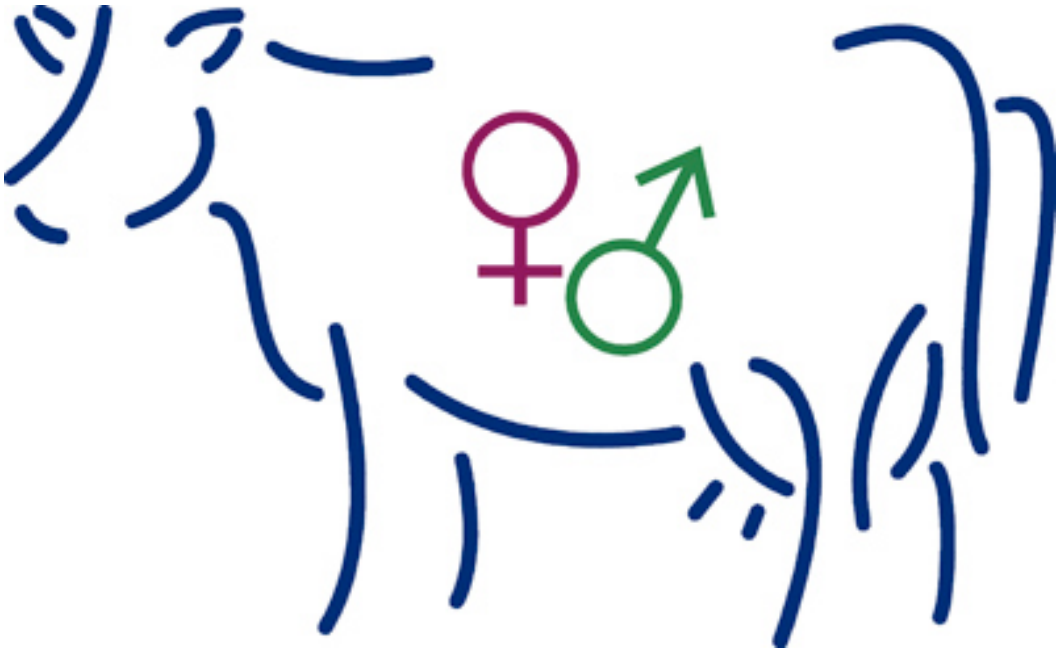
Fair comparison

Net Present Value

(using a discounting rate)

Assumptions

Similar for sexed and conventional semen



Starting of reproductive program

At 14 months of age

Breeding attempts

Five services

Non-pregnant are replaced

Experimental Design

Three fertility levels in each: low, mean, high

Control and treatments studied

Treatment	1st Service	2nd Service	3rd Service	4th Service	5th Service
Control	CS	CS	CS	CS	CS
TRT 1	SX	CS	CS	CS	CS
TRT 2	SX	SX	CS	CS	CS
TRT 3	SX	SX	SX	CS	CS
TRT 4	SX	SX	SX	SX	CS
TRT 5	SX	SX	SX	SX	SX

Baseline inputs

Holstein reproductive parameters

	Low	Mean	High
Conventional semen Conc. Rate 1st service	**34%**	**56%**	**84%**
DeJarnette et al., 2009			
Sexed semen conception rate	**-20%**		
DeJarnette et al., 2009			
Conception rate decrease per service	**-2.5%**		
Kuhn et al., 2006			
Sexed semen heifer calf	**89.0%**		
DeJarnette et al., 2009			
Conventional semen heifer calf	**46.7%**		
Silva del Rio et al., 2007			

Baseline inputs

Economic parameters

Conventional semen cost	**$15**
Olynk and Wolf, 2007	
Sexed semen cost	**$45**
Olynk and Wolf, 2007	
Heifer calf value	**$562**
Wisc. USDA Market Reprot, 2008	
Bull calf value	**$48**
Wisc. USDA Market Reprot, 2008	
Dystocia cost per case	**$28.53**
Dematawewa and Berger, 1997	
Dystocia incidence in bull calves	**1.57 times higher**
Martinez et al., 1983	

Other inputs

Economic and productive parameters

Heifer maintenance 15-20 mo	**$2.4/d**
Zwald et al., 2007	
Weight 20-mo non-pregnant	**505 kg**
NRC, 2001	
Salvage 20 mo non-pregnant	**$1.79/kg**
Wisc. USDA Market Report, 2008	
Value 20-mo pregnant heifer	**$1,200**
Wisc. USDA Market Report, 2008	
Interest rate	**12%/yr**

Analyses

Baseline comparisons

EV baseline conditions
Treatment with higher EV

Break-even analysis
Conception rate required for a positive expected value

Sensitivity analysis
Find the most important variables

Scenario analysis
Find optimal treatments

Results

Baseline parameters

Economic Value (EV, $/heifer) of sexed semen treatments

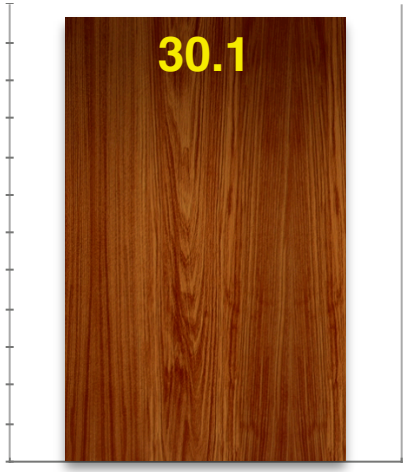
Treatment	**CS** CR 34%	**CS** CR 56%	**CS** CR 83%
TRT 1: **1 SX**	6.5	49.3	100.0
TRT 2: **2 SX**	-3.4	57.8	111.6
TRT 3: **3 SX**	-23.1	46.4	96.1
TRT 4: **4 SX**	-48.9	24.7	71.7
TRT 5: **5 SX**	-78.5	-2.7	43.9

Cabrera, 2009

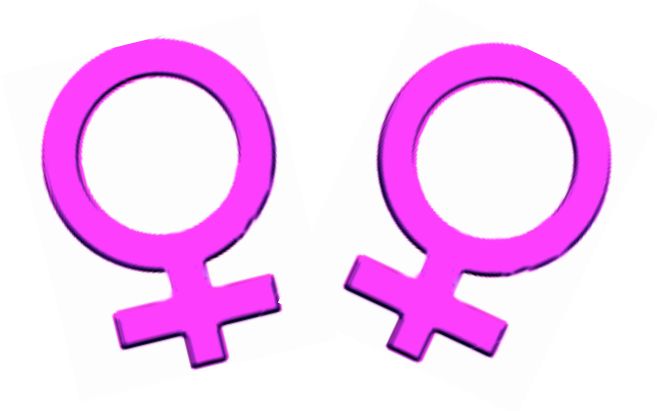
Results

Baseline parameters

Overall EV
$30.1/heifer

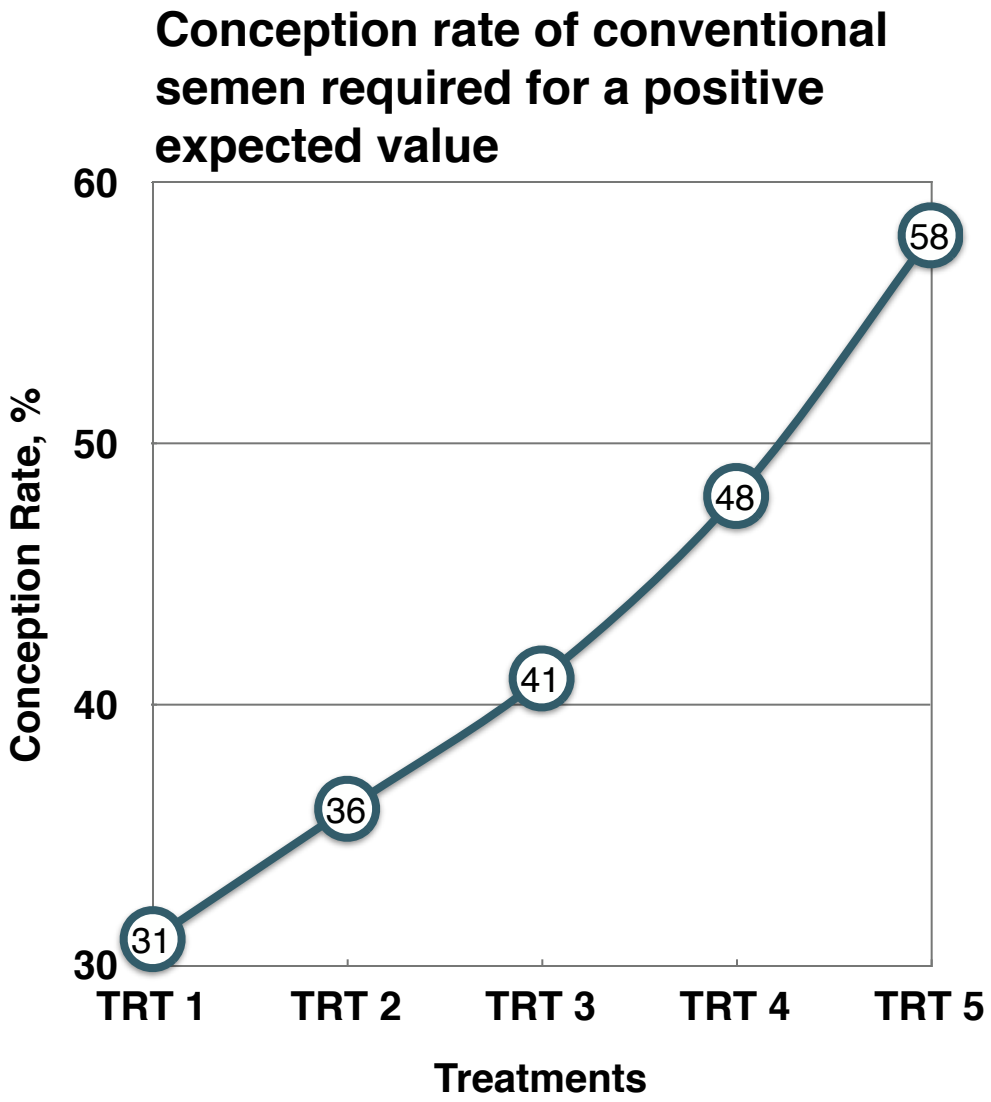


When to use sexed semen?
Always justified for 1st service



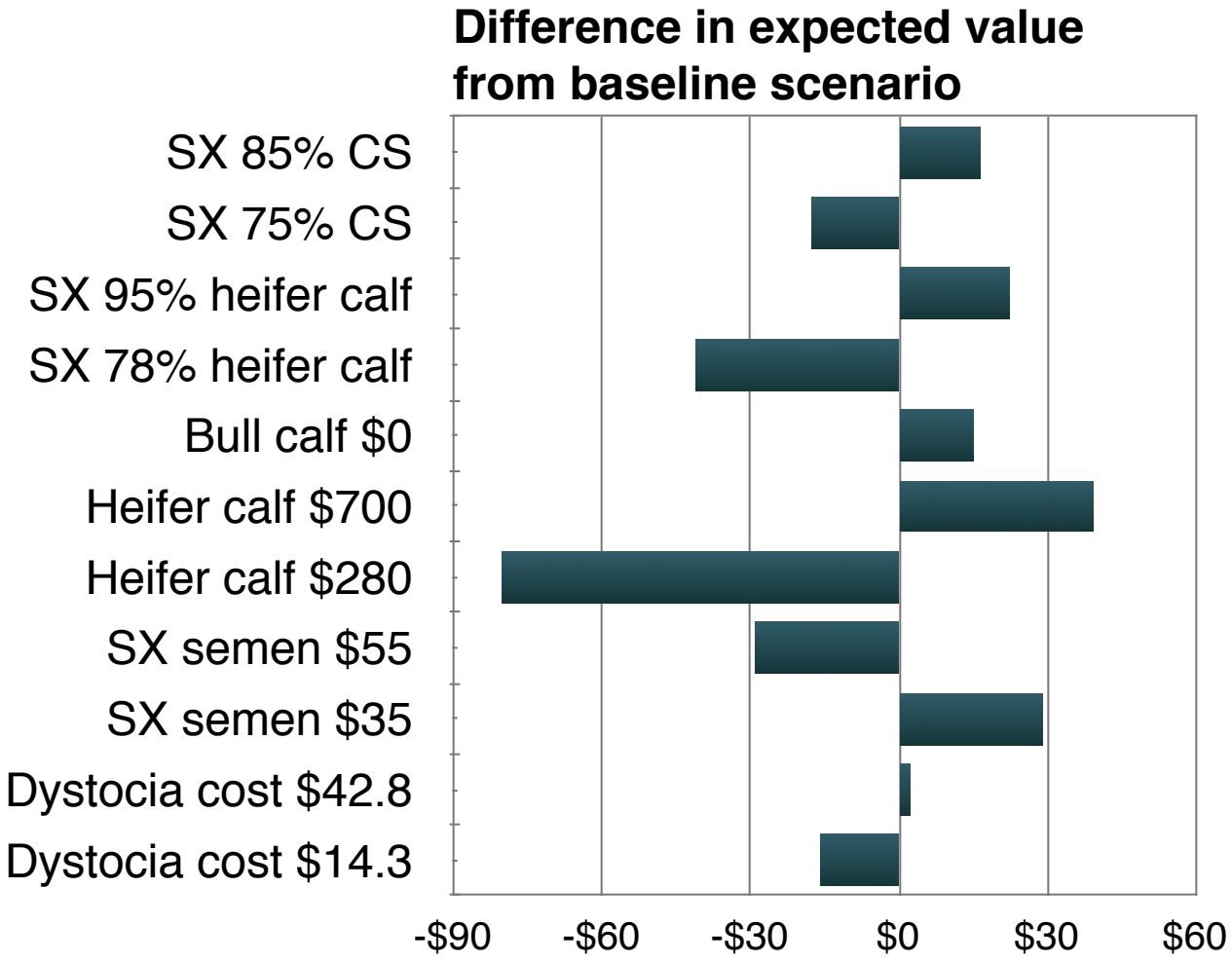
Results

Break-even analysis



Results

Sensitivity analysis



Results

Optimal treatment

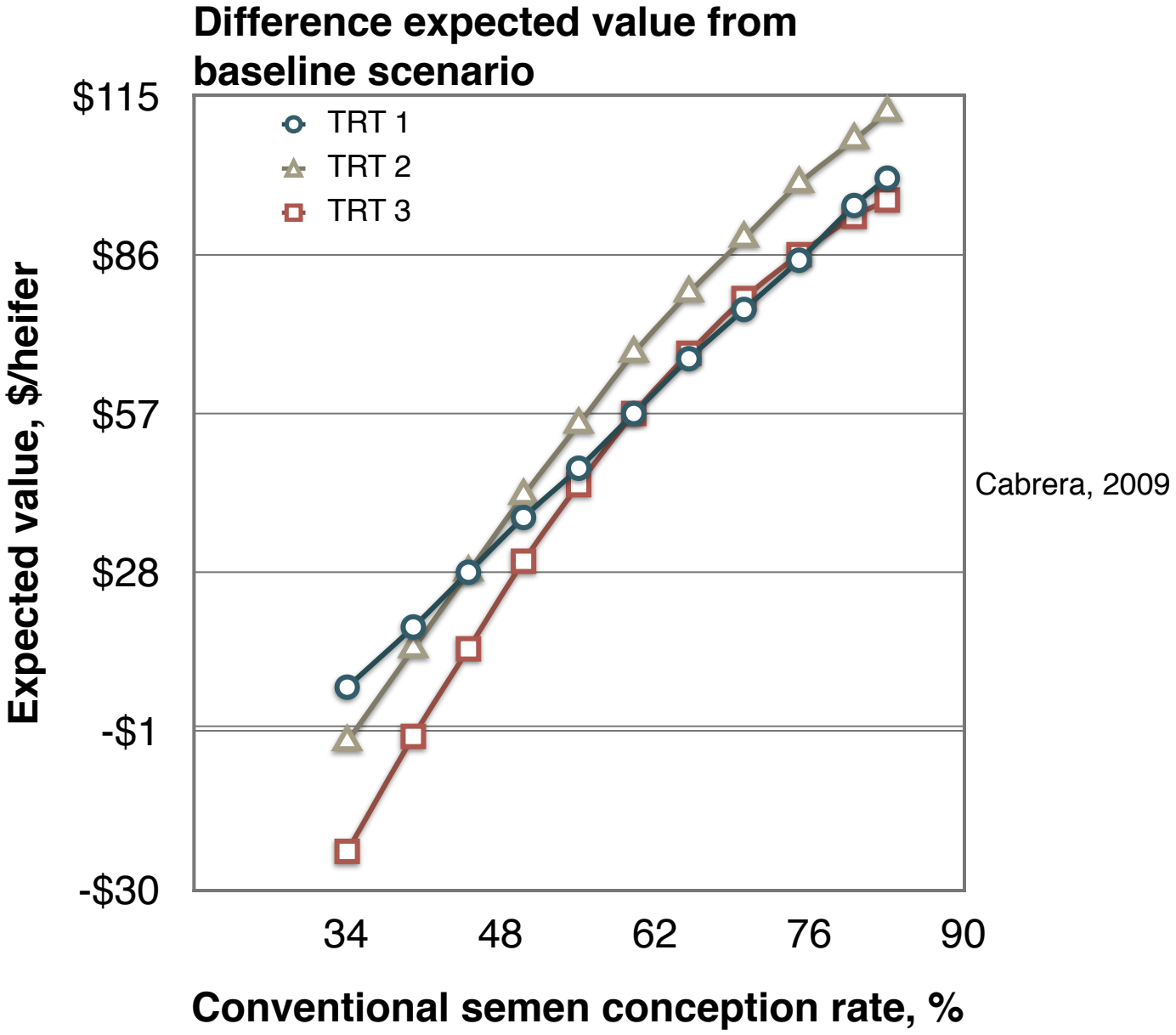
Optimal decision (treatment) to different scenarios

Scenario	**CS** CR 34%	**CS** CR 56%	**CS** CR 83%
Sexed semen 85% of CS	1	2	2
Sexed semen 75% of CS	None	2	2
Sexed semen 95% heifer calf	1	2	2
Sexed semen 78% heifer calf	None	1	1
Bull calf $0	1	2	2
Heifer calf $700	1	2	2
Heifer calf $280	None	None	1
Dystocia cost $42.8	1	2	2
Dystocia cost $14.3	1	2	2

Cabrera, 2009

Results

Optimal treatment



Cabrera, 2009

Other impacts

Sensitivity to other variables

Difference in expected value to variable changes

Variable	Impact	
	For every $ change	EV $ changed
Heifer maintenance cost, $/d	+0.1	-1.0
Salvage value, $/kg	+0.1	-1.0
Pregnant heifer value, $/heifer	+100	-2.8
Dystocia cost, $/heifer	+10	+1.44
SX semen cost, $/service	+5	-14.5
Discount rate, %	+10%	-0.1

Cabrera, 2009

Conclusions

Main take-home messages

Sexed semen has higher economic value than conventional semen
Under the baseline and scenarios studied here

Single most important variable: Conception rate
- 31 to 44% CR: 1 service
- > 44% CR: 2 services

Other important variables:
Conception rate sexed semen, % heifer calf, heifer calf value, cost sexed semen

Additional variables:
Will only have limited impact in the decision of using sexed semen

Discussion

Additional considerations when using sexed semen

Exist some evidence of:

- Greater incidence of stillbirths
- Longer gestation periods

Implications for farm herd expansion

Implications for US herd expansion

Faster genetic improvement

Decreased bio-security risks

Decision support system

Perform your own calculations

Results might not apply equally to all farms
Every farm is different

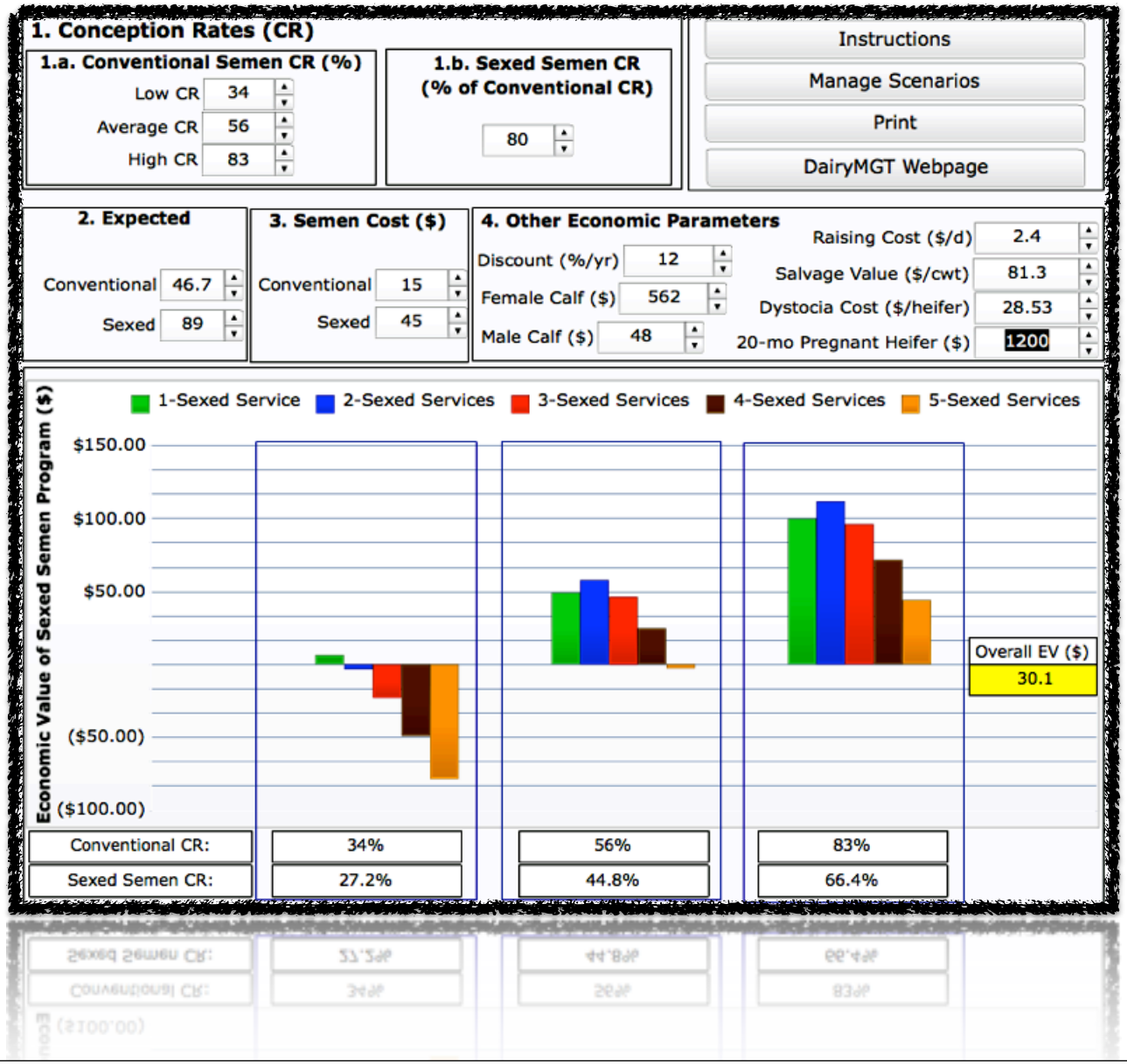



Market conditions change permanently
Might impact decisions

Challenge is to provide a user-friendly application
Easy to use, still robust

Economic value of sexed semen

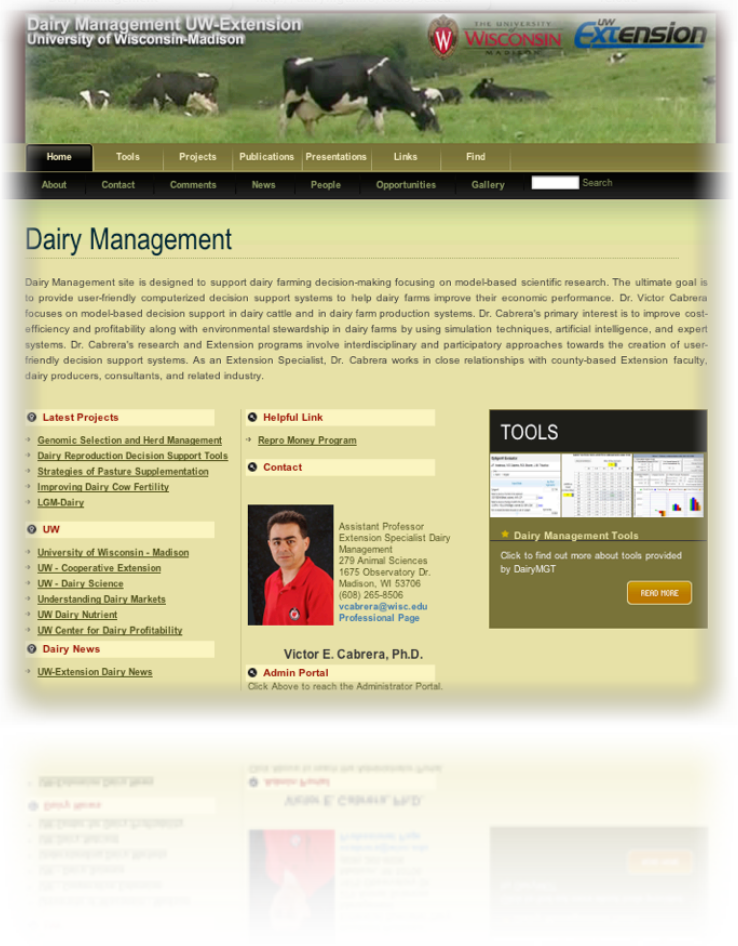
Ready for you to use



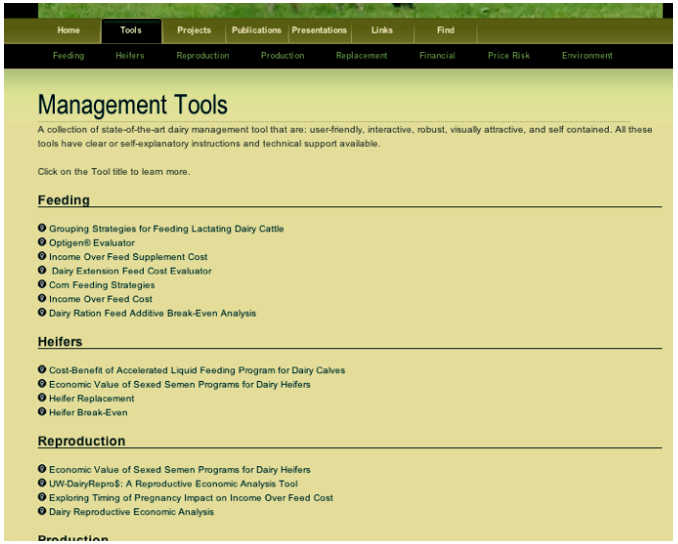
Economic value of sexed semen

Where to find it

DairyMGT.info



Tools



Scenario analyses

Adjust tool to local and current conditions

Data to analyze alternatives of sexed semen use in dairy farms in Texas[1]

	Conventional semen	Angus Semen		Holstein semen	
		75%	90%	75%	90%
Heifer CR[2], %	65	55	55	55	55
Cow CR, %	34	24	24	24	24
Cow PR[3], %	17	12	12	12	12
Bull calves, %	50	75	90	25	10
Price semen, $/unit	18	12	25	20	25
Bull calf value, $	--	260	260	160	160
Heifer calf value, $	--	260	260	250	250

[1]Courtesy of Jorge Melchor, CRI Texas, April 2012

[2]CR = Conception rate

[3]PR = Pregnancy rate assuming 50% heat detection rate or 42 days of interbreeding interval for synchronization programs

Scenario analyses

Adjust tool to local and current conditions

Additional information

	Conventional semen
Heifer raising cost, $/day	2.0
Salvage value, $/cwt	120
20-mo pregnant heifer	1000
Dystocia cost, $/heifer	30
Discount, %/year	10

Scenario analyses

Adjust tool to local and current conditions

Results for heifers

	Angus Semen		Holstein semen	
Treatment	75%	90%*	75%	90%
TRT 1: **1 SX**	-5.6	-19.4	2.6	6.1
TRT 2: **2 SX**	-4.6	-31.6	2.6	4.8
TRT 3: **3 SX**	-0.8	-40.6	1.9	0.9
TRT 4: **4 SX**	4.3	-48	1.1	-4
TRT 5: **5 SX**	10.2	-54.6	0.3	-9.1

*It would become positive if:

the sexed semen cost is $13 or lower, or

the value of a bull calf is $100 greater than the value of a heifer calf

Scenario analyses

Adjust tool to local and current conditions

Results for cows

	Angus Semen		Holstein semen	
	75%	90%*	75%	90%
A. Loss because decrease in PR[1], $/year	63	63	63	63
B. More expense in semen[2], $/year	-25	29	8	29
C. Additional value of female calf[3], $/year	0	0	83	83
Economic balance (C-A-B), $/cow per year	-38	-92	12	-9
Minimum conception rate required, %	28	40	23	27
Sexed semen cost to break-even, $	3	3	24	23

[1]Calculated using the tool “The Economic Value of a Dairy Cow” at DairyMGT.info: Tools.
[2]At 24% conception rate, 4.17 services/cow are needed
[3]Assuming a 13 month calving interval