

# HERD SIZE MANAGEMENT USING CATTLE CYCLE PRICE SIGNALS AND WEATHER UNCERTAINTY

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# RESEARCH QUESTIONS

- A Dollar Cost Averaging strategy, where the dollar amount of herd size reinvestment was constant over time, proved to generate larger cash returns when compared to a constant herd size strategy in a 2002 study at Iowa State University
- Given a fixed land resource and weather variability that impacts forage production, does this hold for the most recent cattle cycle '04- '14?
- How does a strategy based on price trends using moving average prices compare to both a constant herd size and a dollar cost averaging strategy?

# OVERVIEW

- Strategy Descriptions
- Farm Scenarios
- Forage Production Index
- FORCAP modeling
- Results, Conclusions, and Limitations

# STRATEGY SUMMARIES

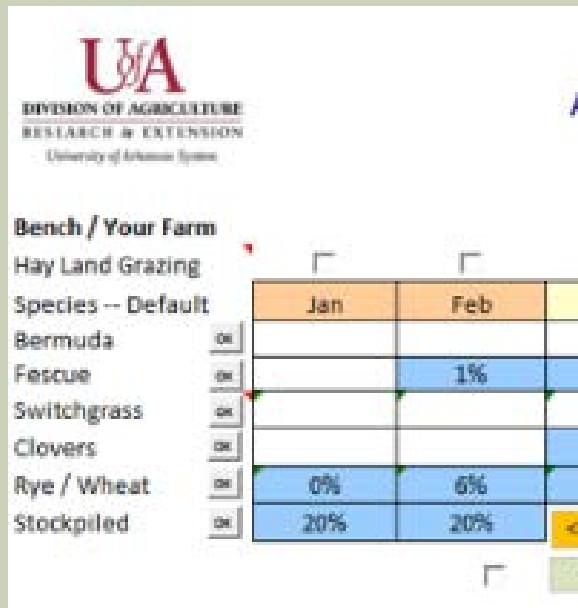
- The constant herd size (CHS) strategy holds cattle replacement and cow herd size constant throughout.
- Dollar Cost Averaging (DCA) strategy grows/shrinks the herd when replacement heifers are cheaper/more expensive than average using nominal prices.
- Moving Average (MA) strategy identifies price trend based upon two different length moving averages of 400-500 pound steer prices.
  - If ratio of 10- to 27-month averages  $>1$  = uptrend,  $<1$  =downtrend
  - Uptrend leads to a signal to sell more replacements as eventual downturn in prices for added replacements with production lag is anticipated and vice versa for a downtrend signal
- Hay shortfall/excess is bought and sold as needed across all strategies.

# FARM SCENARIOS

- **Scenario 1: 100-Cow scenario**
  - Low fertilizer option
  - Scenario yields hay surplus of 49 bales for CHS under average weather conditions.
  
- **Scenario 2: 100-Cow Scenario**
  - Medium Fertilizer option
  - Scenario diversifies income source as more hay is sold (171 bales)
  
- **Scenario 3: 160-Cow scenario**
  - High fertilizer
  - Scenario yields approximately same hay yield as Scenario 1 in CHS (46 bales).
  
- All scenarios were repeated using a forage production index that would modify forage yield given weather variability.
  
- Scenarios 1-3 – no weather impact
- Scenarios 4-6 – weather impact included

# MODELING FORAGE PRODUCTION

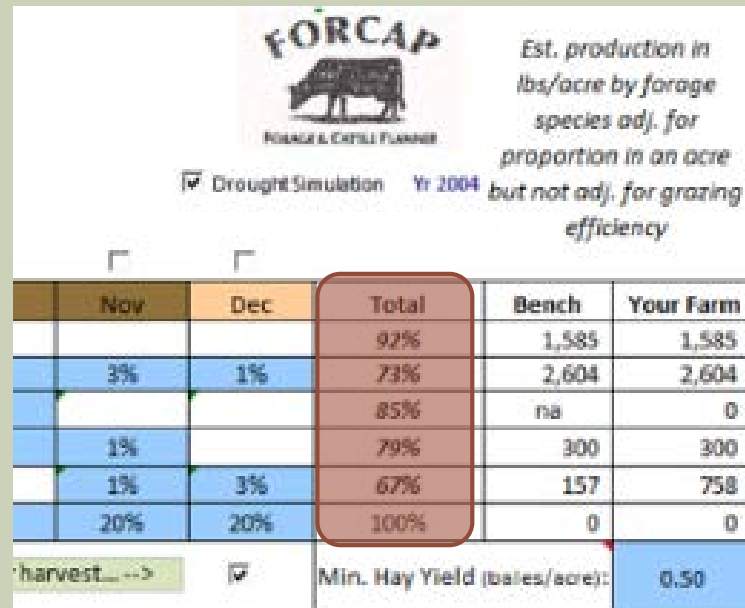
- National Drought Vegetation Index values were collected twice a month for six Washington county pasture lands via satellite imagery.
- Monthly values were divided by thirty year average for a particular month to determine annual total forage growth as modeled in FORCAP



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**Bench / Your Farm**  
Hay Land Grazing

Species -- Default	Jan	Feb	
Bermuda			
Fescue		1%	
Switchgrass			
Clovers			
Rye / Wheat	0%	6%	
Stockpiled	20%	20%	



**FORCAP**  
FORAGE & CATTLE PLANNER

Drought Simulation Yr 2004

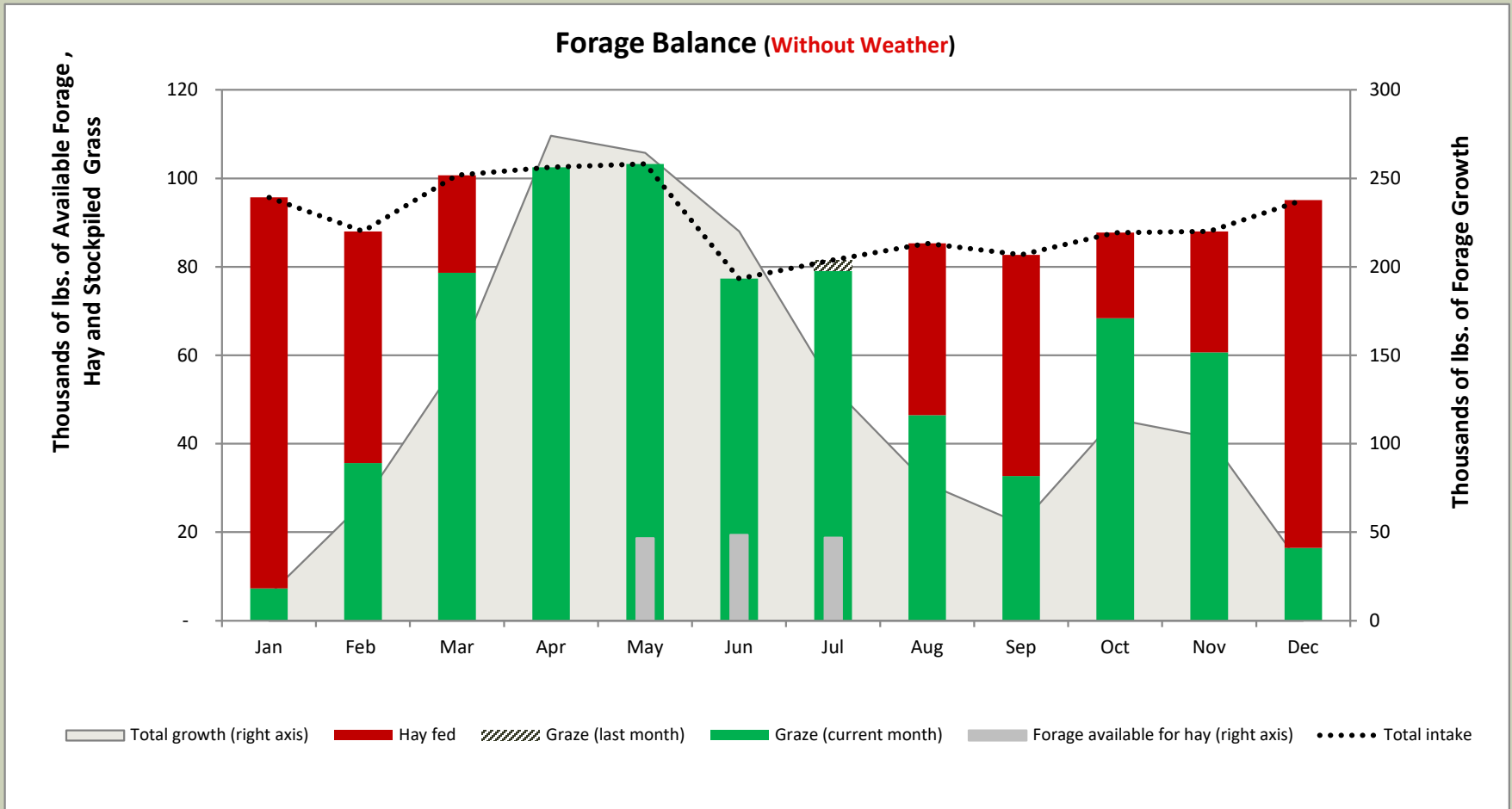
Est. production in lbs/acre by forage species adj. for proportion in an acre but not adj. for grazing efficiency

	Nov	Dec	Total	Bench	Your Farm
			92%	1,585	1,585
	3%	1%	73%	2,604	2,604
			85%	na	0
	1%		79%	300	300
	1%	3%	67%	157	758
	20%	20%	100%	0	0

harvest... -->

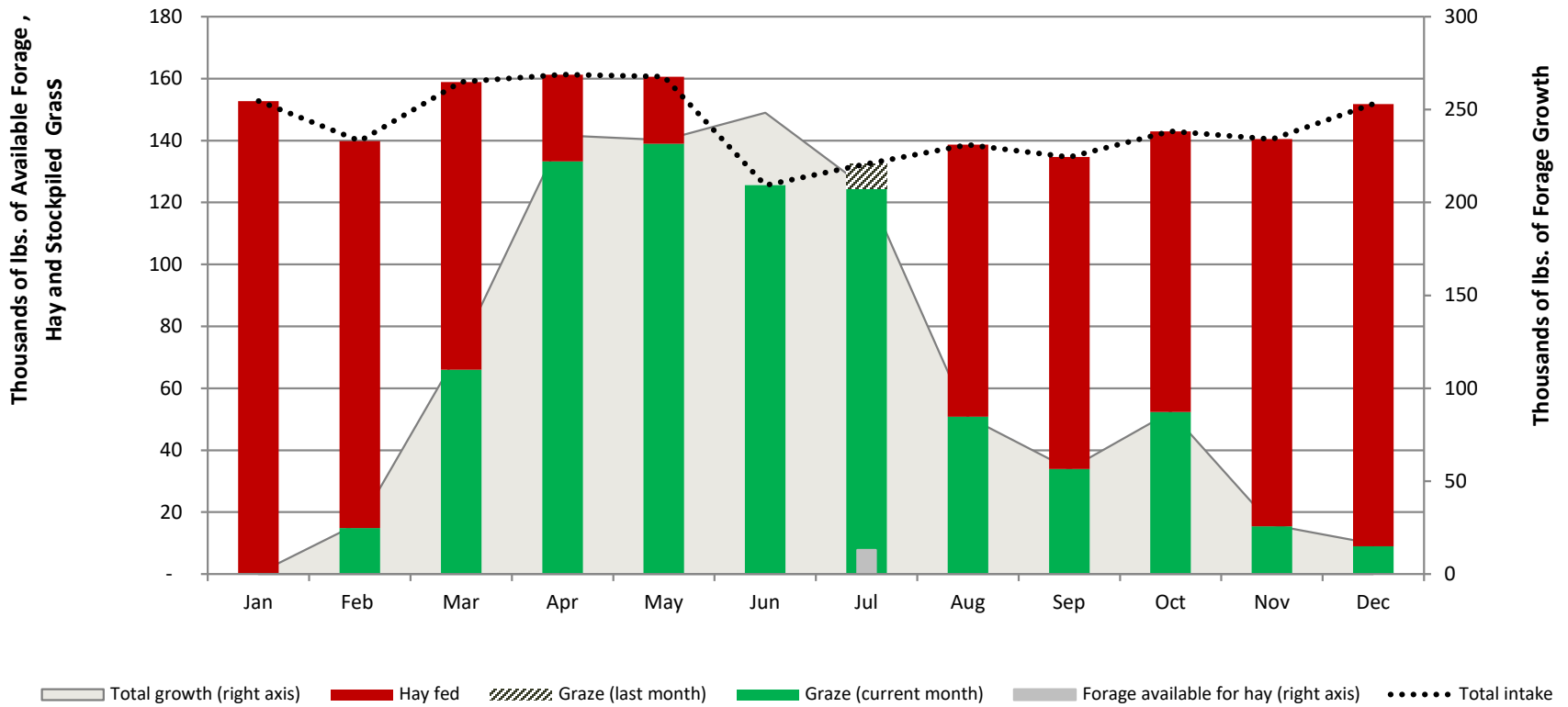
Min. Hay Yield (bales/acre): 0.50

# FORAGE BALANCE



# FORAGE BALANCE

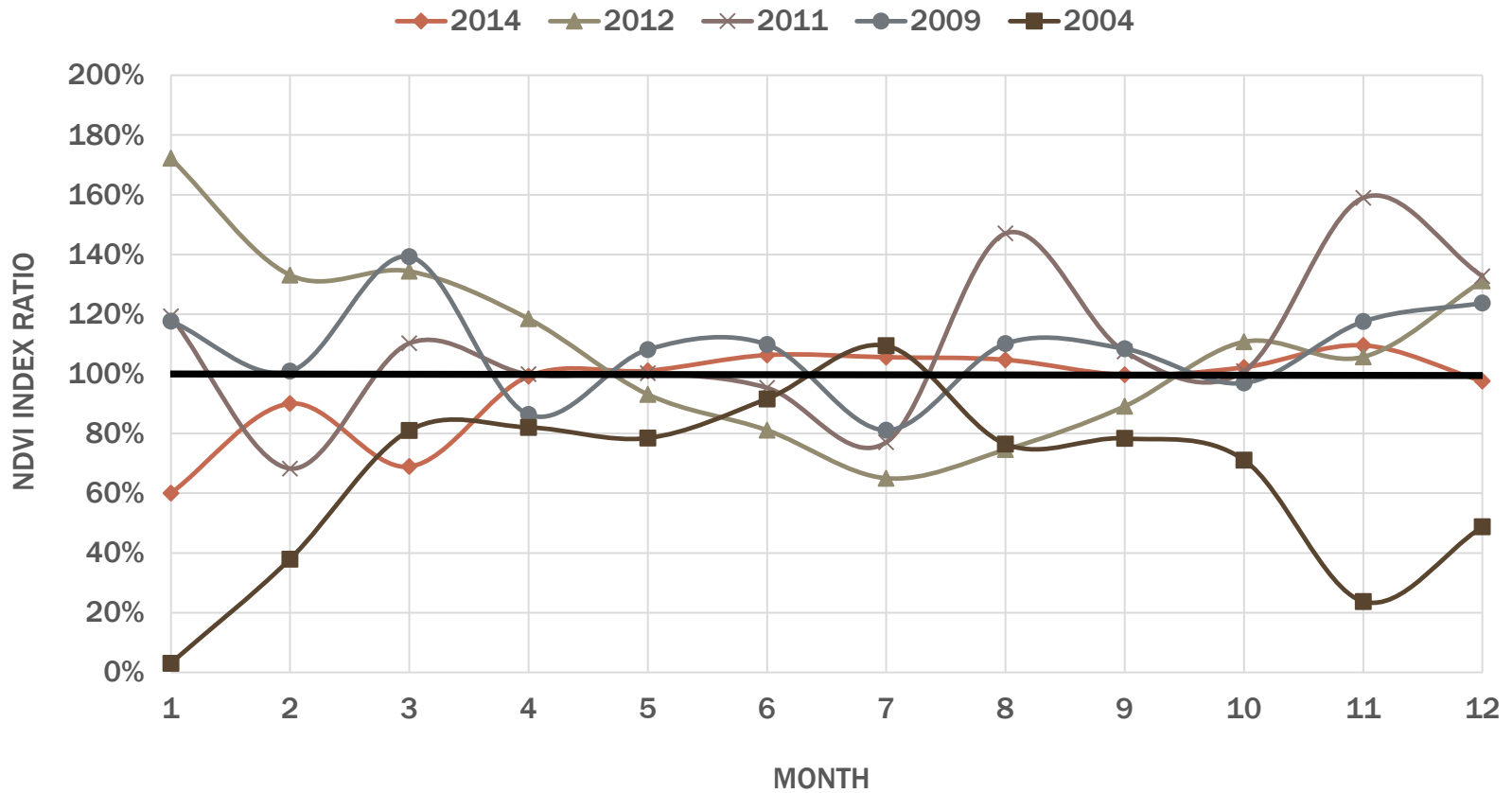
Forage Balance (With Weather)





# WEATHER IMPACT

## FORAGE PRODUCTION INDEX (SELECT YEARS)



# FORCAP PARAMETERS

- Each scenario utilizes:
  - 320 acres of pasture land and 80 acres of hay land
  - 100/160-Cow beginning herd pending fertilizer level
  - Nominal input and output prices
  - 80 acres of winter wheat planted annually
  - Fall calving season
  - Default birth weight, weaning weight, mature/cow weights
- Net Cash returns to cow/calf production include feed, fuel, fertilizer and herd health costs and account for revenue from cattle and hay sales

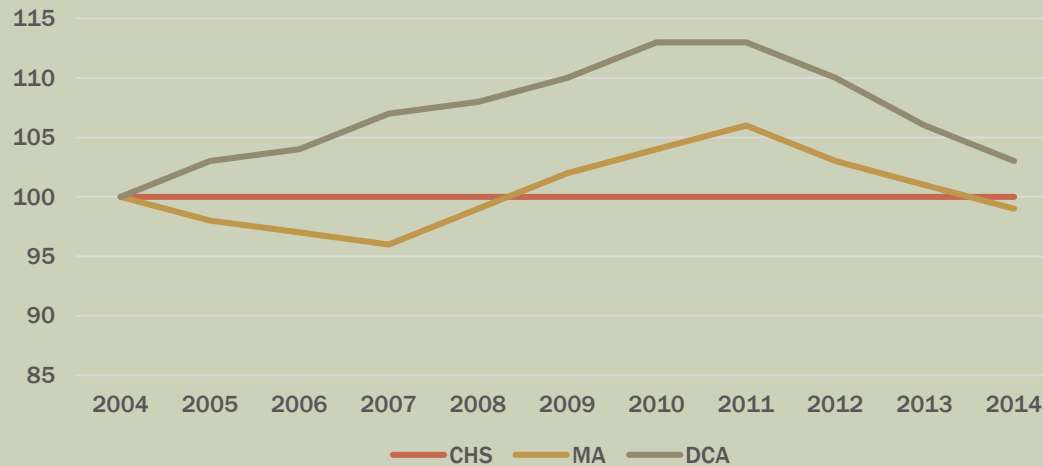
# FORCAP PARAMETERS

Press Reset for default values below	Your Farm (includes impact of extra cattle)		Press OK for Our Defaults Based on Your Farm Options or Enter your own to the right	Your Farm (includes impact of extra cattle)
<b>Description</b>		<b>Herd Size and Description</b>		
Days on Hay & Supplements	127	Cows	... the age ratio of cows depends on the no. of calves over a cow's life OR specify. <input type="button" value="Reset"/>	83
Days on Pasture	238	Young Cows		17
		Cow herd size	<input type="button" value="OK"/>	100
Breeding failures	6%	Replacement	... based on young cows and cow death losses. You can override to grow/shri. <input type="button" value="Reset"/>	21
Cow death losses	1.0%	Herd Sires	... based on 'Bull Estimator'	4
Calf death losses	3.0%	Calves Sold		
		Male		45
Avg. culling age of cows	7.58	Female (you buy replacements if negative)	... based on calf losses, 50/50 steer/heifer calf ratio, replacements retained, cow losses and average herd sire culling age as listed in the 'Bull Estimator'	24
Avg. number of calves over life of cow	6	Cull cows	<input type="button" value="Reset"/>	17
		No. of years between bull purchases		1.00
Weight of mature cow in lbs	1,250	Death losses		
Weight of young cow (at first calf) in lbs	1,000	Cows		1
Weaning age in months	7	Calves		3
Avg. age of replacements at first breeding	15			
Avg. birth weight in lbs	90	Hay Waste with feeding & storage	<input type="button" value="OK"/>	15%
Avg. steer weaning weight in lbs	555			
Avg. heifer weaning weight in lbs	520	Hay produced (from hay & pasture acres in bales)		456
Avg. herd sire weight in lbs	1,850	Hay fed (in bales -- accounts for waste)		414
		Number of 1200 lb. round bales sold (bought if negative)		42
<b>Calving Season</b>				
... choose your calving season	<input type="button" value="Fall"/>		... bench mark changes with fertilizer option (Farm), modify on your farm by selecting a different cow herd size	3.2
<b>Net Cash Returns (\$)</b>	<b>12,340</b>	Pasture acres per cow		

# RESULTS

- DCA strategy created a peak calving cow herd of 113/176 and minimum size of 100/160.
- MA strategy created a peak calving cow herd of 106/167 and a minimum size of 96/153.

Calving Cows (October)



# RESULTS

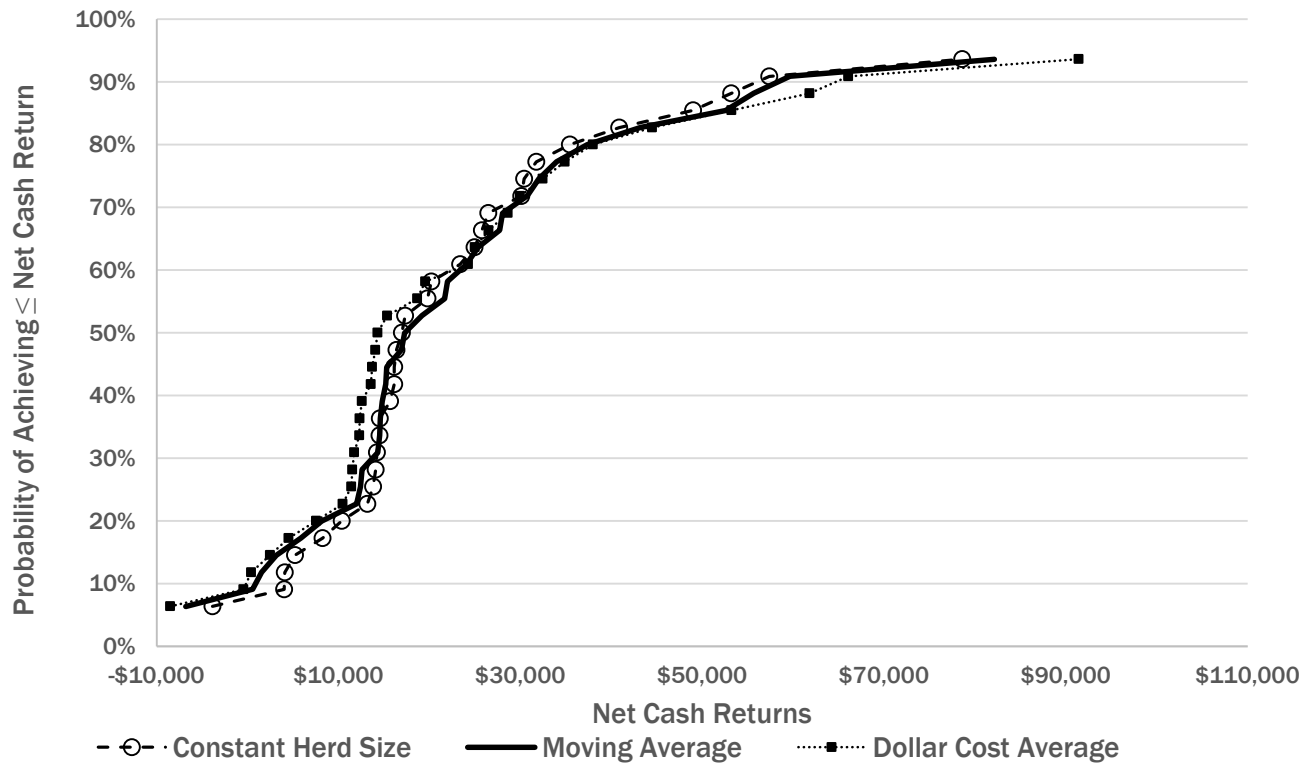
		Farm Scenario							
# of cows bred annually		100			100			160	
Fertilizer applied		Low		Med			High		
Strategy	Performance Statistics	Net Cash Returns	Hay Sold	Head Sold	Net Cash Returns	Hay Sold	Net Cash Returns	Hay Sold	Head Sold
<b>CHS</b>	Avg.	\$20,552	49	90	\$22,946	171	\$25,439	46	146
	Std. Dev.	\$13,777			\$14,403		\$21,584		
	Min	\$4,071			\$5,223		(\$3,869)		
	Max	\$53,185			\$57,367		\$78,610		
	NPV	\$160,231			\$178,257		\$194,927		
<b>MA</b>	Avg.	<b>\$20,637</b>	28	92	\$23,230	152	<b>\$25,917</b>	44	147
	Std. Dev.	\$15,207	41	4	\$15,675	33	\$23,618	48	6
	Min	\$1,548			\$3,153		(\$6,815)		
	Max	\$55,662			\$59,652		\$82,124		
	NPV	\$160,757			\$180,206		\$198,280		
<b>DCA</b>	Avg.	\$20,111	-47	98	<b>\$23,265</b>	84	\$25,175	-76	157
	Std. Dev.	\$17,414	50	6	\$17,755	45	\$26,446	72	8
	Min	\$376			\$2,455		(\$8,511)		
	Max	\$61,826			\$66,076		\$91,417		
	NPV	\$153,491			\$177,633		\$188,519		

# RESULTS

		Farm Scenario							
# of cows bred annually		100			100		160		
Fertilizer applied		Low		Med		High			
Strategy	Performance Statistics	Net Cash Returns	Hay Sold	Head Sold	Net Cash Returns	Hay Sold	Net Cash Returns	Hay Sold	Head Sold
<b>CHS+</b>	Avg.	\$20,859	40	90	\$23,695	171	\$26,921	61	146
	Std. Dev.	\$13,535	102		\$14,707	100	\$21,694	142	
	Min	\$5,839			\$6,494		(\$868)		
	Max	\$52,806			\$57,367		\$80,657		
	NPV	\$159,848			\$181,594		\$203,428		
<b>MA+</b>	Avg.	<b>\$21,140</b>	21	92	<b>\$23,875</b>	151	<b>\$26,935</b>	48	147
	Std. Dev.	\$14,702	93	4	\$15,656	89	\$23,288	136	6
	Min	\$3,578			\$5,005		(\$4,026)		
	Max	\$55,285			\$59,007		\$82,975		
	NPV	\$161,862			\$183,054		\$202,872		
<b>DCA+</b>	Avg.	\$20,597	-56	98	\$23,742	78	\$26,328	-72	157
	Std. Dev.	\$17,154	77	6	\$18,047	71	\$26,552	113	8
	Min	\$1,182			\$4,590		(\$4,808)		
	Max	\$61,509			\$65,432		\$93,590		
	NPV	\$154,297			\$178,781		\$193,855		

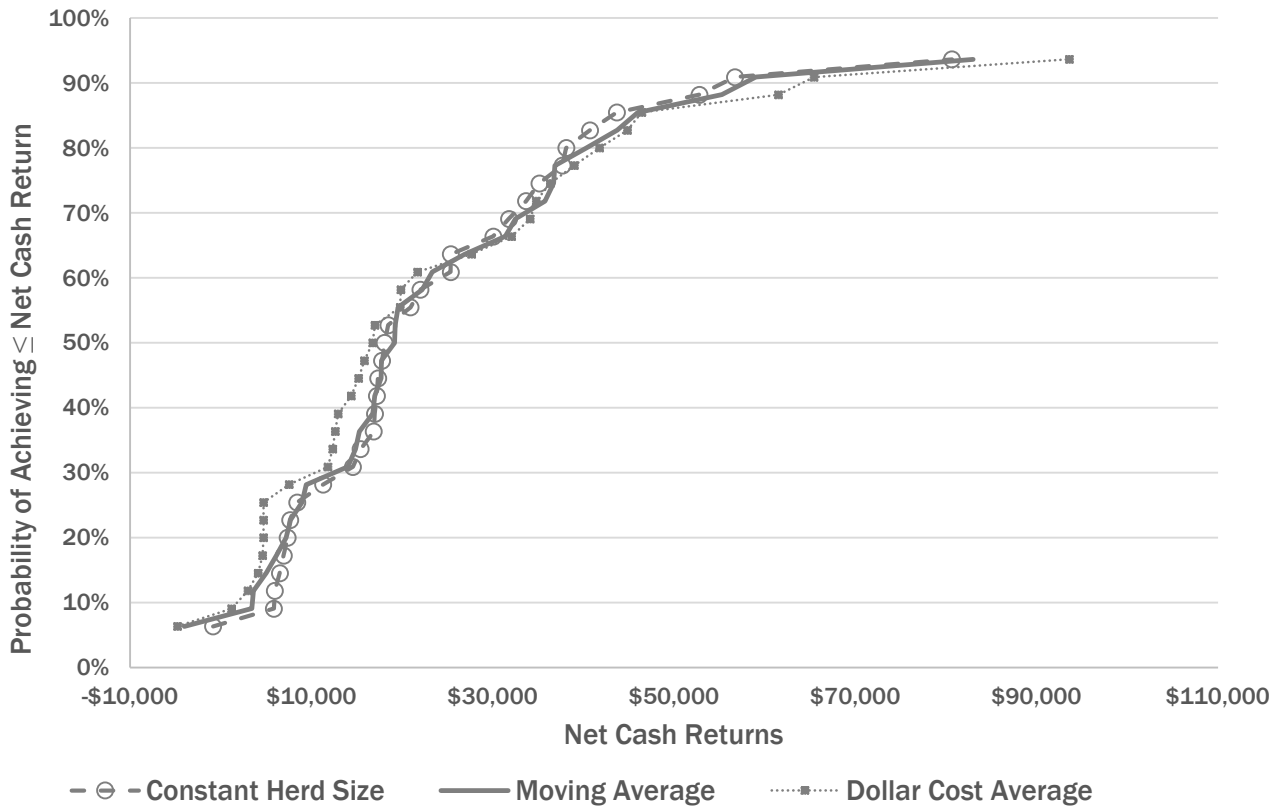
# RESULTS

## Cumulative Probability Density Functions of Net Cash Returns by Herd Size Management Strategy without Weather Effects.



# RESULTS

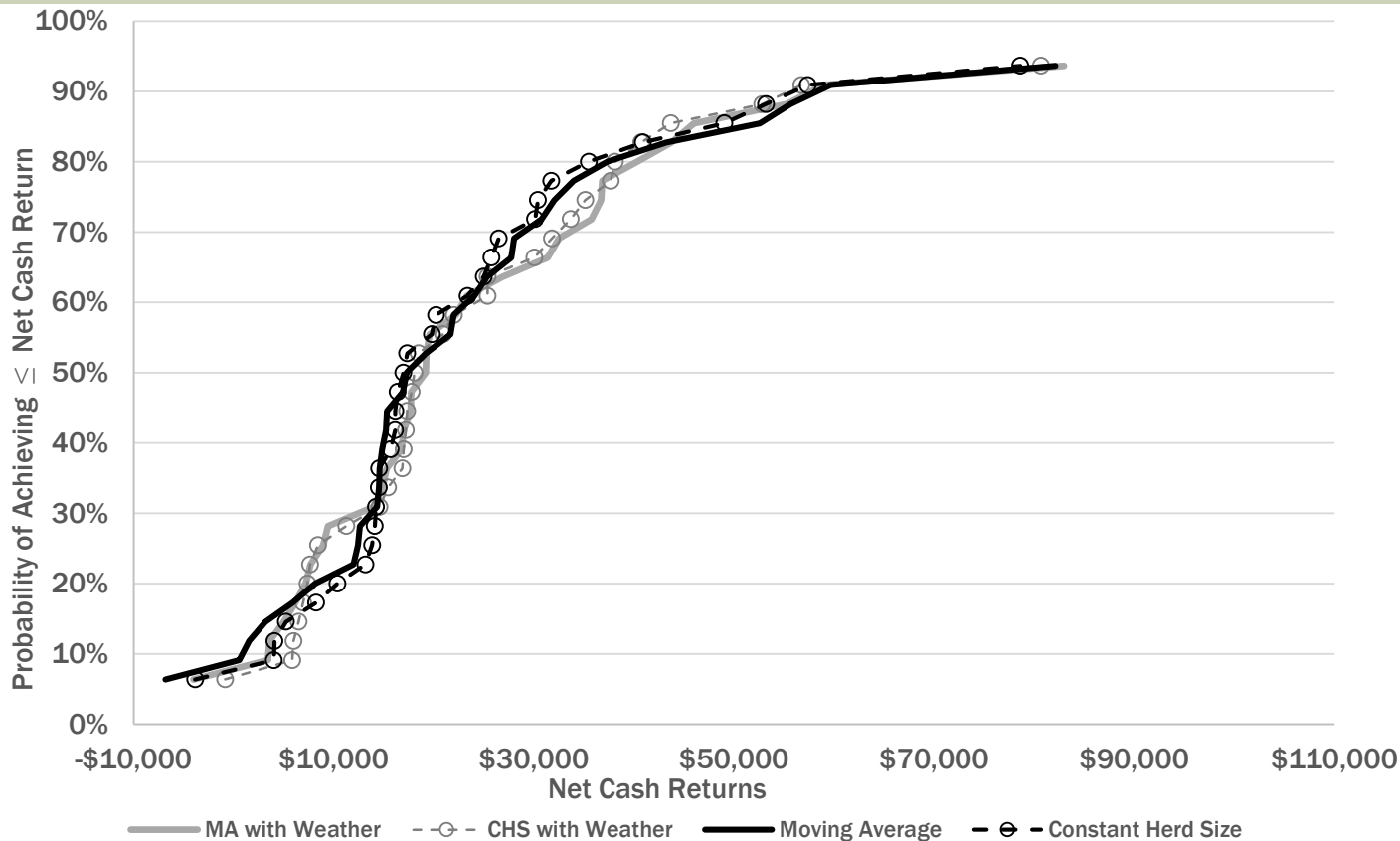
## Cumulative Probability Density Functions of Net Cash Returns by Herd Size Management Strategy with Weather Effects.





# RESULTS

Combined Cumulative Probability Density Functions of Net Cash Returns by Constant Herd Size and Moving Average Strategies With and Without Weather Effects.



# RESULTS

- The MA strategy generated the highest average net cash returns in five of six scenarios.
- In these five scenarios, the net cash returns for the MA strategy were \$198 or 0.8% higher than the next best strategy.
- The DCA strategy generated the highest net cash returns in one scenario.
- In every scenario, the CHS strategy created the smallest range in yearly returns.

# CONCLUSIONS

- The MA and DCA strategies have the potential to yield the highest net cash returns.
- The MA strategy proves that a price signal based management strategy can consistently generate slightly higher profits than a CHS strategy.
- The CHS strategy generates slightly lower profits, but creates the lowest risk in terms of net cash return volatility.
- Adding forage production risk with the vegetative index number did not modify results to a large extent.
- Using a constant herd size strategy was deemed most appropriate as management cost of determining herd growth or decline was not included

# LIMITATIONS

- A fixed land resource restricted the size of operation that was tested.
- With a much larger land base and herd, marginal increases in profits could be large enough to justify the use of a MA strategy.
- Hay carryover strategies are not analyzed.
- One cattle cycle (2004-2014) was examined.
  - Ethanol mandate and drought created record high prices.
  - Further research is needed to determine if the aforementioned conclusions remain constant across cycles.