Accelerated lamb production:

an opportunity to build markets and increase production efficiency

Presenter:

Richard Ehrhardt, Ph.D.

Small Ruminant Extension Specialist

Michigan State University

Host/Moderator: Jay Parsons

September 23, 2014

This webinar is being offered in cooperation with the American Sheep Industry Association Rebuild the Sheep Inventory Committee.

Overview:

- What is accelerated production and how does it compare to annual production systems?
- Resources required for a successful accelerated system
- Barriers to accelerated production success
- Approaches to insuring aseasonal breeding success

MICHIGAN STATE UNIVERSITY | Extension

What is accelerated lambing?

- Production system that decreases lambing interval to less than 12 months.
  - ✓Creates multiple birth periods
- Most accelerated systems have 2 major management groups:
  - ✓Ewes in late pregnancy or lactation
  - ✓Ewes exposed to rams or in early pregnancy

MICHIGAN STATE UNIVERSITY | Extension

What potential advantages does an accelerated system have over a traditional, annual system?

- **Lambs born and survival to market age/ ewe**
  - ❖ Annual:
    - ✓ Lambs born: 0.95 births/yr x 2.0 lambs/birth=**1.9** lambs/ewe/yr
    - ✓ Lambs to market age: 1.9 x 85% survival to market=**1.6** lambs/ewe/yr
  - ❖ Accelerated:
    - ✓ Lambs born: 1.37 births/yr x 1.9 lambs/birth=**2.6** lambs/ewe/yr
    - ✓ Lambs to market age=2.6 x 85% survival to market=**2.2** lambs/ewe/yr
- **Marketable lambs: lambs to sell per ewe/yr**
  - ➢ Ewe replacement rate is slightly higher but offset by increased lamb production
  - ➢ Marketable lambs/ewe, (lambs/ewe/year –ewe replacement rate)
    - ❖ Annual: 1.6-**0.22**=**1.38**
    - ❖ Accelerated: 2.2-**0.25**=**1.95**
    - ❖ **Accelerated: 41% greater annual ewe productivity**

What potential advantages does an accelerated system have over a traditional, annual system?

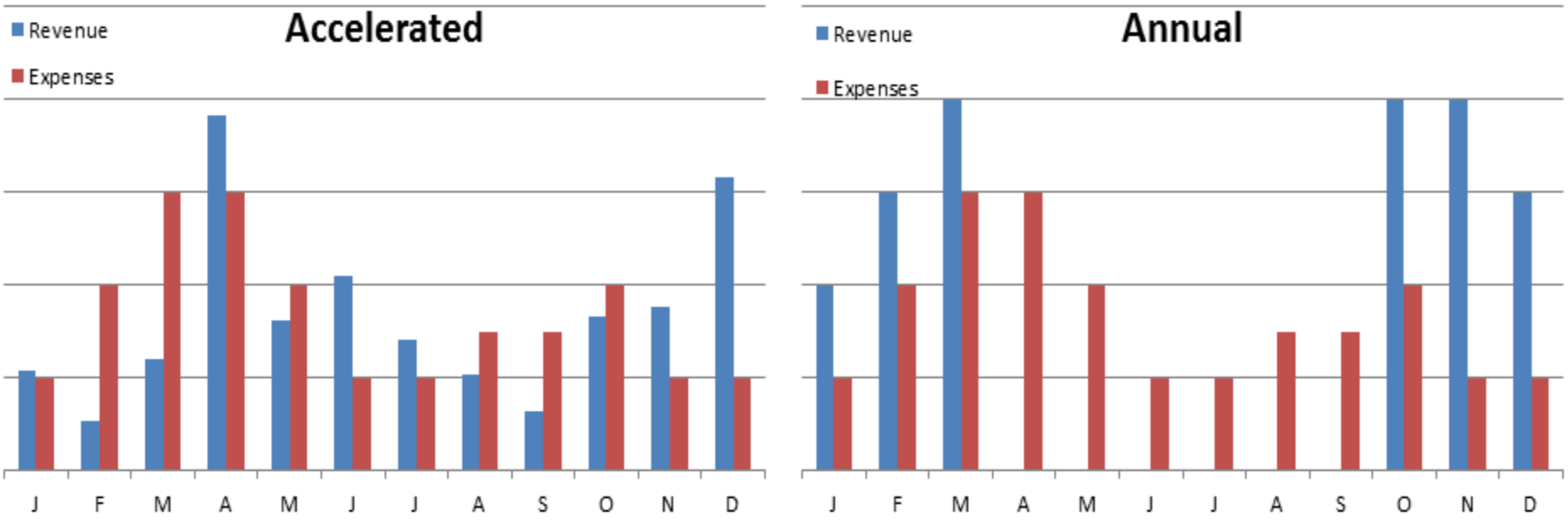
Marketing flexibility:

- Can hit a huge diversity of markets allowing more opportunistic marketing possibilities
  - ✓ Large, 140 lb lambs for traditional market
  - ✓ Small “roaster”, 40-50 lbs for non-traditional trade
- Year-round supply allows creation/access to new markets
- Reduced risk due to price fluctuations within a year

What potential advantages does an accelerated system have over a traditional, annual system?

- Cash flow advantages of accelerated production

Chart 1. Cash Flow: Accelerated versus Annual



* John Molenhuis, Ontario Ministry of Agriculture (OMAFRA), Proceedings of the Ontario Sheep Seminars 2013, Summary of 3 year benchmarking study on lamb production. Ontario Sheep Marketing Agency (OSMA) sponsored study

What potential advantages does an accelerated system have over a traditional, annual system?

Table 1. 3 year average results – top flocks – per lamb		
Per Lamb	Accelerated	Annual
Revenue	$202	$195
Feed costs	$78	$77
Other variable costs (excluding labour)	$51	$54
Fixed costs	$23	$24
Net enterprise income per lamb (before labour expenses)	**$50**	**$40**
Marketable lambs per ewe	1.9	1.3
Number of Ewes	708	918
Net enterprise income (before labour)	$66,906	$48,103
Ewes per person (labour)	354	481
Net enterprise income per person	**$33,359**	**$25,152**

* John Molenhuis, Ontario Ministry of Agriculture (OMAFRA), Proceedings of the Ontario Sheep Seminars 2013, Summary of 3 year benchmarking study on lamb production. Ontario Sheep Marketing Agency (OSMA) sponsored study

What potential advantages does an accelerated system have over a traditional, annual system?

- More lambs to sell/ewe/yr, >40%
- Greater net income (per ewe, lamb, unit labor or enterprise basis)
- Creation of year-round supply of lamb
  - ✓Create and build markets
  - ✓Reduced market risk
  - ✓Improvement in farm cash flow

Key strategies to improve the efficiency of sheep production:

- ***Lower feed costs***
  - ✓ ***Extend the grazing season***
  - ✓ ***Use inexpensive, by-product feedstuffs***
  - ✓ ***Strategic nutritional management***
- ***Decrease labor input***
  - ✓ ***Birth systems-pasture and indoor***
  - ✓ ***Efficient feeding systems-TMR and bale format***
- ***Increase production***
  - ✓ ***Prolific genetics***
  - ✓ ***Use of terminal sires***
  - ✓ ***Strategic nutritional management***
  - ✓ ***Reduce the birth interval***

Accelerated lambing-historical perspective

- Extension of efforts started in the 1960's to try to increase the efficiency of production
- Efforts in the U.K., Canada and U.S.A. led to a number of systems designed to decrease lambing interval using various breed combinations
- The Polypay breed evolved out of these efforts
- Brian Magee and Doug Hogue from Cornell studied a variety of systems and fixed on the STAR system in the early 80's.

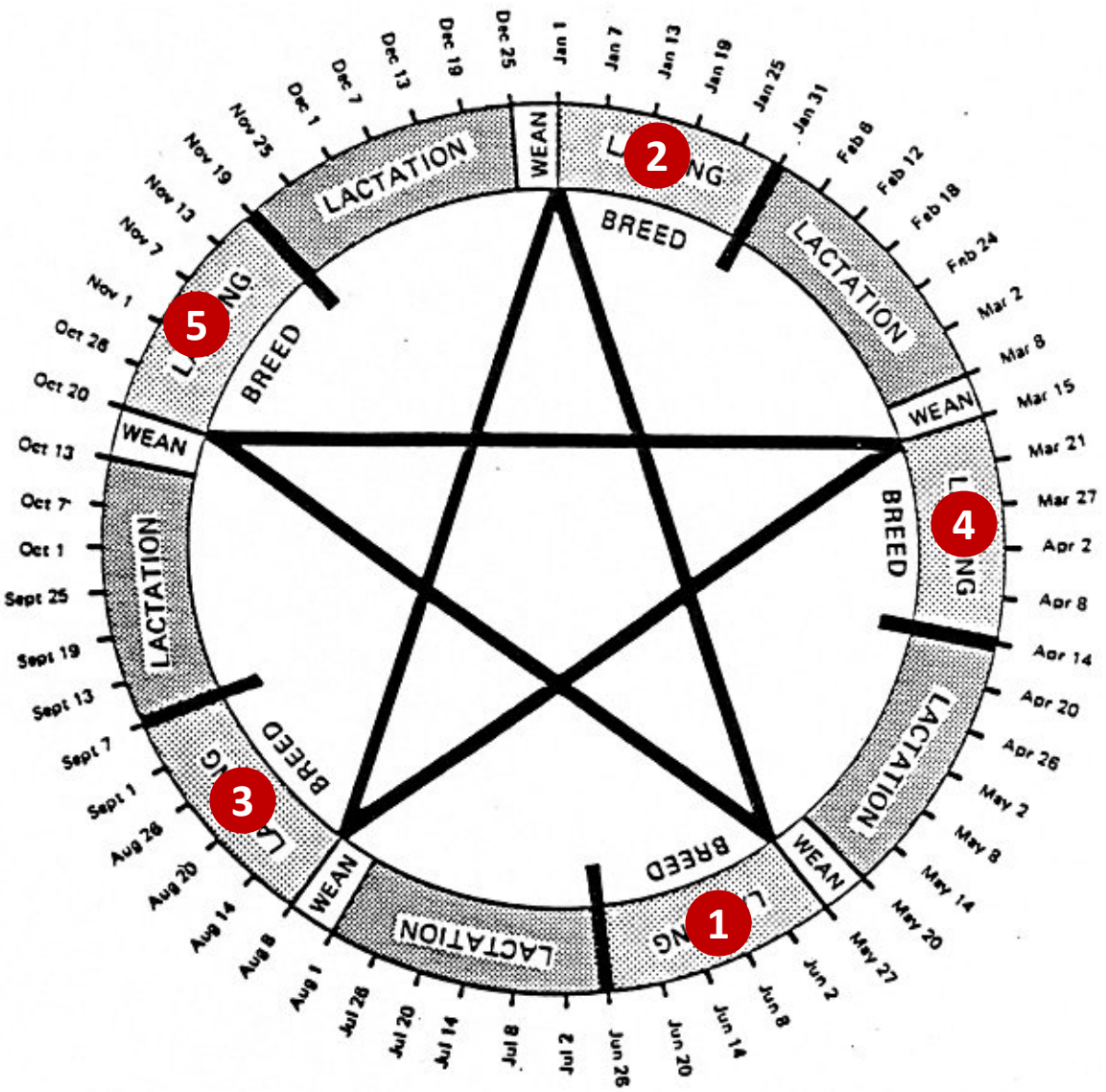
Accelerated production systems:

- **8 month system: 3 lambing periods in 2 years**

- **STAR system: 5 lambing periods in 3 years (7.2 month intervals).**

MICHIGAN STATE UNIVERSITY | Extension

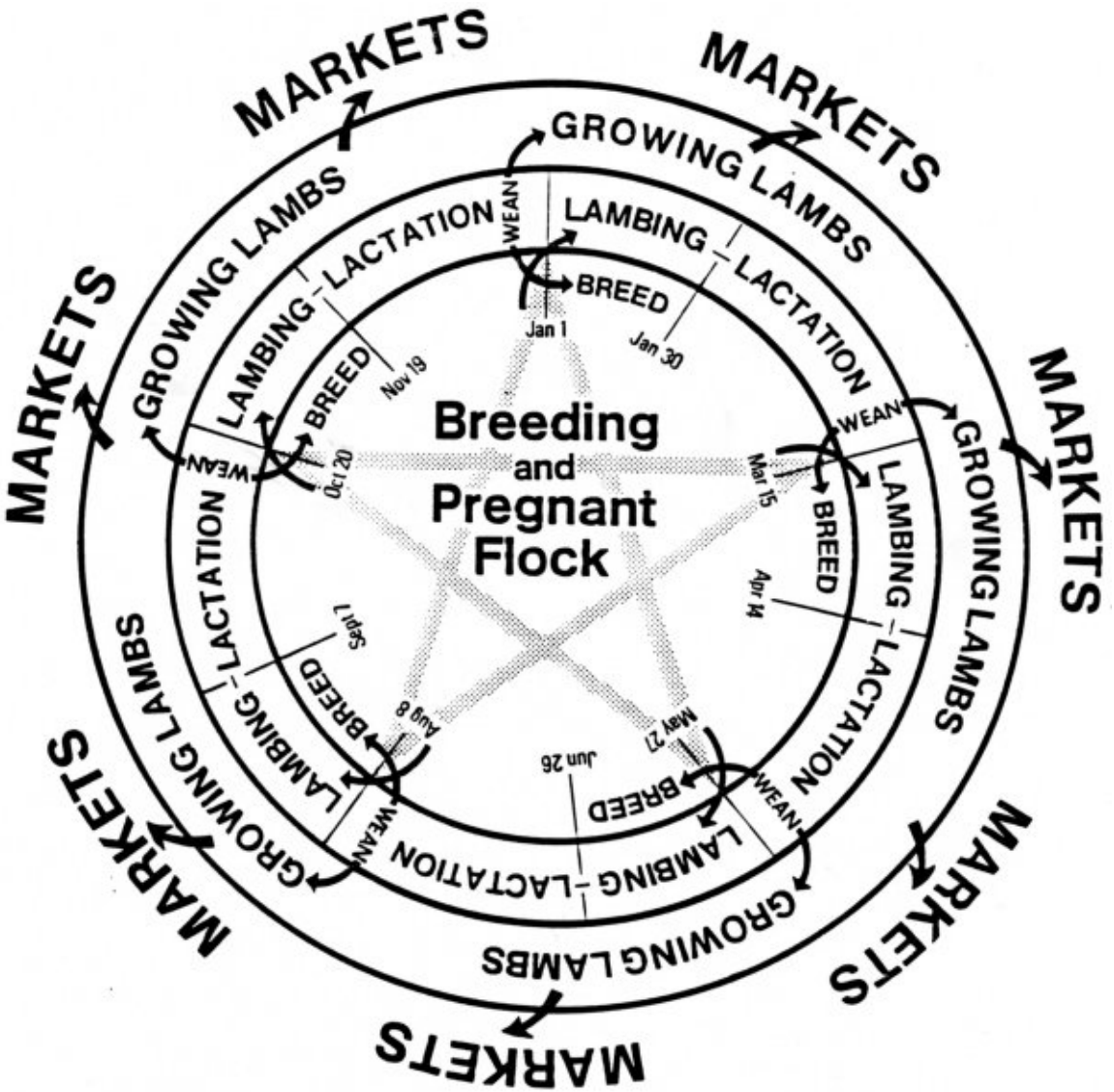
Cornell STAR® system



STAR system facts:

- Five, 73 day periods in one year
- Ewes can lamb at 7.2 mo intervals
- If ewes do not breed at first chance (7.2 mo) they can be rebred 72 days later (9.5 mo)
- 30 day lambing period
- 30 day breeding period
- 43-73 day lactation period
- Lambs are 43-73 days old at weaning

Cornell STAR® system



8 month system:

- Can alter birth periods a few weeks –creates flexibility to adjust for:
  - ✓Labor availability
  - ✓Need to hit specific market time table
  - ✓Variation in lactation length
- If ewes do not breed (8 interval) they must wait 120 days to be rebred (12 mo interval)
- Can allow ewes a few weeks of “recovery” between lactation and breeding
- Can lengthen breeding periods >30 days

MICHIGAN STATE UNIVERSITY | Extension

Summary of Accelerated Systems:

	STAR	8 month
Birth interval	7.2 mo	7-9 mo
Lactation length	42-72 d	42-100d
Breeding period	<30 d	< 51 d
Lambing periods/year	5	3
Breeding periods/year	5	3
Max. # of births/ewe/yr	1.67	1.5

- **Either system can be further manipulated by photoperiod and/or hormone therapy**

Accelerated production: Theory vs. Reality

- Few formal comparisons of accelerated systems or deviations of systems.

CEPOQ studies (Cameron et al. 2010):

	Births/ewe/yr (1.5 max.)	Lambs/birth	Lambs/ewe/yr
Lighting control	1.37	**2.81**	**3.85**
Progesterone therapy	1.26	2.27	2.86

Note: this productivity is incredibly high compared to systems in the rest of the world!

Kyle Farms, Avon, New York

2010-2013 production from 2000 ewes on an 8 month system: extended light

- 1.34 births/ewe/yr
  - ✓83% conception in October
  - ✓93% conception in May and Feb
- 1.73 lambs weaned/ewe/lambing
- 2.32 lambs weaned/ewe/year
- 2.07 lambs marketed/ewe/year
- *1.76 x maternal weight marketed in 2013*

2009-2013 production from 150 ewes on an 8 month system: extended light and teaser rams

- 1.38 births/ewe/yr
  - ✓86% conception in October
  - ✓93% conception in May and Feb
- 1.90 lambs weaned/ewe/lambing
- 2.62 lambs weaned/ewe/year
- 2.36 lambs marketed/ewe/year
- *1.79 x maternal weight marketed in 2013*

Resources required for accelerated production

- *Birth facility* capable of housing 2/3 of flock
- *Must provide a higher plane of nutrition over the year than annual birth* as females are in a more productive state a greater proportion of the time
  - ✓ High energy forages (grazing or harvested)
  - ✓ Energy concentrates at critical windows (lactation)
- *Chronic disease* issues are more apparent in accelerated lambing (foot rot, OPP, Johnes) as any ceiling imposed on production is more apparent in highly productive animals.
- ***Precise management*: nutrition, reproduction, health**
  - ✓ **An Ontario study* suggests that the productivity benchmarks for lambs marketed /ewe/year must be >1.3 for annual and >1.9 for accelerated for either system to be profitable.**
  - ✓ ***Implication? If your annual system cannot produce >1.3 marketable lambs per ewe per year, work on improving that before considering a switch to accelerated production.***

* John Molenhuis, Ontario Ministry of Agriculture (OMAFRA), Proceedings of the Ontario Sheep Seminars 2013, Summary of 3 year benchmarking study on lamb production. Ontario Sheep Marketing Agency (OSMA) sponsored study

Optimizing accelerated production:

- Nutrition
- Genetics
- Lighting protocols
- Hormone therapies
- Ram effect
- Male libido/fertility

Primary Barrier for Accelerated Systems

- *Aseasonal fertility (ewes pregnant/ewe exposed) varied from 18-92% between surveyed farms in New York in 2004.*
- *Producers reported large variations in aseasonal fertility from year to year within their flocks.*
- *A change in aseasonal fertility from 92% to 18% translates into a profit loss of 36% per ewe/year in a 3 lambings per year system.*

Why does aseasonal fertility vary so much within and between farms?

- *Genetics*
- *Environment*
  - *Nutrition*
  - *Chronic disease*

Sheep breeds that exhibit aseasonal fertility

Horned Dorset
*Polled Dorset**
Rambouillet
Merino
Romanov
Finn
Many hair breeds of West African decent

- *Aseasonal fertility is inversely related to the latitude unless selection pressure was exerted (i.e. Finn, Romanov, Dorset).*

Cross breeding enhances aseasonal fertility:

Heterosis and complimentarity

Examples of crosses used in accelerated lambing:

- *Romanov x Dorset*
- *Finn X Dorset*
- *Finn x Dorset x Ile de France x Romanov*
- *Finn x Dorset x Rambouillet*

Composites:

- *Rideau Arcott*
- *Polypay*

Field Study to identify factors that influence aseasonal fertility

Two flocks chosen that share the same genetic background- Finn x Dorset with a trace of Romanov and Rambouillet.

Fertility average over 3 years

	April-June Mating	Sept.-Dec. Mating
High Fertility Flock	84%	92%
Low Fertility Flock	25%	87%

Supported by SARE (Sustainable Agriculture Research and Education)

Ewe fertility and lambing percentage

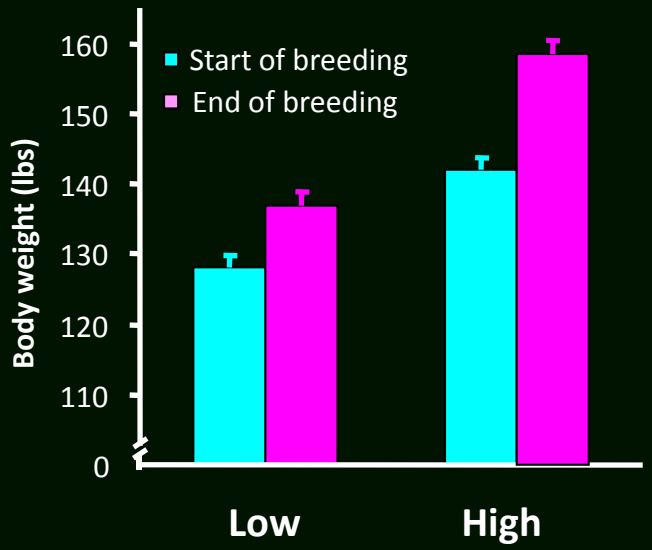
	Low Fertility	*High Fertility*
Fertility[1]:	32%	92%
Lambing Percentage[2]:	133%	206%

[1] Fertility expressed as ewe lambed/ewe exposed x 100%

[2] Lambing Percentage expressed as lambs born/ewe lambed x 100%

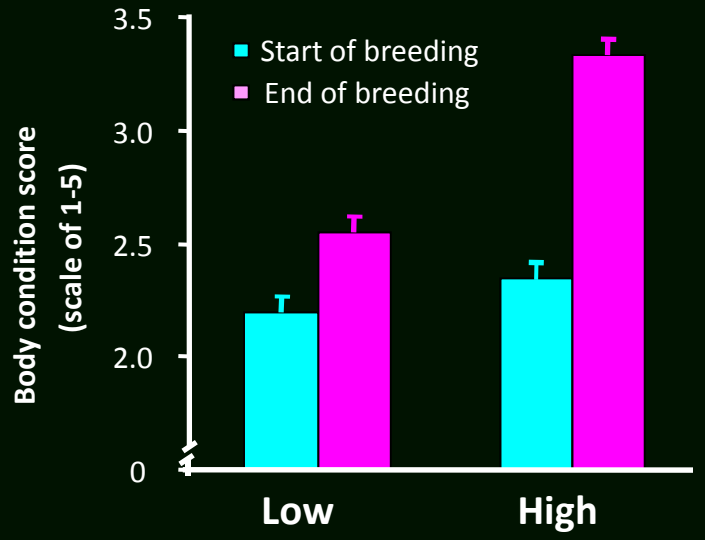
Nutritional status of ewes at the start and end of the breeding season

Body weight



P<0.001 Flock
P<0.001 Time
P<0.001 Flock x time

Body condition score



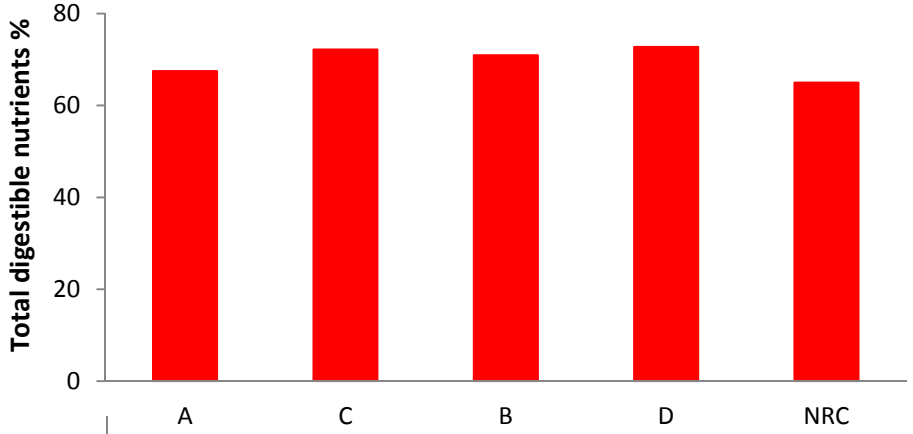
P<0.001 Flock
P<0.01 Time
P<0.001 Flock x time

Comparison of energy requirements between annual and accelerated systems at 200% crop (expressed relative to maintenance, 1.0):

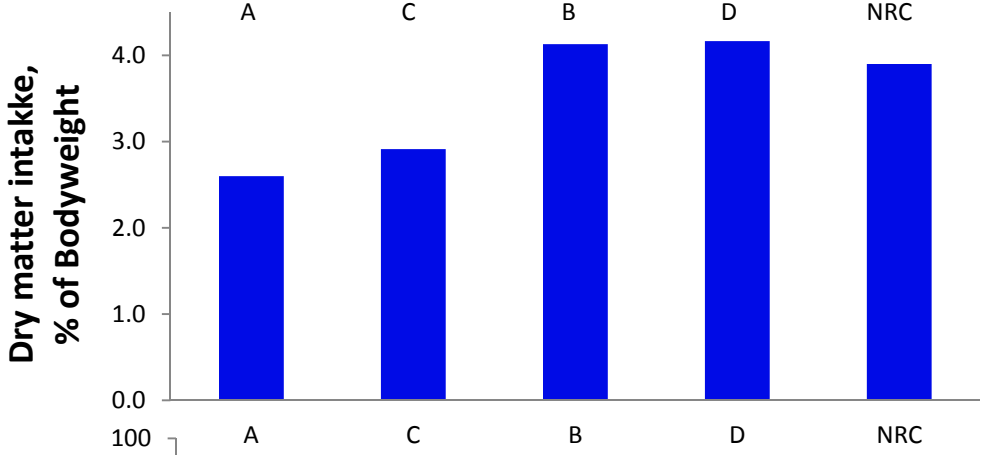
Period:	12 mo	8 mo
2wk pre-breeding	1.4	*1.4*
day 0-40 PC	1.2	1.2
day 40-115 PC	1.1	1.1
day 115-term	2.0	2.0
day 0-40 lactation	2.2	2.2
day 40-60 lactation	1.9	***2.2***

Energy nutrition during peak lactation (day 30) in 4 accelerated flocks during the winter rearing period

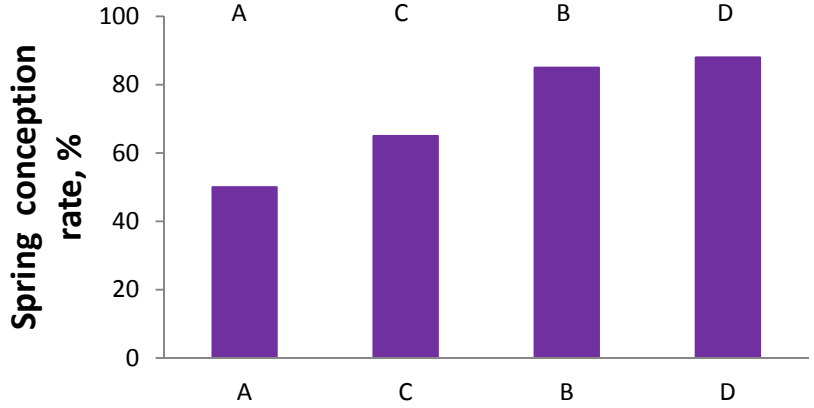
Dietary energy concentration



Feed intake



Spring conception rate



Forage quality as measured by fiber digestability differed markedly between high and low out of season conception farms

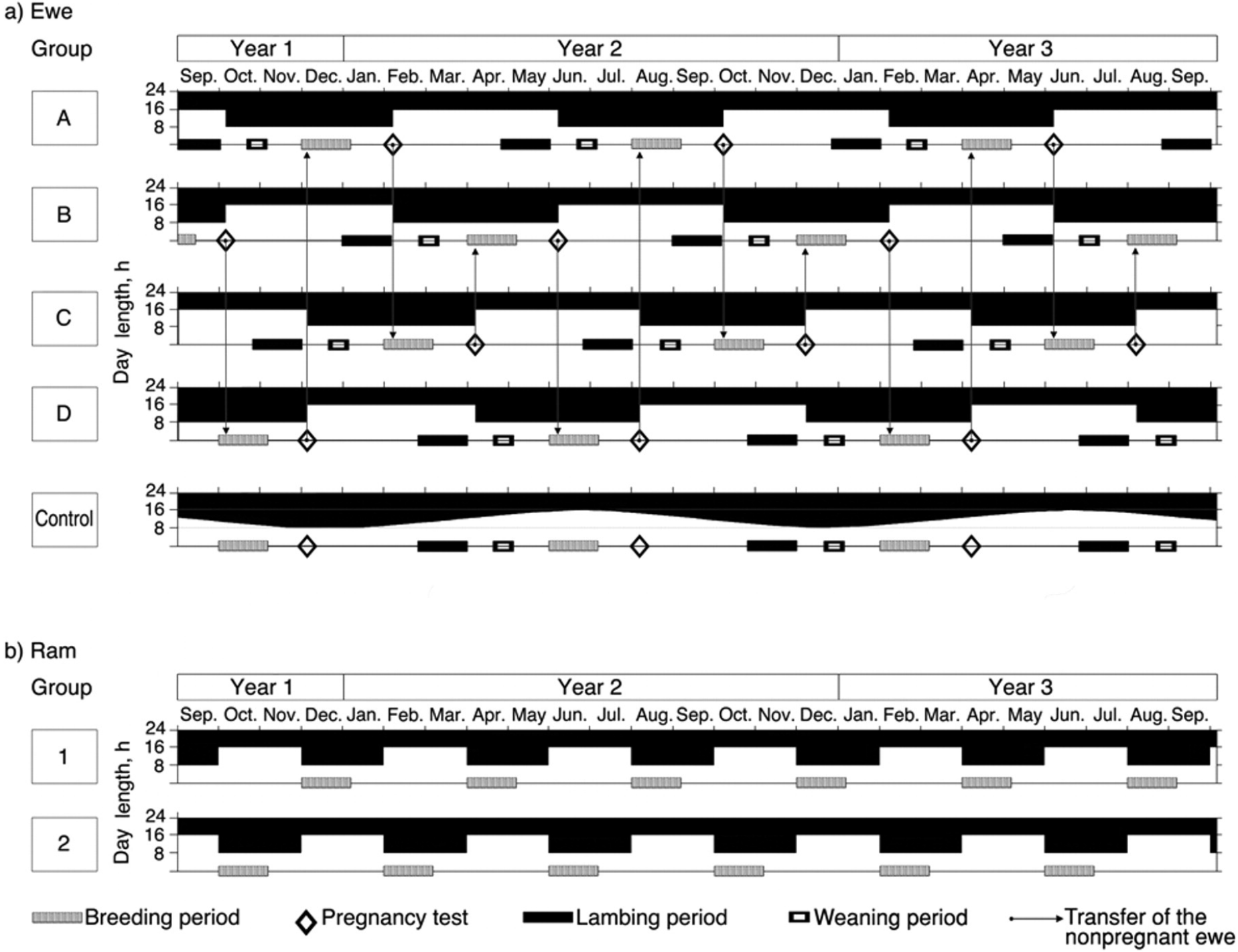
Nutritional management of accelerated lambing

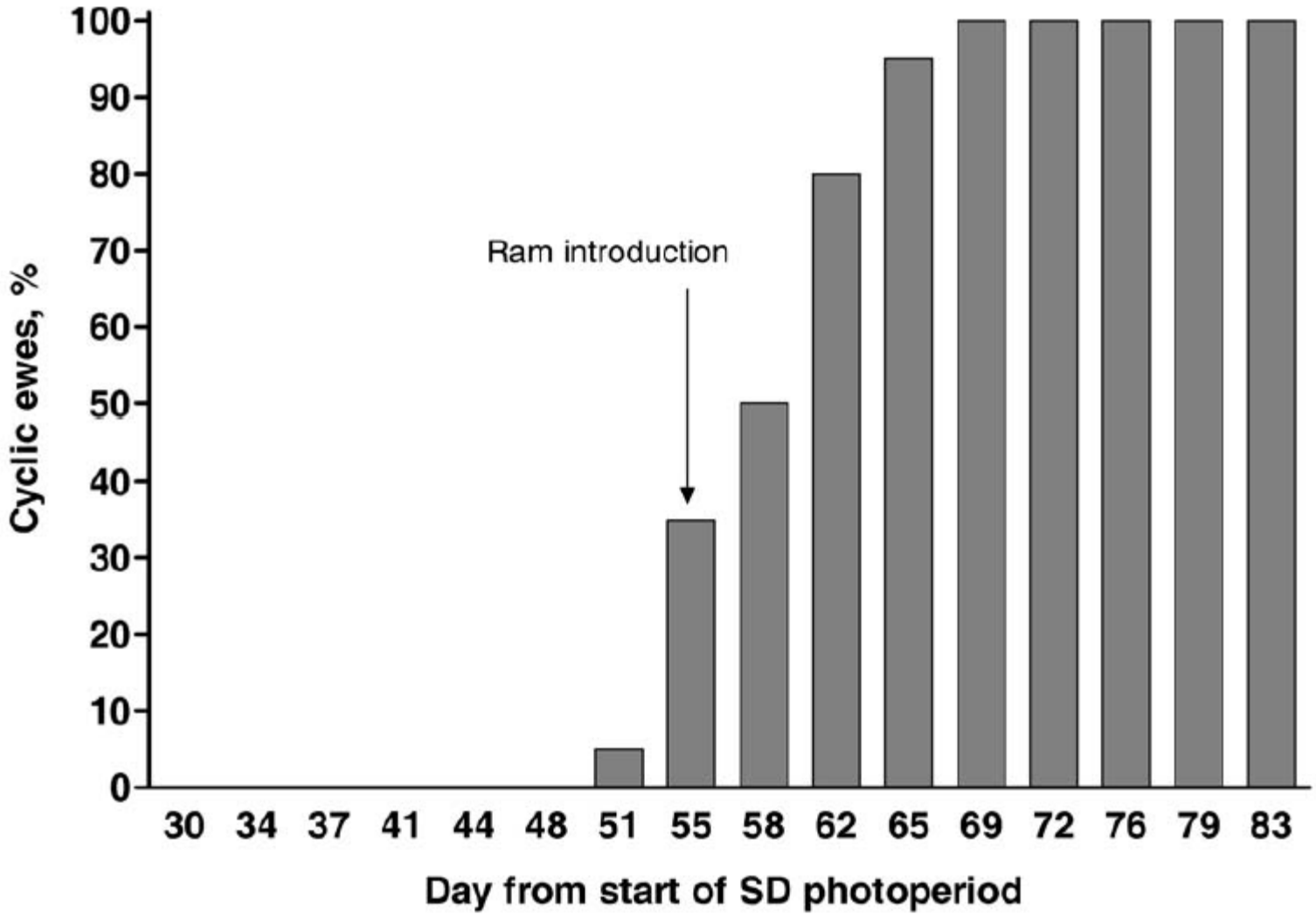
- Critical aspect yet has received little study
- Important windows:
  - ✓ Energy intake during lactation
  - ✓ Energy intake during the breeding season
- Field observations indicate a link between energy intake during lactation and subsequent spring breeding success. Intake may be limited by:
  - ✓ Neutral detergent fiber content and digestibility
  - ✓ Starch content

CEPOQ-photoperiod control

- Nearly continuous production (4 groups)
- Alternating 4 month light intervals (16L/8D; 8D/16L)
- Overlapping 8 month system
- Optimizes ovulation rate and conception
- Limited grazing, mostly confinement
- Maximum production (3.78 lambs per/ewe/year!!)

Cameron et al. 2010; Journal of Animal Science 88: 3280-3290


a) Ewe
Group
Year 1
Year 2
Year 3
Sep. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep.
A
B
C
D
Control
24
16
8
Day length, h
b) Ram
Group
1
2
Breeding period
Pregnancy test
Lambing period
Weaning period
Transfer of the nonpregnant ewe



Cameron et al. 2010, Journal of Animal Science 88: 3280-90

Extended day protocol:

- 60 days of 24 hrs light followed by 60 days of ambient lighting condition - turn in rams.
- 100 lux (10 FC) at ewe eye level (3.5 FC minimum)
- How I do it:
  - ✓ Bring ewes in from winter pasture on Jan 5.
  - ✓ Set lights to come on at dusk and off at dawn starting Jan 5.
  - ✓ Ewes lamb Jan 25 - Feb 20
  - ✓ Turn lights off on March 5, natural light thereafter
  - ✓ Put in rams May 5.

Extended day: under evaluation…

Field application in 2008 with 300 ewe flock:

- No change of spring conception rate in aseasonal ewes (Finn x Dorset x Ile de France, n=140-182).
  - ✓ 92% natural light (3 yr average [2005-7], n=132-186)
  - ✓ 94% extended day (2008, n=182)
- Huge change in spring conception rate in seasonal ewes (purebred and ¾ suffolk ewes,).
  - ✓ 0% natural light (2 yr average [2006-7], n=13-17)
  - ✓ 92% extended day (2008, n=16)

Extended day:

- Cost of $1.60/ewe/year for electricity use
- Bulbs cost $0.25/ewe/year
- Barn was lighted during winter lambing which created a stable environment for ewes and nice atmosphere for the shepherd

- ***Will it overcome the negative effect of sub-par nutrition on spring conception?***

Hormonal therapeutics to insure successful out of season breeding and to tighten birth managment:

- Progesterone CIDRs
  - ✓ FDA approved for use in sheep
  - ✓ 40-85% conception in spring

- Melengestrol acetate (MGA) plus gonadotropin
  - ✓ Not approved for sheep
  - ✓ Ceiling of ≈70% conception in spring as reported in commercial production in Canada

Ram “male” effect:

- Induces estrus in females “on the edge” of anestrus; synchronizes females that are naturally cycling
- 1 vasectomized male: 50 females
- Isolate females from males 30 days prior to exposure
- Introduce vasectomized males and remove 14 days later, females will exhibit estrus in two modes either 17-18 or 22-23 days following initial male exposure.

- ***Does it work on females that are deep in anestrus?***

- ***IT IS A VERY GOOD SYNCHRONIZATION TOOL!***

Male fertility:

- Male fertility and libido have a huge impact on the success of out of season breeding programs.

- ***How can you ensure that males are not limiting conception?***

Ensuring male fertility:

- Feed males 1.4X maintenance for 3 weeks pre-breeding

- Perform breeding soundness exam
  - ✓ Documents fertility but are all fertile males active breeders (have high libido)?

- Light priming: works well on all genotypes
  - ✓ 120 day protocol: 30 d (16h L/ 8h); 30 d (8h D/ 16 L), 30 d (16h L/ 8h); 30 d (8h D/ 16 L) then introduce rams/bucks.
  - ✓ Ensures high libido even in seasonal breeding rams/bucks

MICHIGAN STATE UNIVERSITY | Extension

Accelerated: reduced birth interval with multiple birth periods

- **Pros**

✓Year-round supply: create new and build existing markets

✓ Improve cash flow

✓ Reduced market risk

✓ Greater net income (per ewe, lamb, labor unit, enterprise)

✓Spreads labor out more evenly over the year

- **Cons**

✓ Higher level of management: nutrition, reproduction, health

✓ Requires a winter lambing period and facilities

✓ Steady labor requirement

✓ Requires higher quality forage (grazing or machine harvested)

Factors to consider in choosing accelerated production:

1. Land value: accelerated production systems are well suited for higher value, more productive land.
2. Genetics: aseasonal genetics are key, light control protocols reduce risk.
3. Can you buy or produce high quality forages?
4. Investment: accelerated production requires a greater initial investment (indoor lambing facility, feeding infrastructure) however the higher productivity creates lower fixed cost/lamb produced when depreciated over time.
5. Labor: accelerated production evens labor over the year but is a *steady* requirement.
6. Management benchmarks: If your annual program cannot attain >1.3 lambs marketed/ewe, it is unlikely that accelerated production will be a profitable option.

Accelerated lamb production:

an opportunity to build markets and increase production efficiency

Richard Ehrhardt, Ph.D.
Small Ruminant Extension Specialist
Michigan State University
Email: ehrhard5@msu.edu
Phone: (517) 353-2906 (office)
(517) 899-0040 (cell)

Host/Moderator: Jay Parsons

September 23, 2014

This webinar is being offered in cooperation with the American Sheep Industry Association Rebuild the Sheep Inventory Committee.

Consequences of poor out-of-season breeding success:

		Conception Rates			Number of ewes lambing (300 Ewe Flock)							
		Breeding Season			Year 1			Year 2			Total	Relative to
Program	Conception	Jan	May	Sept	Jan	May	Sept	Jan	May	Sept	2 years	Annual
Accelerated	Excellent	0.93	0.92	0.90	140	148	137	151	137	147	859	1.54
Accelerated	Average	0.93	0.90	0.67	140	144	104	182	106	130	806	1.44
Accelerated	Poor	0.93	0.90	0.35	140	144	54	228	64	82	714	1.28
Accelerated	Poor adjusted	0.93	0.90	0.35	140	144	54	150	135	58	681	1.22
Annual	Excellent			0.93			279		279		558	1.00

MICHIGAN STATE UNIVERSITY | Extension