

Updated 10/20/2008

Crossbreeding systems

Rotational systems
Terminal systems
Composites



These notes are intended as an outline. It is still important to take notes.

To design a crossbreeding system consider:

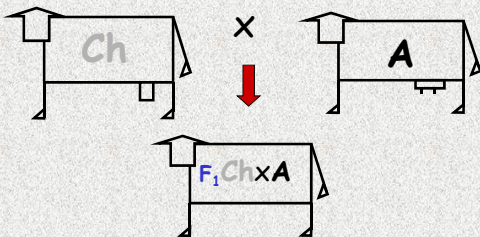
- o Herd size
- o Source of replacement heifers
- o Number of breeding pastures
- o Level of management

To take advantage of heterosis & complementarity



On the web

Terminal sire with straightbred females

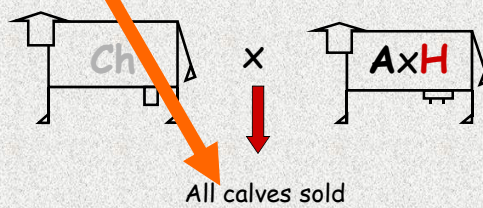


F₁ has maximum individual heterosis.
The purebred A cows have **no** maternal heterosis.
Need to have a portion of the herd purebred A to maintain system (or could purchase) purebred A females

Increase calf production/cow exposed by 9 %

On the web

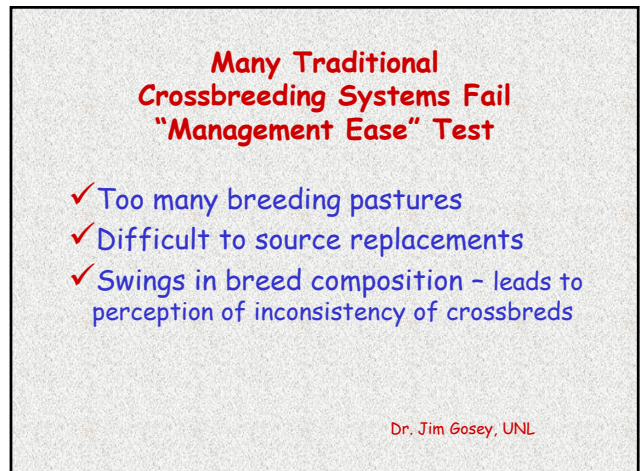
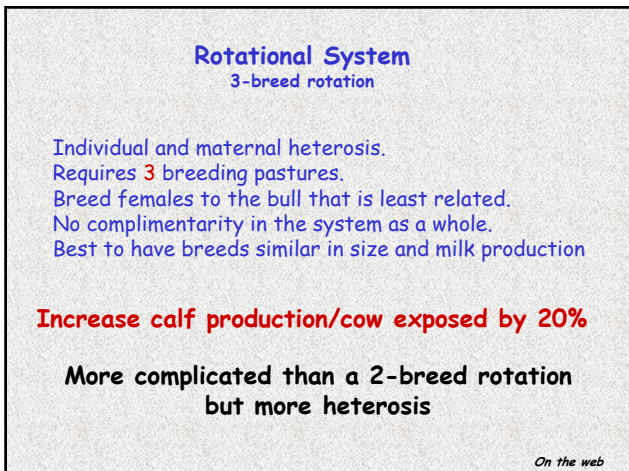
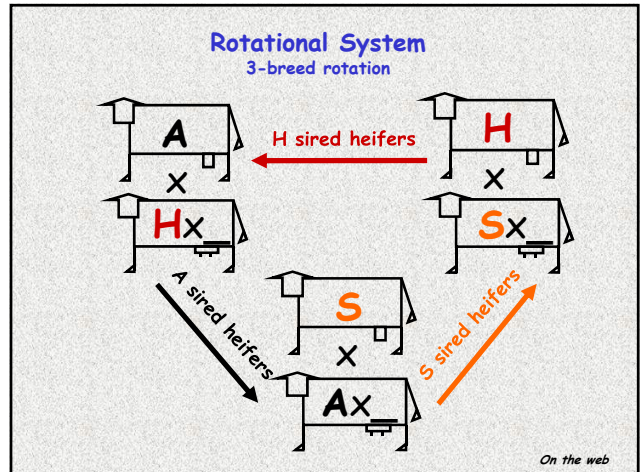
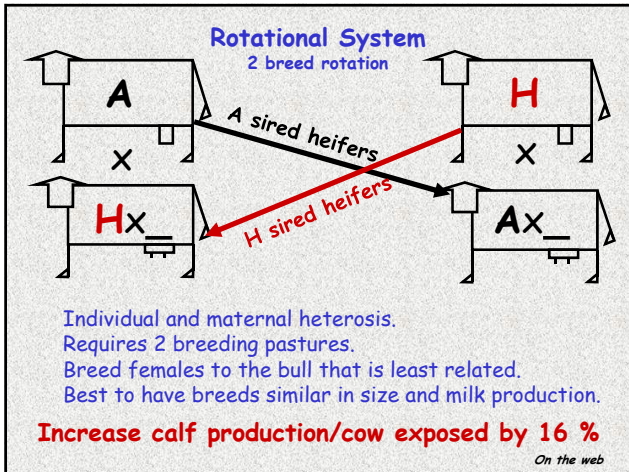
Terminal sire with crossbred females



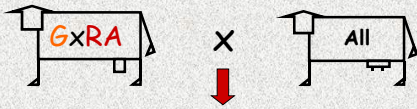
Maximum individual & maternal heterosis.
Can take advantage of complementarity.
Simple - 1 breeding pasture.
Can not raise replacements within this system.

Increase calf production/cow exposed by 28 %

On the web



2 breed composite (hybrid) bulls



After several generations the cow herd and progeny will be about 50% G and 50% RA.

- Individual and maternal heterosis.
- 1 breeding pasture.
- No complementarity
- Consistent breed makeup over several generations
- Simple but with the advantage of heterosis

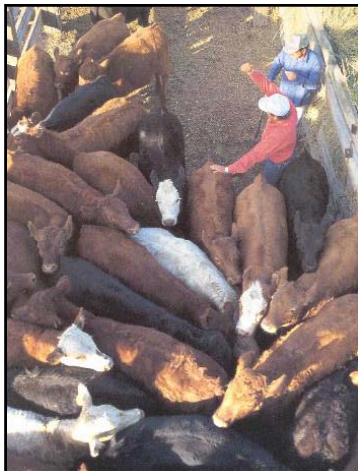
Increase calf production/cow exposed by 13 %

On the web

Meat Animal Research Center
Clay Center, NE

Composite Lines

<u>MARC 1</u>	<u>MARC II</u>	<u>MARC III</u>
Charolais	Gelbvieh	Pinzgauer
Limousin	Hereford	Angus
Hereford	Simmental	Red Poll
Braunvieh	Angus	Hereford
Angus		
Terminal	General Purpose	Maternal



Uniformity?

Quantitative traits

Qualitative traits

Variation of quantitative traits

Trait	Purebred	Composites
Wean weight	.10	.11
ADG	.11	.11
SC	.07	.07
Backfat	.48	.44
Marbling	.27	.29

* coefficient of variation

Gregory, MARC

for commercial producers

Advantages of using composite bulls

- ✓ Simple breeding system with heterosis
- ✓ Heterosis with uniformity through consistent genetic makeup (50% British/50% Continental or 75% British/25% Continental)
- ✓ Do not compete with seedstock producers for bulls

Disadvantages of using composite bulls

- ✓ Less heterosis than rotational systems
- ✓ ?Maybe less genetic info on parents?
- ✓ Non-traditional

On the web

for seedstock producers

Advantages of producing composite bulls

- Heterosis for lower cost of production
- Lower investment in breeding stock, fees, etc.
- Possibly wider customer base by filling a niche

Disadvantages of producing composite bulls

- Maybe lower sale prices
- 2-breed composites simple to produce but 4-breed composite complicated and requires large population base and long term planning.

On the web

Hybrid Vigor is Dollars in the Bank
Dr. Harlan Ritchie, Bottom Line, Spring 2006

During the past five years, use of hybrid bulls has increased at an exponential rate.

In the pork industry, about 70 percent of the hogs marketed in the US are from hybrid parent stock.

In the poultry industry, essentially 100 percent of the birds now come from hybrid parent stock.

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Combining systems to take advantage of complementarity and raise replacement

- ✓ Young cows more likely to have calving difficulty when bred to terminal sire breeds.
- ✓ It makes sense to breed terminal sires to mature cows and maternal bulls on younger cows (<=4) to generate replacement females.
- ✓ Possible combinations to raise replacement heifers & take advantage of complementarity:
 - Rotational system on young cows, terminal sires on mature cows (>4)
 - Composite bulls on young cows and terminal sires on mature cows (>4)

Levels of Expected Heterosis for Various Mating Systems

Mating System	% of max. heterosis ^a	increase in wt weaned/cow exposed, %
Pure breeds	0	0
2-breed rotation at equilibrium	67	16
3-breed rotation at equilibrium	86	20
Terminal sire x purchased F ₁ females	100	23-28
2-breed rotation & terminal sire	90	21
2-breed composite ($\frac{1}{2}$ A, $\frac{1}{2}$ B)	50	12
3-breed composite ($\frac{1}{2}$ A, $\frac{1}{4}$ B, $\frac{1}{4}$ C)	63	15
4-breed composite ($\frac{1}{4}$ A, B, C, D)	75	18

^a Relative to F₁ @ 100%

On the web

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