


# Breed Utilization and Production Efficiency




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# Introduction




- **Production (Economic) Efficiency**  
➔ Output:Input (or Profit \$ = Output \$ - Input \$)

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- **Production (Economic) Efficiency**  
Output:Input (or Profit \$ = Output \$ - Input \$)
- ➔ Total Industry.....not just one producer or one segment

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# Introduction



- **Production (Economic) Efficiency**  
Output:Input (or Profit \$ = Output \$ - Input \$)
- Total Industry.....not just one producer or one segment
- ➔ What are the key cattle characteristics?

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# Introduction



- **Breed Utilization**  
➔ Single breed – choosing between them?


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# Introduction



- **Breed Utilization**  
Single breed – choosing between them?
- ➔ Crossing systems where each breed contributes as a sire and a dam?

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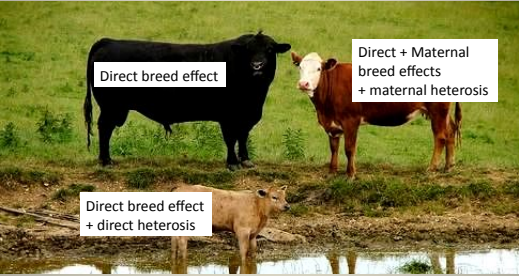
## Introduction

- **Breed Utilization**  
Single breed – choosing between them?
- Crossing systems where each breed contributes as a sire and a dam?
- ➔ Crossing systems where breeds have a role as either a sire OR a dam?

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## Genetic Components



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## Balancing Act!



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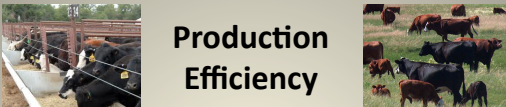
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## Or.....Lack of Balance!



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## Production Efficiency

- **Key cattle characteristics**  
Cow & bull fertility; calf survival ➔ HETEROSIS  
Growth rate ➔ heterosis  
Marbling & fatness  
Feed intake for maintenance

MacNeil et al. (1994), MacNeil (2005) & Barron Lopez (2013)

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## Breed Utilization

- **Variation between breeds in these key cattle characteristics is available for the industry to utilize for increasing efficiency—this variation is GOOD!**


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### Breed Utilization


- Breeds differ in allelic frequencies of many genes, due to different selection histories and different mutation events.
- Some frequency differences are at the extreme (0 vs 1), others are more subtle.

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### Breed Utilization

- Different frequencies between breeds produce more heterozygosity and thus heterosis when we produce crossbreds.
- *Bos taurus* vs *Bos indicus* breeds are the most different, hence the most heterosis expressed.


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### Production Efficiency

- Breed to be used as both a sire and a dam in commercial beef production

Cow & bull fertility; calf survival  
Growth rate  
Marbling & fatness  
Feed intake for maintenance

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### Production Efficiency

- Breed to be used only as a sire (or part of) in commercial beef production

Bull fertility; calf survival  
Growth rate  
Marbling & fatness  
Feed intake for maintenance


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### Production Efficiency

- Breed to be used only as a dam (or part of) in commercial beef production


Cow fertility; calf survival  
Growth rate  
Marbling & fatness  
Feed intake for maintenance – **GREATER IMPORTANCE**

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### Production Efficiency

- Nebraska research – crossbred cows, using breed differences to have differing levels of milk production, and hence in feed costs for maintenance of cows and calves
- System through slaughter  
Montano-Bermudez et al. (1990) ; van Oijen et al. (1993)


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### Production Efficiency

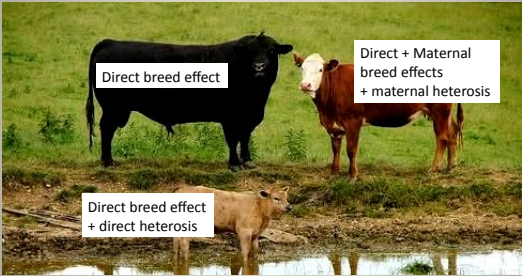



- Nebraska research – crossbred cows
- Low milk cows had 7% greater biological and 5% greater economic efficiency, respectively, than higher milking cows

Montano-Bermudez et al. (1990) ; van Oijen et al. (1993)


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### Genetic Components




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### Reasons for Crossbreeding




- Gain HETEROISIS in calves and cows
- Combine strengths and overcome weaknesses by using breed combinations – complimentary
  - Dam breed x Sire breed
  - or
  - Balancing strengths as both breeds contribute as dams and sires in the system

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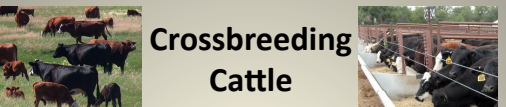
### Reasons for Crossbreeding




- Can aid in matching cow breed type to an environment while producing calves that add value through the production chain
- With heterosis, can improve performance in more challenging environments...but not an excuse for not trying to improve conditions!

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### Crossbreeding Cattle



- The BIG CHALLENGE: a system to sustain a cowherd due to the low reproductive rate of females....very unlike swine or broilers
- Terminal crossing (dam breed x sire breed complimentary) is limited to <50% of commercial production

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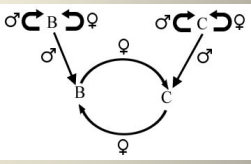
### Single Breed or Composite



- Commercial herds purchase bulls from seedstock producers, heifers from own herds
- Choose breed(s) based on all key characteristics




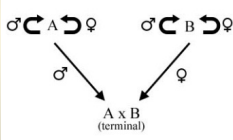
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### Rotational Crossing


- Commercial herds purchase bulls from seedstock producers, heifers from own herds
- Choose breed(s) based on all key characteristics

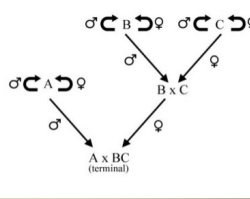
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### Terminal Crossing


- Commercial herds need replacements of both heifers and bulls
- Choose dam breed & sire breed on some same and some different key characteristics

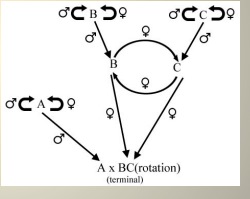
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### Terminal Crossing


- The impact of dam reproductive rate on number in terminal cross:
  - Swine: ~90%
  - Cattle: ~40%


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### Terminal Crossing


- Rota-terminal using rotation to generate replacement females
  - Cattle: still ~40% but more heterosis


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### Crossing Systems


- Selecting from 10 breeds
  - 45 unique 2-breed rotations
  - 120 unique 3-breed rotations
  - 360 unique rota-terminals
  - 45 unique composites of 2 breeds (1/2 ea)
  - 210 unique composites of 4 breeds (1/4 ea)

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### Crossing Systems

- Nebraska simulation research (14 breeds) of the full system: for each system, included all groups to sustain life-cycle production
  - Fixed: amount grass resource & slaughter endpt
  - Economic measure: Profit = Income – Expense

Tomsen et al. (2001) 

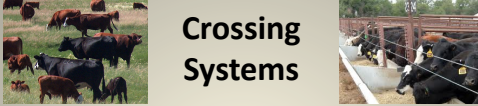
### Balancing Act!



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### Crossing Systems




- Percentage gain (or loss) in Profitability of the **10 best (or 10 worst)** in the crossing system over the **3 best** of the purebreds:

	<u>10 Best</u>	<u>10 Worst</u>
– Two-breed rotation	32%	-20%
– Rota-terminal	55%	-28%
– Composite (4-breed)	51%	-15%

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### Summary




- Breeds of cattle differ, and that is **GOOD!**
- Crossbreeding: capitalize on cow and calf heterosis – especially for reproduction & survival
- Crossbreeding: use breed strengths for complementarity – direct and maternal effects

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### Summary



- Key characteristics that impact production or economic efficiency
- Some crossing systems use breeds as both sire and dam inputs, so all key characteristics are important; others use breeds as only a dam or only a sire, so different use of key characteristics

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### Summary



- Wise breed choices and crossing systems will improve economic efficiency for the industry
- But, poor breed choices for specific crossing systems can produce poorer industry efficiency than using the better pure breeding programs

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## Thank You!

## Questions?

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