

# Review of Principles of Crossbreeding

**Randy Wiedmeier, Regional Livestock Specialist, South-Central Area**

First the **disclaimer**, I have minimal formal training in the field of breeding and genetics. Please contact your state extension animal breeding and genetics specialist for more pertinent information. The following are a few facts and opinions regarding the importance of using a well-planned crossbreeding system in commercial cow-calf operations.



**Crossbreeding:** Many of us harbor cattle breed preferences or prejudices. So crossbreeding may be a difficult concept for some. **Crossbreeding is the mating of two animals of different established breeds**, for example Hereford x Angus. The two major reasons for crossbreeding cattle are **1) Breed Complementarity and 2) Heterosis**. Breed complementarity is selecting and mating cattle breeds that have opposing trait strengths and weaknesses to obtain the desired effect. The following table summarizes a few cattle breed strengths and weaknesses (x=lowest, xxxxx=highest):

Breed	Growth Rate/Mature Size	Lean to Fat Ratio	Milk Production
Breed 1	X	X	XXXXX
Breed 2	XXX	XX	XXX
Breed 3	XXXXX	XXXXX	X
Breed 4	XXXXX	XXXX	XXXX
Breed 5	XXXX	XXX	XXX

Other important complementarity traits are heat resistance, eye and udder pigmentation, and disposition. Heterosis is the improvement in productivity of crossbred offspring compared to the average of the breeds used in the cross. The following table depicts the principle of Heterosis for **Calf Weaning Weights** :

Breed	Lower Breed Productivity	Higher Breed Productivity
Breed 6	410	510
Breed 7	390	490
Average of Two Breeds	400	500
Average of Crossbreds	420	525
% Heterosis	$(420 - 400) \div 400 = 5\%$	$(525 - 500) \div 500 = 5\%$

It is important to remember that, although crossbred calves will exhibit heterosis, much of the improvement in beef cattle productivity associated with crossbreeding can be accounted to the heterosis shown by **crossbred cows** regarding **Pounds of Calf Weaned per Cow**:

Breeding System	% Heterosis (hybrid vigor)
Straightbred Cows and Straightbred Calves	0
Straightbred Cows and Crossbred Calves	8.5
Crossbred Cows and Crossbred Calves	23.0

Before the importance of Heterosis can be fully appreciated, another breeding principle must be reviewed, Heritability. **Heritability** is defined as the proportion of the variability in a trait that can be

assigned or attributed to Heredity or genetic differences. Heritability's are expressed as Percents (%). Heritability of traits is often considered to be **low (0 to 20%), medium (20 to 40%), or high (40 to 60%)**.

There is a certain degree of **Complementarity between Heterosis and Heritability**. The Heritability of important reproductive traits is quite low but the Heterosis (hybrid vigor) of those traits is high. So genetic selection for reproductive trait would result in slow progress, but crossbreeding would result in relatively rapid progress. Conversely, Heterosis is not affective with regard to USDA carcass traits but rapid progress can be made through genetic selection, Heritability.



The following table shows **Heterosis/ Heritability Complementarity** regarding important traits associated with the Farm/Ranch, the Feedlot, and Carcass/Meat characteristics.

Trait	Heterosis	Heritability
<b>Ranch</b>		
Percent calf crop weaned	High	Low
Cow Longevity	High	Low
Sale Weight	Moderate	Moderate
Cow Lifetime productivity	High	Low
<b>Feedlot</b>		
Growth Rate	Moderate	Moderate
Disease Resistance	Moderate/High	Low
<b>Product</b>		
Palatability	Low	Moderate/High
Cutability	Low	Moderate/High

The following table shows the difference in economic expectation when an operation switches from a **straightbred system** to a well-managed **two-breed sire rotation crossbreeding** program after the herd is composed primarily of crossbred cows. Remember this is an example using estimates.

Item	Straightbred	Crossbred
Annual Cow Cost, \$/cow/year	800.00	800.00
Calf Weaning Weight, lbs.	550.00	578.00
Cow Weaning Percentage	80 (.80)	88 (.88)
lbs. Calf Weaned /cow/year	440.00	508.64
Calf Breakeven Price, \$/lb.	1.82	1.57
Calf Breakeven Value, \$/calf	1001.00	907.40
Calf Market Price, \$/lb.	1.71	1.66
Calf Market Value, \$/calf	940.50	959.48
<b>Profit/Loss</b>	<b>-60.50</b>	<b>+52.02</b>

For more detailed information on the management and expected results of different types of beef cattle crossbreeding systems refer to <https://extension2missouri.edu/g2040>.