

The Common Denominator



Many commercial cow/calf operators enhance the profitability of their operations through thoughtful application of heterosis and breed complementarity made available through crossbreeding.

Since 1960, the Red Angus Association of America (RAAA) has promoted planned crossbreeding systems as a tool for sustainable and profitable commercial beef production. Red Angus' balance of economically relevant traits makes it a flexible, user-friendly component of any crossbreeding plan.

Today, Red Angus breeders fulfill this commitment by offering the beef industry's best objectively described seedstock and marketing programs designed to provide value and identity to Red Angus influenced cattle. Thus, allowing cow/calf operators to create a more valuable product.

Red Angus Crossbreeding Solutions

Crossbreeding Tools



Genetic Change = Heritability x Selection Pressure

Heritability is the proportion of an animal's genetic merit that is - on average - transmitted to their offspring. Heritability varies for different traits, (see Table 1 – opposite page). Reproductive traits tend to have low heritabilities, while growth traits are moderate and carcass characteristics typically have higher heritabilities.

Selection pressure utilizes genetic variation. In practice most selection pressure involves utilizing bulls whose genetic merit (for those traits the producer seeks to improve) is superior to the average of the cows they will breed. In Crossbreeding, genetic variation comes from both the selected variation within a breed (represented by EPDs), and the genetic variation between selected breeds (breed differences). When selection pressure is applied across breeds to allow one breed's strength to offset another's weakness, these breed differences are referred to as **Breed Complementarity**.

Breed Complementarity...

...occurs from combining the desirable characteristics of two or more breeds to achieve a higher frequency of desired genes among the crossbreds than could be found within a single breed.

In other words, the strong points of one or more breeds can be used to compensate for the weaknesses of another breed. Thus, benefits gained through taking advantage of breed differences are due to “additive” gene effects. Different breeds excel in different traits. British breeds are traditionally categorized as maternal, efficient cattle that produce high quality carcasses, Continental cattle are known for producing lean carcasses with high red meat yield, and Zebu breeds can offer heat tolerance and increased insect resistance.

Large breed differences exist in traits such as:

Growth Rate	Carcass Composition	Age at Puberty
Mature Size	Calving Difficulty	Milk Production

The “ideal cow herd” and breeding program varies depending on the area in which your operation is located, your product, and your target market. Once you have analyzed these aspects of your operation you can design and implement a breeding program that will help you achieve your production goals.

Heterosis (hybrid vigor) results from “nonadditive” gene effects. Heterosis is defined as the percent of superiority expressed in a trait by crossbred progeny over the average of the parents’ breeds in the cross.

Heterosis is calculated by the following formula:

$$\frac{\text{Crossbred Avg.} - \text{Straightbred Avg.}}{\text{Straightbred Avg.}} \times 100 = \% \text{ Heterosis}$$

i.e. assume that the two parent breeds in a cross had weaning weight averages of 575 and 475 lb. And their crossbred progeny averaged 550 lb. The percent of heterosis would be:

$$\frac{550 - 525}{525} \times 100 = 4.8\%$$

Heterosis and Heritability

The degree of heterosis varies between traits, and follows a general rule that it tends to be inversely proportional to that trait’s heritability. In moderate to highly heritable traits, such as carcass composition, the level of heterosis is low, while traits of low heritability such as calving rate and weaning rate have higher levels of heterosis. Table 1 shows that heterosis obtained through crossbreeding is a powerful tool for increasing performance in traits with low heritabilities.



This polled and pigmented Red Angus sired calf out of a dehorned Hereford cow is an example of individual heterosis.

Table 1. Heritability and Heterosis Estimates for Some Economically Important Traits.

Trait	Heritability ^a	Total heterosis ^b (%)
Calving rate	.02 - .17	6
Calf survival to weaning	.10 - .15	4
Weaning rate	.17	8
Birth weight direct	.31	6
Weaning weight direct	.24	11
Milk production	.20	9
Post-weaning gain	.31	3
Yearling weight	.33	4
Mature cow weight	.50	1
Feed conversion (TDN/gain)	.32	- 2
Dressing %	.39	0
Rib eye area	.42	2
% cutability/retail product	.47	0
Marbling/quality grade	.38	2
Tenderness	.29	0

^a Koots et al. (1994).

^b Kress and Nelsen (1998).

Heterosis...

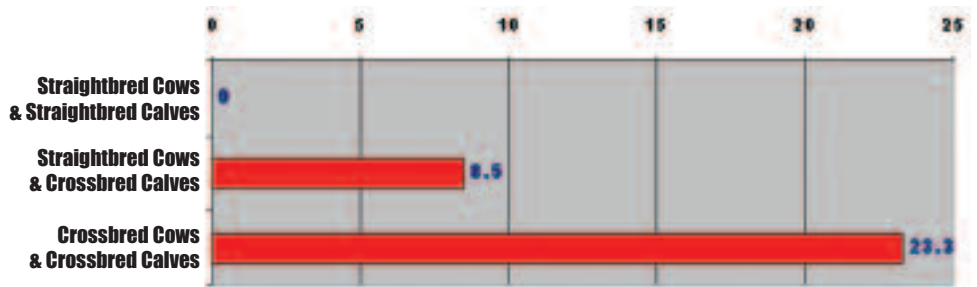
Individual vs. Maternal Heterosis

Individual heterosis is the increased performance a crossbred calf exhibits relative to its straightbred parents for traits such as growth to weaning, or yearling weight.

Maternal heterosis is expressed in the crossbred female’s progeny, such as the increased weaning weight of crossbred females’ calves due to the increased milk production of their crossbred dams.

Heterosis increases lifetime production per cow 20-25% in *Bos taurus* x *Bos taurus* crosses. This increase results from the cumulative effects of heterosis which include: increased fertility, longevity, weaning rate, etc.

The table below compares increases in weight of calf weaned per cow exposed that may be expected with individual heterosis vs. both individual and maternal heterosis.



Crossbreeding Systems

Utilizing crossbreeding systems to meet production goals requires using breeds that complement each other while maintaining optimum levels of heterosis.



Additionally, the system must fit the size of the producer: herd size, number of pastures, and other practical constraints. Below several crossbreeding schemes are evaluated; each offers different opportunities and requires varying levels of inputs and management.

Rotational System

Red Angus are especially well suited for Rotational systems due to their calving ease, maternal merit, moderate size, growth and carcass quality. This balance of traits make Red Angus a natural fit for crossbreeding systems that generate replacement females with very acceptable levels of maternal heterosis.

Note: To avoid large swings in biological type, choose breeds that are genetically similar for birth weight, mature size and milk production.

Two-Breed Rotation

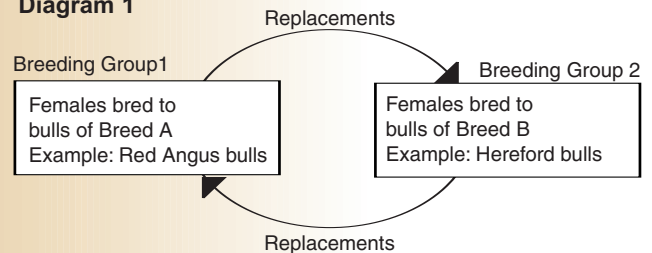
Cows sired by Breed A (Red Angus) bred to Breed B bull (Hereford, Simmental, etc.). Resulting daughters bred back to Breed A for the rest of their lives. Daughters resulting from this cross are bred back to bull from Breed B. A female is always bred to a bull of a different breed than her sire. (Diagram 1)

Sire selection objectives: Choose sires similar for calving ease, maternal traits, and mature size. Must ID sires to daughters.

No. of Sires: 2
 No. of Pastures: 2
 Min. No. of Cows: 50
 % Heterosis: 67%

Expected increase in lbs of calf per cow exposed = 16%

Diagram 1



Three-Breed Rotation

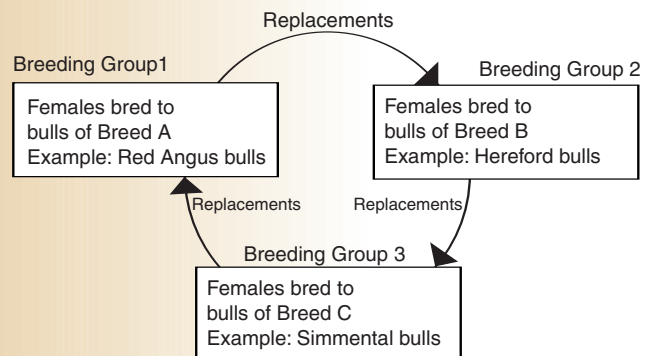
Cows sired by Breed A (Red Angus) bred to Breed B bull. Resulting daughters bred back to Breed C for the rest of their lives. Daughters resulting from this cross are bred back to bull from Breed A. A female is always bred to the sire she is least related to. (Diagram 2)

Sire selection objectives: Choose sires similar for calving ease, maternal traits, and mature size. Must ID sires to daughters.

No. of Sires: 3
 No. of Pastures: 3
 Min. No. of Cows: 75
 % Heterosis: 86%

Expected increase in lbs of calf per cow exposed = 20%

Diagram 2



SMALL HERD FRIENDLY

This symbol denotes Crossbreeding opportunities that work equally well for both small and large producers.

Terminal System

In this system cows of a specific two-breed cross are mated to a “terminal” sire of a third breed, and all resulting progeny are marketed. This system allows the producer to make cows from maternal breeds which fit a specific production environment. The Terminal sire can be chosen based on other traits such as growth, rib eye area, etc. With advanced genetic selection tools for reproduction and maintenance, Red Angus is an obvious choice for one maternal component of this crossbreeding system.



This is the simplest, fastest and most effective way of utilizing the advantages of crossbreeding - heterosis and breed complementarity. Producers purchase F1 (two breed cross) replacement females, mate them to a terminal breed of bull and market all of the progeny. No heifer calves are retained as replacements.

Selection objectives:

1. Select Red Angus influenced ProCow Replacement Females for fertility, fleshing ability and environmental fit.
 2. Select Red Angus or F1 Red Angus Hybrid sires to target quality pricing grids.
- OR
3. Select terminal sires or Red Angus x terminal F1 Hybrid sires to increase growth and red meat yield.

No. of Sires:	1	Expected increase in lbs of calf per cows exposed = 25%
No. of Pastures:	1	
Min. No. of Cows:	any size	
% Heterosis:	This system maximizes use of individual and maternal heterosis	

Terminal Sire

Purchase F1 Females

**Example:
Purchased
ProCow
Replacement
Females bred to
Continental or
Hybrid bulls**

**SMALL HERD
FRIENDLY**



Pro-Cow **Red Angus Replacements for Professional Cattlemen**

Maternal Efficiency means much more than maximum milk production. The cumulative effect of reproduction, calving ease, optimal milk flow, fleshing and foraging ability, longevity, and low maintenance costs make Red Angus an obvious cornerstone of any cow/calf operation. ProCows must be a minimum of 3/8th Red Angus. Interested in buying or selling Procows? Find or list them at www.redangus.org



Artificial Insemination (A.I.) is a management tool that allows producers to utilize heterosis and breed complementarity in a simple and effective way. A.I. enhances selection precision by allowing producers access to high accuracy, proven sires. New synchronization programs make A.I. more manageable and cost effective. **Here are some management practices that can eliminate the need for buying pasture bulls of multiple breeds.**

- A.I. heifers to high Calving Ease (CED EPD) Red Angus bulls
- A.I. mature British breed herds to high growth, high cutability terminal sires to increase pounds and lean yield.
- A.I. mature Angus herds to high maternal continentals or hybrids to produce replacements
- A.I. mature Continental or Brahman influenced herds to Red Angus bulls to reduce feed requirements and enhance carcass quality.
- Utilize Red Angus bulls in “Clean Up” roles behind an A.I. program - even when using a terminal A.I. sire. Calves sired by a Red Angus pasture bull will make outstanding replacements.

**SMALL HERD
FRIENDLY**



Hybrid Bulls are F1 cross (50% Breed A + 50% Breed B) and offer the advantages of combining heterosis and breed complementarity in one package. Red Angus may be paired with a terminal continental, maternal continental, British, or Bos indicus breed to build Red Angus influenced hybrids. However, they are often used to infuse continental breeds without getting a full 50% continental in the resultant calves. Using unrelated F1 bulls of the same breed (A-B, A-B) can result in a retention of 50% of maximum possible heterosis. Rotating F1 bulls that have one breed in common (A-B, A-C) can result in 67% heterosis. Rotating F1 bulls that have no breeds in common (A-B, C-D) can offer 83% of maximum heterosis.

**SMALL HERD
FRIENDLY**

The Crossbreeding Specialist

Crossbreeding does not replace the need for high quality purebred cattle. In fact, accurately described seedstock resources are paramount to the success of a crossbreeding program.

Industry's most reliable genetic predictions

Red Angus led the beef industry by implementing Total Herd Reporting (THR) in 1995 as a means of providing the most reliable EPDs. THR requires the annual production of every cow and the performance information of every calf raised through weaning to be reported. THR eliminates selection bias, which can skew genetic predictions when only data from the calves "good enough to register" is reported.

The number of EPDs calculated by beef breeds continues to grow. Red Angus continues to describe reproduction, growth, maintenance, and carcass using the fewest EPDs possible. Achieving this goal has meant that Red Angus focuses less on indicator traits and more on the Economically Relevant Traits (ERTs) that affect their bull customers' bottom lines. Red Angus' use of THR and ERTs make it the ideal British component for any crossbreeding system.



Profit starts at Reproduction! Research has shown reproduction to have four to ten times the economic impact of carcass traits. Red Angus' unique utilization of THR allows the breeding and subsequent pregnancy/calving of each replacement heifer to be reported. In a nutsell, Red Angus is the only major beef breed to completely describe cow herd reproduction from unassisted birth to productive lifespan.

Cows Eat Money! In January, 2004, Red Angus published the Mature Cow Maintenance Energy Requirement (ME) EPD becoming the first breed to evaluate the expense side of the rancher's profit equation. Expressed in Mega-calories per month, differences in ME EPD can easily translate into differences in feed required to maintain body weight. Use ME in conjunction with revenue traits to ensure the income from increased performance isn't "eaten up" by increased feed costs.

Genetic Predictions of the Future - Across Breed EPDs!

Red Angus is one of several breeds who seek to serve commercial customers better by providing true across breed (Multi-breed) EPDs. These genetic predictions will allow commercial customers to make better informed crossbreeding decisions because all breeds' EPDs would evaluate the same traits, be calculated using the same models and presented on equivalent base and scale. This will allow producers to evaluate animals across breeds as well as hybrids and composites on a level playing field, as the multi breed model will account for performance due to heterosis that is seen in derivative cattle. Working with other breeds and the National Beef Cattle Evaluation Consortium, these genetic predictions of the future are just around the corner.



**ANGUS
PLUS**

Enough Ear, But Not Too Much.

- Angus x Brahman derivatives
- Registered with the RAAA
- Red or Black in hide color
- Flexible Angus Percentage from 65% to 96%

Angus Plus offers producers flexibility to breed cattle that are best suited for their customers' ranch environments.

With "Enough Ear, But Not Too Much", Angus Plus allows breeders to take advantage of the breed complementarity existing between Angus and Brahman cattle as well as the heterosis that is expressed in a Bos taurus x Bos indicus cross.

The Red Angus Formula

Red Angus x Terminal Continentals

Red Angus crossed with terminal Continental breeds like Charolais and Limousin, produce feedlot cattle that can excel in feedlot efficiency while reaping premiums for both Yield and Quality grade. While these Continentals are known to improve Yield Grade through increased leanness and ribeye area, Red Angus complements both with improved marbling and fewer days to finish. The feedlot industry values the intangible traits of Red Angus crosses, such as improved docility; fewer bruises when handling and ease of starting on feed.



Red Angus x Maternal Continentals

When crossed with maternal Continental breeds such as Simmental and Gelbvieh, Red Angus can improve production efficiency. Through breed complementarity, Red Angus can lower birthweights, moderate mature size, decrease cow maintenance requirements, extend longevity and thus, improve the overall functionality of the replacement females resulting from such crosses.



Red Angus x British Breeds

The "Baldy" female is still a favorite for many commercial ranch environments, and are produced in uniform fashion when Red Angus and Hereford are crossed. Added maternal traits and marbling genetics are produced in the polled, pigmented progeny of this British x British cross. The Red Angus component of highly efficient baldy steers helps them reach choice grade faster. Red Angus can be used on other British breeds to reduce maintenance costs and add fleshing ability.



Red Angus x Brahman Derivatives

In regions that require added heat tolerance, Red Angus and Angus Plus bulls work well on Brahman derivatives or other heat tolerant Bos taurus breeds, such as Senepol. The replacements resulting from such crosses make adaptable, heat tolerant, easy fleshing brood cows, while their steer mates should express improved carcass traits due to Red Angus' superior marbling genetics. Additionally, higher levels of heterosis may be seen when Red Angus are used on cattle of such divergent origins.



Various biotypes of cattle ranked by cost of gain.

Biotype	% Choice ^a	%YG 1 & 2 ^a	Feed ^b Conversion	Cost of gain ^b /cwt ^c
1/4 Continental 3/4 British	66	52	6.52	\$54.00
1/2 Continental 1/2 British	56	56	6.49	\$54.80
100% British	70	38	6.76	\$57.50
100% Continental	30	89	6.78	\$59.80
3/4 Continental 1/4 British	43	83	6.72	\$60.10

^a Adapted from U.S. MARC data (Cundiff, 1999).

^b Swift & Co. and Gelbvieh Alliance data (T. Schiefelbein, 2003 and D. Schiefelbein, 1998).

^c Includes interest.

Crossbreeding Pays



With inherent maternal efficiencies, unsurpassed carcass merit, and objective genetic predictions, Red Angus is a logical “Angus” foundation for any crossbreeding system. Across different environments, marketing goals, and breeding systems, the inclusion of Red Angus with its focused selection for economically relevant traits provides an excellent means to access the economic benefits of breed complementarity and heterosis. In addition, Red Angus offers numerous marketing programs to assist bull customers in harvesting the full value of their investment in superior Red Angus genetics.



Identifying Value...The Red Angus Feeder Calf Certification Program (FCCP) provides market topping results when Red Angus bulls are used on a variety of beef breed females. This USDA Process Verified Program identifies Red Angus sired calves with the yellow FCCP tag for traceability to Angus Genetics, Source Verification to ranch of origin and Group Age verification. In addition to the demand created by Certified Red Angus calves' access to Angus product lines, these calves can fit various programs offering premiums for source and age verified cattle.

Certified Red Angus are supported with FREE marketing tools that expand market access for both feeder and fed cattle. Regardless of the breed type of a producer's base cow herd, Red Angus bulls and the “yellow” FCCP tag are the ticket to higher calf prices and additional fed cattle marketing options.



“R” Stamped - Certified Red Angus Carcasses on their way to branded product premiums

Crossbreeding isn't for Everyone

Herd Size - Systematic crossbreeding programs are more easily carried out in larger herds. However, the use of F1 bulls, PRO-COW replacement females and/or extensive A.I. provide simple crossbreeding solutions when herd size falls beneath 50 cows.

Pastures and Herd Bulls - Unless maximum use is made of A.I. or replacements are purchased, crossbreeding usually means keeping two or more breeds of bulls and providing more than one breeding pasture during the breeding season. Consequently, producers incur greater investments in bulls and the infrastructure required to separate breeding pastures.

Identification and Record Keeping - Crossbreeding requires accurate identification of the genetic makeup of each generation.

Matching Biological Types - Breeds differ in bio-economic traits; this is one reason for crossbreeding. However, extreme mis-matches in biological type can lead to problems.

- Calving difficulty when a large breed of sire is mated to a small breed of cow.
- Failure to efficiently utilize a large crossbred cow when she is rotationally mated to a smaller breed of sire.
- Large swings in biological type from generation to generation in some rotational systems.

Fitting Production Environment - More is not always better. Care must be taken to build crossbred replacement females which fit the environment they must work in. More size, more frame, more growth, or more milk may result in reduced reproductive efficiency, increased feed costs, and reduced profits.

Fit the Box - Only introduce breeds into your crossbreeding scheme that complement your marketing plan. Adding high retail yield breeds won't improve performance on a quality based grid. Adding high growth, large framed breeds generally will not work for producers who background and sell yearlings. Using high maintenance, low maternal sires may limit the value of replacement females.

Sustaining a Crossbreeding System Requires Discipline - Because of the length of generation interval of beef cattle, crossbreeding programs are not an overnight fix. Successful crossbreeding programs have plans for optimizing heterosis, while making the necessary improvement in additive genetic traits as required by their environment, management and marketing programs.



Building Better Beef...

Red Angus

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