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crossbreeding

FOR BEEF PRODUCTION

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Issued November 1969, 3,500

crossbreeding for...

BEEF PRODUCTION

Delwyn D. Dearborn ^{1/}

Production costs of commercial cow-calf units have more than doubled since World War II. This forces the commercial cattleman to consider all possibilities for improving production efficiency.

Hybrid vigor has proven to be a real bonus for many segments of commercial agriculture. The most dramatic example is hybrid corn. Other popular examples include line crosses in poultry and breed crosses in swine. It is natural, then, that commercial cattlemen are asking: "Will crossbreeding be profitable for me?"

CROSSBREEDING OPPORTUNITIES

Crossbreeding provides two opportunities for improved production:

1. Combining desirable characteristics of two or more breeds, thus achieving a higher frequency of desired traits than is generally found within a given breed.
2. Taking advantage of hybrid vigor both in the brood cow and in her offspring.

Combining Breed Strengths

Breed strengths are being evaluated and certain *differences are becoming evident*. However, results have been published from only a small number of experiments which evaluated all important economic traits.

Rather than relying only on the results of these studies, a survey was conducted among selected beef cattle breeding, Extension and research personnel. These men are familiar with the literature and have the opportunity to make first-hand observations of breed characteristics.

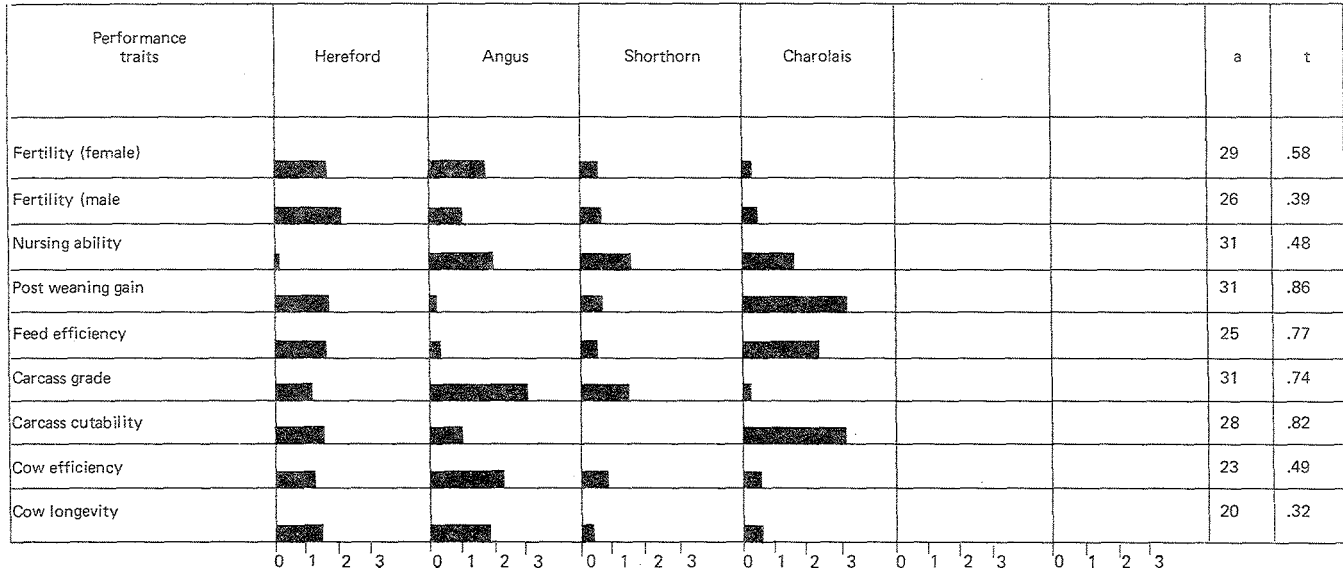
Relative strengths of four major beef breeds, based on the opinions of this group, are shown in Figure 1.

The final column is an intraclass correlation (t) which provides a measure of consistency of opinion by those who responded. These correlations indicate that there is considerable agreement in ranking these four breeds for postweaning gain, carcass cutability, feed efficiency and carcass grade.

The small correlations for cow longevity and male fertility indicate differences of opinion and a real need for well-designed research to further evaluate these traits.

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Figure 1. Profile of Breed Strengths^{1/}



^{1/} Average ratings of four beef breeds for the most important performance traits plus (a) number of replies included in the average and (t) intraclass correlations. A blank breed strength table was sent to each selected individual. The accompanying instructions suggested that the poorest breed for a particular trait be ranked 0 and the remaining breeds were to be ranked between 0 and 4 in accordance with their superiority.

Intermediate correlation values were obtained for female fertility, nursing ability and cow efficiency.

Other breeds will be considered for crossbreeding purposes in the future. The two blank columns are left so that you can compare other breeds with these four as information becomes available.

Variation within each breed is large and some samples from each breed would not perform as shown in Figure 1. However, recognition of these differences can be helpful in designing a crossbreeding plan and in determining which traits deserve the most consideration when making individual animal selections.

Hybrid Vigor

Individual heterosis or hybrid vigor is the difference in performance between crosses and the average of the parental breeds used in the cross. Therefore, to estimate individual heterosis an experiment must include reciprocal crosses. Consider Figure 2.

Figure 2. Individual heterosis.

Breed (Parents)		Wng. Wt. (Offspring)	Progeny average:	
Bull	Cow	lbs.	Crossbreds	420 lbs.
H	H	400	Straightbreds	405 lbs.
A	H	405	Difference	15 lbs.
H	A	435	Percent Heterosis =	
A	A	410	100 (15 ÷ 405) = 3.7%	
			405	
			3.7% Individual Heterosis	

In Figure 2 the average of the crossbreds exceeds the average of the straightbreds by 3.7 percent. Note that the comparison of only one cross with only one parent breed would be considerably different and should not be considered as an estimate of average heterosis.

The crossing of two straightbreds allows for heterosis to be observed in traits—such as livability and growth rate—exhibited by the offspring. This is referred to as “individual heterosis.”

Crossbred females compared with the average of straightbred females representing the two parent breeds and both being mated to bulls from a third

breed to produce crossbred calves allows for an evaluation of maternal heterosis. See Figure 3.

Figure 3. Maternal heterosis.

Breed (Parents)		Wng. Wt. (Offspring)	Progeny average from:	
Bull	Cow	lbs.	Crossbred dams	440 lbs.
S	H	415	Straightbred dams	420 lbs.
			Difference	20 lbs.
			Percent Heterosis =	
			$100 (20 \div 420) = 4.8\%$	
S	HA	435		
S	AH	445		
S	A	425		
			4.8% Maternal Heterosis	

Crossbred offspring from crossbred dams exceed the average crossbred offspring from straightbred dams by 4.8 percent in Figure 3. This is an estimate of maternal heterosis and reflects the superiority of the crossbred dam for one trait, mothering ability.

A crossbreeding plan may be developed which will combine the benefits of individual and maternal heterosis. Though the examples deal with only one trait, the cattlemen must consider all traits of importance and must compare the crossbreds with the superior parent breed rather than the average of the parent breeds.

Conclusions relative to heterosis based on work with beef cattle and other species suggest that:

1. Most heterosis is observed in traits with low heritability. These include fertility, livability and mothering ability.
2. The magnitude of heterosis is related to the degree of relationship between parents crossed. Greater amounts of heterosis have been observed between breed crosses than between crosses of lines within a breed. Furthermore, the cross of breeds which have the most diverse background seem to give the most heterosis.

Benefits from crossbreeding will not be maximized without considering both breed strengths and heterosis. Breed choice should be based on strengths which complement the weaknesses of the present herd. Fortunately, crosses of breeds which differ widely appear to display greater amounts of heterosis.

It may also be possible to use breeds strong in fertility and mothering ability for females and mate these to specialty bull breeds which are superior for growth and carcass characteristics.

POTENTIAL FOR CROSSBREEDING BEEF CATTLE

Several beef cattle crossbreeding experiments were started in the 1950's. Though most of these differed in design and purpose, it now becomes possible to combine their results to evaluate crossbreeding potential.

British Breed Crosses

Five experiments conducted in various areas of the United States are summarized in Table 1.

Three of these (Nebraska, Virginia and California) included all three British breeds. The remaining two (Ohio and Montana) included only the Angus and Hereford.

Heterosis was evaluated in all of these experiments by comparing the crossbreds with the average of the straightbreds. Combined, these experiments represent about 1,000 of both crossbred and straightbred matings.

Percent calving and survival are the most important economic advantages for the crossbreds. Combining these two traits, the improvement in percent calf crop weaned ranges between 3.0 and 13.0 percent.

The improvement in weaning weight is consistent. Collectively, the experimental results suggest an improvement of about 4.5 percent. The improvement in percent calf crop weaned and weaning weight must be combined to evaluate pounds of calf weaned per cow exposed the previous breeding season.

Postweaning performance was not reported in all experiments. The limited results suggest improved performance though not as great as was noted in preweaning performance.

Fertility and maternal characteristics of crossbred and straightbred cows have been evaluated in three experiments. These results are summarized in Table 2.

Collectively, these three experiments represent about 900 matings of both straightbred and crossbred cows. Two-thirds of these totals are represented in the Nebraska study.

This study indicates a large advantage for the crossbred cow in both fertility and mothering ability. Since the straightbred cows in these studies are bred for crossbred calves, one must combine the results in Tables 1 and 2 to evaluate the total benefits of crossbreeding. These tables indicate the potential. Care must be taken in developing a crossbreeding system which will allow a commercial producer to achieve these advantages over a long-term period.

Table 1. Results from crossing straightbreds of British breed origin.

Location & Dates	No. Matings Or Calves Born		Advantage of Crossbreds as Compared to Straightbreds (%)					
			Percent Calving	Percent Survival	Percent Weaned	Wng. Wt.	Yearling or Slaughter Wt.	
	Straight- Bred	Cross- Bred					Steer	Heifer
Ohio ^{1/} 1940-47	209	196	-----	+3.6	-----	+5.1	-----	-----
Nebraska ^{2/} 1960-63	447	470	0	+3.0	+3.0	+4.6	+3.3	+6.5
Virginia ^{2/} 1957-61	144	142	+8.0	+5.1	+13.0	+3.9	+3.0	+5.0
Montana ^{1/} 1962-65	166	143	+5.6	+1.1	+6.2	+4.7	-----	-1.6
California ^{2/} 1961-66	73	147	+11.0	+1.3	+12.3	+4.5	-----	-----

^{1/} Angus and Hereford straightbreds plus reciprocal crosses of these two breeds.^{2/} Angus, Hereford and Shorthorn straightbreds plus reciprocal crosses of these three breeds.

Table 2. A Comparison of Crossbred and Straightbred Cows

Location & Dates	No. of Matings		Advantage of Crossbreds As Compared to Straightbreds (%)		
	Straightbred Cows	Crossbred Cows	Percent Calving	Percent Weaned	Calf Wng. Wt.
Nebraska 1962-68	571	688	+7.5	+8.1	+4.9
Virginia 1963-66	238	237	+1.2	+ .4	+4.4
Montana 1965-67	62	61	-2.2	- .6	-----

Charolais Crosses

Experiments with Charolais crosses are not as plentiful as those with British breeds. One problem which has hampered research has been the shortage of Charolais females. Preliminary data suggest a basis for the strengths and weaknesses reported in Figure 1.

One experiment has been conducted in Ohio. It included three calf crops by each of about 50 Hereford and 50 Charolais females. The Charolais were three-fourths or higher percentage. The cows were bred to produce straightbreds of both breeds and crossbreds.

Their results indicate that Charolais calves were heavier at birth and weaning and gained more rapidly than did the Herefords. The Charolais carcasses had less fat trim. The Hereford carcasses showed more marbling and higher quality grades than the Charolais.

The crossbred calves grew about four percent faster than the average of the straightbreds. There was no apparent hybrid vigor in either feed efficiency or in carcass traits.

Slightly higher calving percentages were reported for crossbred mating than for straightbred. Most of the calving difficulties were encountered in two-year-old Hereford heifers which were bred to Charolais bulls.

Crosses With Other Breeds

Exotic breeds such as the Simmental and Limousin are receiving considerable interest. There is also an increased interest in some dairy breeds. Sufficient data are not available to support extensive use of these breeds in a crossbreeding system at this time. Results from research which is now being started will provide a basis for decisions relative to these breeds in the future.



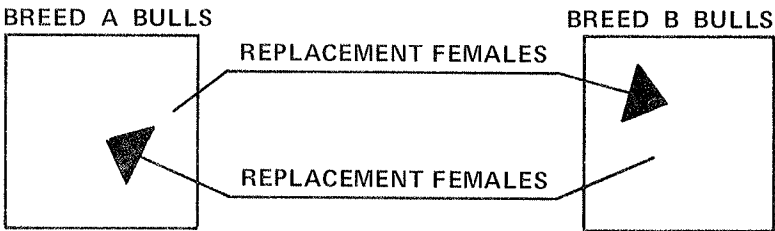
Hereford X Angus cow with her Simmental sired calf.

PLANS FOR CROSSBREEDING BEEF CATTLE

Crossbreeding is not new to the beef cattle industry. But there is little evidence that a planned system has been followed when tried previously.

One of the major problems in developing a crossbreeding system for commercial cattle production is the overlap of generations among females in a cow herd. In a herd that raises its own replacement heifers, more than one breed of bulls must be used to combine most favorably with the specific females from the different breeding groups. This will require more than one breeding pasture in herds which practice natural mating.

Figure 4



Two Breed Crisscross

Consider the blocks in Figure 4 as two breeding pastures. Replacement females sired by bulls from Breed A will in turn be mated to bulls from Breed B. Replacement females sired by bulls from Breed B will in turn be mated to bulls from Breed A.

Individual and maternal heterosis will finally stabilize at 67 percent of the maximum which is present in the first cross.^{2/} This system seems best suited for moderate-sized operations.

Two breeding pastures, a cooperative arrangement between two herds, or artificial insemination is required to make this system work. The *cooperative arrangement* refers to a situation in which Herd 1, beginning with cows of Breed B, breeds to bulls from Breed A. Herd 2, beginning with cows of Breed A, breeds to bulls from Breed B. Each herd continues to use the same breed of bulls and replacement heifers are traded between herds.

The potential of this system, at least with certain breeds such as Hereford x Angus and Hereford x Shorthorn, can be predicted from present research. Further results will be available soon.

Disadvantages of this system include the sacrifice of some heterosis and the management problems associated with employing this system on a particular operation. In addition, it does not provide the possibility for using separate bull and cow breeds in a specialty role. However, replacement heifers can be raised within the herd which certainly has merit in operations large enough to make this practice economically feasible.

Breed choice would begin with the present breed of a commercial herd as the base and then choosing a second breed which will help to complement the first.

Three Breed Rotation

Consider the blocks in Figure 5 as three breeding pastures each assigned to bulls representing a different breed.

Replacement females sired by bulls from Breed A will be mated to bulls from Breed B. Replacement females sired by bulls from Breed B will be mated to bulls from Breed C. Replacement females sired by bulls from Breed C will be mated to bulls from Breed A.

Individual and maternal heterosis in this system stabilizes at 87 percent of the maximum potential which is about 20 percent greater than with the two-breed crisscross.

Three breeding pastures, a cooperative arrangement between three herds, or artificial insemination will be required to make this system work.

Disadvantages of this system will often be related to the management required. This system does not provide the possibility for using separate bull and cow breeds and adds the additional challenge of finding three breeds which will complement each other. It would appear to be practical only in large commercial operations.

^{2/} This is based on dominance effects as the basis for heterosis and assumes that recombination effects in offspring from crossbred dams are negligible.

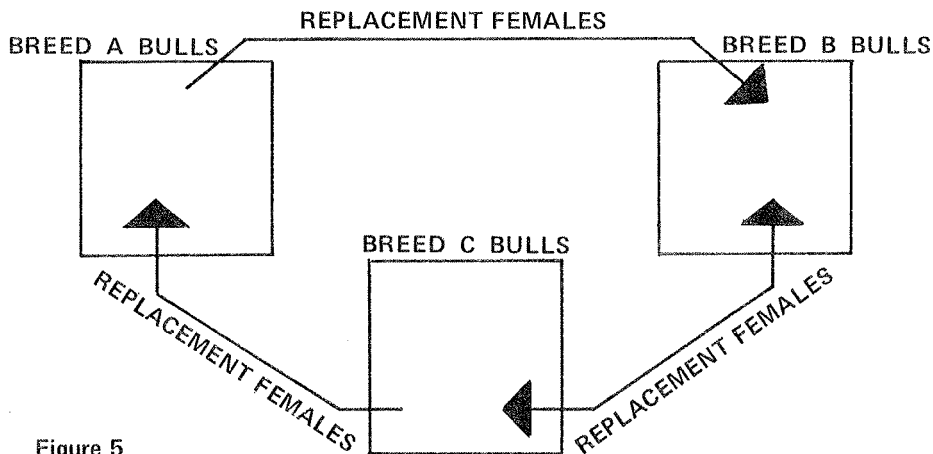


Figure 5

Breed choice would begin with the present breed of a commercial operation. Additional choices should be made to complement the production potential of the first. This system, slightly modified, is probably the most popular with commercial swine producers.

Periodic Changes in Breed of Bull

It is difficult on some operations to maintain more than one breed of sire at a time. When this situation prevails, it is possible to modify the three breed rotational system using only one breed of bulls at any one time.

The recommended interval each breed of bull should be used depends on the number of breeds, age of heifers at first calving and age at which the old cows are removed.

From a theoretical standpoint, it appears that one of the better arrangements for maintaining hybrid vigor with this system would be to include four breeds of bulls and use each breed three years. Replacement heifers would be kept from the last two calf crops sired by each breed of bulls.

If you were to use only three breeds of bulls, the interval that each breed should be used should be four or five years.

This system is easy to manage but provides no possibility for using breeds in specialty roles. Some heterosis is also sacrificed. The amount depends on the number of breeds and the length of interval that each is used. Plans for this system should prevent cows from being mated to the same breed of bull as their breed of sire.

Purchase of Crossbred Females and Mating to Bulls From a Third Breed

Research indicates that crossbred females, with improved fertility and mothering ability, are basic to maximizing total heterotic benefits. This can best



Hereford X Shorthorn cow with her Charolais sired calf.

be achieved in some herds, especially those which are relatively small (approximately 100 cows or less), by purchasing crossbred females to use as future brood cows. It may also deserve consideration in larger operations that are neither suited for dividing their herd during the breeding season or for using artificial insemination.

Disadvantages of this system must be recognized. First, extreme care must be taken not to introduce a disease problem with the purchased females. Secondly, and probably quite important at this time, is the limited availability of crossbred females. Even if larger supplies become available, the purchase price may be high enough to absorb some of the increased potential.

In addition to the advantage of heterosis, there may also be other advantages to this system. If there are breeds which are best suited to serve as sire breeds and others which are more suited to serve as cow breeds, it may be easier to utilize these breed advantages by purchasing crossbred heifers than by saving replacements from offspring produced within the herd.

Accurate data for characterizing the breeds and breed crosses best suited to a system of separate dam and sire breeds are limited. It would appear that the female should represent breeds noted for superior fertility and maternal ability; and should data become available on cow efficiency, this should also be considered. Growth rate, feed efficiency and carcass merit deserve most consideration on the sire side.

The role of maternal ability in the future may change. Multiple births is one possibility which might suggest a needed increase in milk production. However, the efficiency of milk production needs to be clarified. It may be more efficient to wean early, maintain the cow on a limited ration and feed the calf direct, rather than feeding the cow to produce milk to feed the calf.

The sale of F1 females is based on the rise in popularity of this system. F1 refers to the first cross progeny of two straight breeds. Maximum maternal heterosis is exhibited by the F1 female. However, the production of F1s necessitates the crossing of straight breeds.

From an industry point of view, it seems advisable to sacrifice a small part of the maternal heterosis rather than to maintain straightbred commercial herds which exhibit no maternal heterosis for the production of F1 females. This is based on the assumption that it takes about 40 percent of all females produced to maintain cow numbers. Therefore, about one-half the herds in the industry would be required to produce straightbred and F1 females so that the remainder might capitalize on maximum heterosis.

This crossbreeding system might best be characterized as one in which the females are purchased, grown out and then worn out. The most common example of this system in the livestock industry is the purchase of western white face ewes and mating them to black face rams.

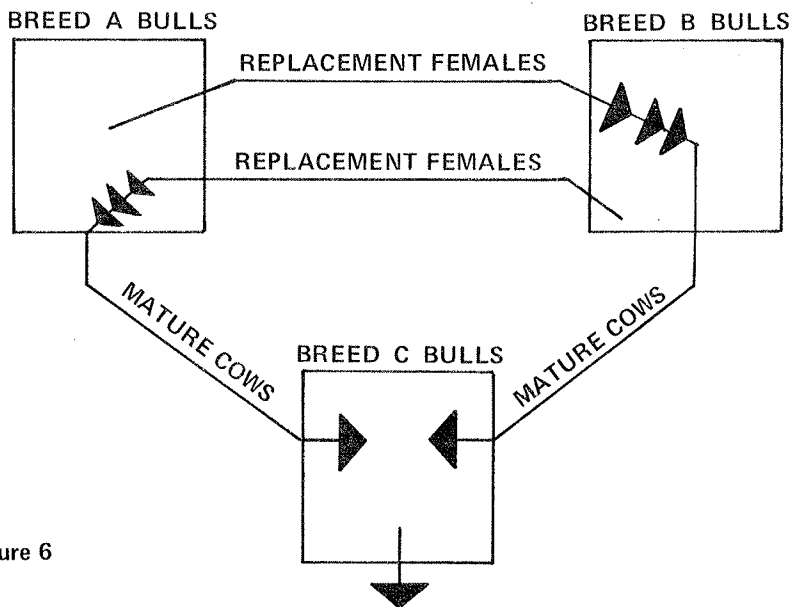


Figure 6

ALL OFFSPRING FROM THIS CROSS ARE SOLD.

Two Breed Crisscross Plus Bulls From a Specialized Bull Breed

Note Figure 6. Replacement females sired by bulls from Breed A will be mated as yearlings, twos and threes to bulls from Breed B. Replacement females sired by bulls from Breed B will be mated as yearlings, twos and threes to bulls from Breed A. All replacement females are kept from these two matings. Mature cows four years old and over will be mated to bulls from Breed C. All offspring from this cross will be used for commercial slaughter purposes.

Maternal heterosis in this system would stabilize at 67 percent. However, it provides several other potential advantages. These include:

Utilizing breeds superior in maternal traits on the female side and mating slightly more than one-half the cow herd to bulls from a specialized bull breed.

Maximizing individual heterosis in a majority of the offspring.

Allowing for use of a bull on mature cows which could not be recommended for heifers because of potential calving difficulties.

Allowing for keeping replacements from young cows before they are milking at their maximum.

Present research results suggest a negative environmental correlation between preweaning environment and lifetime production. Conclusions from this work suggest an advantage in selecting replacement females from young cows.

One must evaluate whether or not these advantages are greater than the 20 percent sacrifice in maternal heterosis when compared to the three breed rotation. The management requirement for the two systems appears similar. This specialized system seems most suitable for large herds.

Replacement females are selected from within the herd. However, individual selection would be restricted since all of the replacements are kept from about two-fifths of the cow herd. This lack of selection on the female side is compensated for, at least in part, by a shorter generation interval. Thus, most of the improvement is dependent upon using superior bulls.

A preferential ranking of these systems based on their merits and their adaptability for different-sized herds and natural or artificial insemination mating schemes is presented in Table 3.

These systems are not presented as the only ones. Modifications or combinations of one or more of these may be necessary to make most efficient use of particular breeds and to fit the management potential of an individual operation. No one system or no two or three breeds have been identified as the best choice at this time. Basic to all of these systems is a cow identification method which at least indicates breed of sire.

The benefits of crossbreeding are real. However, for these benefits to be realized over a long-term period, a well-designed crossbreeding system should be developed and followed.

The importance of using superior-performing bulls should be recognized. A cattleman must use as good performing bulls for crossbreeding as he would for straightbreeding to gain the full benefit of crossbreeding. This points out the continued need for superior-performing purebred bulls to be used by the commercial cattle industry.

Table 3. Ranking of crossbreeding systems for different-sized herds.*

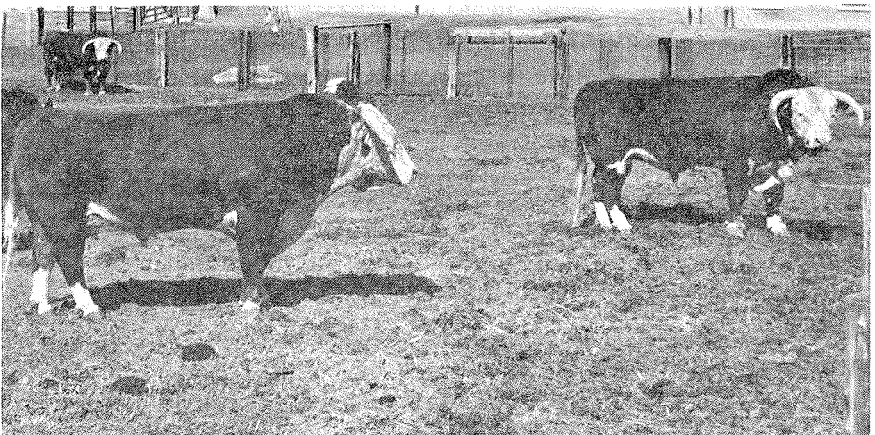
Method of Breeding	Small Herd 50 Cows		Medium Herd 100-250 Cows		Large Herd 300 Cows	
	Natural	AI	Natural	AI	Natural	AI
1. Two Breed Crisscross	NR	NR	3	NR	3	NR
2. Three Breed Rotation	NR	3	2	2	2	2
3. Period Changes in Breed of Bull	2	NR	4	NR	4	NR
4. Purchase of Crossbred females and mating to bulls from a third breed.	1	1	<u>1a/</u>	<u>1a/</u>	NR	NR
5. Two Breed Crisscross plus bulls from a specialized bull breed.	NR	2	<u>1b/</u>	<u>1b/</u>	1	1

*Choice indicated by number; 1 = 1st choice, 2 = 2nd choice, etc.

a/ First choice for herds that choose to buy replacement females.

b/ First choice for herds that choose to select replacement females on a within-herd basis.

NR — Not recommended.



Superior performing bulls are just as important for a crossbreeding program as they are for a straightbreeding program.

COMMON QUESTIONS CONCERNING BEEF CATTLE CROSSBREEDING

1. I have spent a lifetime building up a straightbred herd. Should I start crossbreeding now?

Only you can answer this question. If you can't have the same kind of interest in a crossbred herd as you presently have in your straightbred herd, it is doubtful if you can expect results similar to those reported in this circular. The crossbreds and straightbreds received equal treatment in each of the experiments which were reviewed.

2. What are the possibilities for using crossbred bulls?

Crossbred bulls may show some heterosis in male fertility traits and they allow the possibility for introducing a small percentage of a certain breed with some desirable trait. However, their use is not recommended at this time.

From a theoretical standpoint, there should be no advantage in using both crossbred parents. It also seems logical that maternal heterosis is more important than paternal heterosis. Therefore, all crossbreeding plans discussed in this publication were developed to use purebred bulls on crossbred cows.

The genetic improvement which may be achieved in the beef industry is dependent upon the bull producer. At the present time, this responsibility rests with a rather small number of elite purebred breeders. Crossbreeding with the use of purebred bulls should not have a detrimental effect, and it may even strengthen the role of the purebred industry, though the overall influence of certain breeds may change. Breeding programs must be developed to obtain both the benefits from selection and from heterosis.

3. Isn't it possible to obtain heterosis by crossing lines within a breed?

There is evidence of heterosis from crossing lines within a breed. It is not as great as has been observed from crossing breeds. Line crosses do not allow for the opportunity of combining breed strengths.

Another problem with crossing lines within a breed is the formation of a distinct line. This requires inbreeding. There is normally a decrease in fertility and livability associated with the formation of a line. Therefore, it is probably best to obtain heterosis in beef cattle by crossing breeds.

4. In a crossing program using the Hereford and Angus breeds, which is the best cross?

Most crossing plans have to start with the present breed of females which the producer owns. If he is starting in the commercial cattle business, research results would suggest that he start by purchasing crossbred females.

Nebraska results indicate the use of Hereford bulls on Angus cows is superior to Angus bulls on Hereford cows. However, preliminary results suggest Angus x Hereford (Angus sires—Hereford dams) cross females have outproduced the Hereford x Angus (Hereford sires—Angus dams) cross females. Therefore, there is probably no difference over a long-term basis.

5. Which two of the British breeds work best in a crossing program?

The strengths of the Angus and Shorthorn breeds are somewhat similar. Crosses of these two breeds have shown little if any heterosis. The crossing of either of these breeds with Herefords would be preferred to crosses between Angus and Shorthorn.

6. Which is the best cross—Charolais x Hereford or Charolais x Angus?

The answer to this question will be determined by research presently being conducted. However, there are a few suggestions which are available at this time. First, the use of Charolais bulls on first-calf heifers of any of the British breeds is not recommended.

A review of Figure 1 —Breed Strengths—suggests the Angus breed may best complement the Charolais. This does not mean that the Charolais x Angus will necessarily show more heterosis than the Charolais x Shorthorn or Charolais x Hereford. However, the breed strength figure plus a limited amount of research would suggest that the Charolais x Hereford may require a longer, more concentrated feeding period to grade choice than would Charolais x Angus.

Further research concerning the efficiency and fertility of the Charolais cross female is needed for developing the most efficient long-range plans.

7. Is it desirable for commercial cows to be half dairy (i.e. Angus x Holstein)?

Dairy beef cross females will produce more milk and will wean calves heavier at weaning time. There is not yet, however, sufficient research information which would document the use of dairy x beef females as a recommended practice.

It seems logical to assume that cattlemen would prefer a cow which is first of all a regular breeder and then would produce extra milk rather than becoming fat.

The efficiency of added weight gains in the calf obtained by feeding the cow to produce extra milk is certainly questionable. It might be more efficient to feed the calf direct.

Dairy x beef females will require greater feed supplies to meet the requirements for added milk production and to rebreed on time. They are probably more suited for specialized production schemes than for marginal environments.

8. Will crossbred feeder calves sell as high as straightbred feeder calves?

This depends on the cross, the area and many other factors. Ninety percent of the Texas and Oklahoma feeders that responded to a recent questionnaire survey indicated a preference for crossbred feeder cattle.

Research results indicate the biggest advantage to the commercial calf producer from crossbreeding is increased pounds of calf weaned per cow exposed. The advantage in feedlot performance is not so great. However, it is still positive and suggests that the feeder should pay more for crossbreds than he would for the *average* of the *two parent* breeds.

9. Won't crossbreeding increase my operating expenses more than it will increase returns?

It is doubtful if crossbreeding will increase expenses markedly.

Taxes and interest on investment (land) would increase some if the crossbred cows are larger or give more milk and, therefore, require more feed.

Taxes and interest on investment (cow), hay (labor and operating expenses) and supplement costs should be about the same.

Costs related to death loss and veterinary expenses would be less for crossbred cows than for straightbred cows.

Bull costs may be slightly increased since additional sources must be considered. Labor may also be increased in sorting cows to the correct breeding pastures. Both of these increases should be negligible.

Crossbreeding may require additional fencing. If this is true, depreciation on equipment and improvements would be increased slightly.

Cow depreciation costs should not increase. In fact, some preliminary work suggests an advantage for crossbreds in longevity.

It appears that crossbreeding may increase total costs slightly. However, an evaluation of the opportunities indicates that the added returns should be greater than the small increase in costs.

10. Why should I bother with following a crossbreeding system? I will just use two breeds of bulls in the same pasture and replace them when necessary.

Systems have been developed to maximize total benefits. They may require more planning and management than you have in mind but the added benefits deserve consideration.

Systems are more complex in beef cattle than in other species. This is because of the generation overlap and a lower reproductive rate. However, since each individual unit has a higher economic value additional planning is warranted.

SUMMARY

Crossbreeding provides an opportunity for combining desirable characteristics of two or more breeds and for capitalizing on heterosis.

Breeds of cattle vary in their average performance in the various economic traits. These differences must be considered in designing a crossbreeding system.

Research results suggest the greatest advantage is in the use of the crossbred cow. Superior breeding performance, calf survival and mothering ability increase the pounds of calf weaned per cow exposed by as much as 20 percent.

Planned crossbreeding of beef cattle is difficult because of the overlap of generations within the cow herd. Five basic systems: two breed crisscross, three breed rotation, periodic changes in breed of bull, purchase of F1 females and a two breed crisscross plus bulls from a specialized bull breed are outlined as suggested examples.

The potential of crossbreeding is sizable. However, to obtain this potential, increased management and in some cases slightly increased expenses will be required.

Basic to making crossbreeding work is: acceptance of crossbreds both by the producer and the buyer, selection of superior breeding stock and the development of a well-designed crossbreeding plan.