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The Systems Concept of Beef Production: BIF Fact Sheet

John Massey
Department of Animal Sciences

In recent years, commercial and seed stock producers have emphasized increased production — more milk, faster gains and greater mature size — and have adopted management practices and bred cattle with this purpose in mind. As a result, weights and gains have increased in performance-oriented herds. In many cases, however, increases in profitability have not paralleled increases in production.

The systems concept of beef production incorporates an awareness that there is more to consider in a beef cattle enterprise than simply the level of production. What is most important is the overall efficiency of the enterprise — in other words, net return. While level of production and market price are important factors affecting profitability, costs of production are equally important.

The "systems" part of the concept implies that a beef operation is really a system of many components, all of which play a part in determining net return. These components can be categorized as

- Natural environment (forage resources and weather)
- Costs, prices, and market requirements
- Cattle type
- Crossbreeding system (examples: rotational crossbreeding or use of large terminal sires to produce market calves only)
- Management practices (examples: supplementation, retained ownership through slaughter, practices reflecting supply, and quality of labor).

A beef production system is highly complex because of the large number of factors affecting it and the high degree of interaction of these factors. For example, the management practice of creep feeding might be advisable for one type of cattle in one environment given certain ranges of costs for creep feed and prices for feeder cattle. Change the cattle, the environment, or the economics, however, and creep feeding may no longer pay.

To effectively use the systems concept, a producer must view the beef cattle operation in its entirety and understand how its component parts interact with one another to ultimately affect profitability. Good beef producers have been doing this for years.

The cattle that best fit the systems concept are those that are most profitable. They are those that complement all the other components of the beef operation. They must be compatible with the environment, market requirements, the crossbreeding system, and the particular management practices in use. Because there are so many possible combinations of these factors, there can be no universally "best" animal.

Determining exactly what is the "best" animal for a specific situation is difficult because there are so many traits of importance in beef cattle and so many trade-offs among these traits. For example, increased size and milk production contribute to heavier weaning weights, but create stresses that can depress fertility. Cattle that are more productive, in the sense that they produce larger, leaner and faster growing calves, are more of a reproductive risk. For this reason, a major element of the systems concept, as it appears to cattle type, is the avoidance of extremes in production traits. The very largest, leanest and heaviest milking cattle are not, in most cases, the most profitable. For these traits, intermediate levels of performance are usually optimal.

The systems concept of beef production presents challenges to both commercial and seed stock producers. For the commercial producer, the challenge is to combine cattle and management alternatives in a way that maximizes net return. For the seed stock producer, the challenge is to breed the kind of cattle that best fits the commercial producer's production system. This implies breeding cattle for specific purposes. One breeder may be producing cattle for the Corn belt, another for the Arizona desert. One may specialize in bulls for first-calf heifers, another in terminal sires, and another in general purpose cattle. All, however, can be breeders of "systems cattle."

Table 1

Optimal genetic potentials for cattle in various production environments and breed roles[1]

Production environment		Traits					
Feed availability	**Environmental stress[2]**	**Milk production**	**Mature size**	**Ability to store energy[3]**	**Adaptability to stress[4]**	**Calving ease**	**Lean yield**
High	Low	M to H	L to H	L to H	M	M to H	H
	High	M	L to H	L to H	H	H	M to H
Medium	Low	M+	M	M to H	M	M to H	M to H
	High	M-	M	M	H	H	M
Low	Low	L to M	L to M	H	M	M to H	M
	High	L	L	H	H	H	L to M
Breed role in terminal crossbreeding systems							
Maternal		L to H	L to M	M to H	M to H	H	L to M
Paternal		L to M	H	L	M to H	M	H

[1]L=Low; M=Medium; H=High.

[2]Heat, cold, parasites, disease and quantity and quality of labor.

[3]Ability to store fat and regulate energy requirements with changing (seasonal) availability of feed.

[4]Physiological tolerance to heat, cold, parasites, disease, mud and other stresses.

Table 1 represents an attempt to characterize production environments and list likely ranges for optimal levels of several important traits within those environments. Production environments are categorized by feed availability and degree of environmental stress. Feed availability refers to the quantity, quality and regularity of both natural forage and supplemental feed. Stress-related factors include such things as heat, cold, humidity,

parasites and disease. Quantity and quality of labor can also be classified as stress-related factors. For example, minimal attention at calving time imposes a stress on animals experiencing calving difficulty.

Typical ranges for low, medium and high levels of mature cow size are 800 to 1,000 pounds, 1,000 to 1,200 pounds, and 1,200 to 1,400 pounds, respectively. Ability to store energy might also be termed "doing ability" or "natural fleshing ability" — the ability of a cow to store fat for use during periods of reduced feed availability and to lower her energy requirements during these periods. Adaptability to stress refers to an animal's capacity to withstand the types of stresses mentioned above.

Clearly there are more than six traits of importance to beef production. For the purpose of Table 1, however the assumption has been made that animals are sound, fertile, and marketable. In this context, animals are considered marketable if slaughter weights are within currently acceptable ranges. Today, an acceptable range for live weights would be 900 to 1,400 pounds; for carcass weights, 550 to 850 pounds.

The recommended ranges shown in Table 1 for traits in various production environments are appropriate for general purpose type cattle — cattle typically found in rotational crossbreeding systems The second part of Table 1 lists ranges for the types of cattle used in terminal crossbreeding schemes. "Maternal" refers to the mother cows in such a crossbreeding system and "paternal" denotes the sires used to produce strictly market calves. The recommendations shown for these special-purpose cattle are not broken down by production environment, but it should be recognized that production environment has a bearing on optimal trait levels for these cattle just as it does for general-purpose cattle.

A number of relationships between production environments and optimal levels for traits are depicted in Table 1. The better the environment, both in terms of feed availability and degree of stress, the higher the optimal level of milk production. Optimal mature size also increases with increased feed availability. Environmental stress probably limits mature size only when feed availability is low. To take some extreme examples, it makes little sense to run large dairy crosses in the desert or small cattle with little milk in areas of plentiful, year-round feed.

Ability to store energy is critical when feed availability is low. Animals without this ability often do not carry enough condition to rebreed readily. Cows that are "good doers" in low-feed environments, however, may be fat cows in a high-feed, low-stress environment. Since lean yield and ability to store energy as fat are incompatible, the optimal level of lean yield will vary with feed availability. A leaner animal is desirable when feed availability is high, but with limited feed, cows need to be able to fatten easily.

Ability to withstand stress is always important, particularly in high-stress environments. Heat tolerance, for example, becomes critical in hot, humid regions. In some instances, calving ease is increasingly important at greater stress levels. When calves by terminal sires are large or when labor at calving time is limited, calving ease is crucial.

Recommendations for the sires and dams in terminal sire crossbreeding programs vary somewhat from the recommendations for general purpose cattle. "Maternal" cattle are characterized by higher levels of adaptability to natural environment — i.e. more ability to store fat and less lean yield. Milk production in these cows should not differ appreciably from that of general purpose cows in similar environments, but maternal cattle will normally be smaller to take advantage of the increased efficiency of producing fast-gaining terminal calves from smaller, low-maintenance cows. Calving ease is, of course, very important in these cattle, since they will be bred to large sires.

The traits to be emphasized in the terminal sires themselves ("paternal" cattle) are growth rate and lean yield. Milk production and ability to store

energy are relatively unimportant. Calving ease and adaptability to stress are not to be forgotten, however. High weaned calf crops are as important to a terminal sire system as they are to any other crossbreeding program.

Table 1 is not complete because there are additional aspects of production environment beyond feed availability and environmental stress. These include period of ownership (selling weanling calves versus retaining ownership to slaughter), basis for profit determination (return on investment versus return above production costs), relative costs of feeds, and relative prices paid for different classes of cattle These factors add considerable complexity to the problem of matching cattle to the production environment. Table 1 serves only as a guideline for making decisions in this area.

Reproductive performance can be a barometer to tell you if your cattle are compatible with your production environment. Low conception rates and weaned calf crops are indicators of incompatibility. One way to evaluate the reproductive performance of a herd or of a genetic group within a herd — a breed cross, for example — is to construct a calving distribution table. Table 2 shows hypothetical examples for two groups of cattle in the same environment.

Table 2
Calving distributions for two genetic groups

Age of dam	Count	Percentage calving in period			
		1	2	3	Open
Group I					
2	40	60	30	5	5
3	30	40	35	15	10
4	25	50	30	15	5
5+	105	60	25	10	5
All	200	56	28	10	6
Group II					
2	60	50	35	10	5
3	45	15	30	25	30
4	25	30	30	20	20
5+	70	40	25	20	15
All	200	36	30	18	16

The values in Table 2 represent the percentage of cows in each age group calving in each 21-day period of the calving season and the percentage of each age group open at the end of the previous breeding season. Group I exhibits a very "fertile" calving distribution; high percentages of each age

group calve early in the season, conception rates are high, and relatively few yearlings are required to replace open cows. Group II, on the other hand, appears less fertile. Cows calve later in the season, fewer become pregnant, and more replacements are required to maintain herd size. Only 15 percent of the 3-year-olds in group II calved during the first period of the calving season, indicating a rebreeding problem in first-calf heifers.

The calving distribution in Table 2 for group II would tend to indicate that these cattle are not well adapted to their environment. Perhaps they milk too heavily or are simply too large for available forage resources. Their owner should consider either changing cattle or using management practices more appropriate to the existing cattle.

A calving distribution table cannot tell all one needs to know about the compatibility of cattle and production environment. The only true "systems" indicator of compatibility is not fertility, but the bottom line — net return to the beef operation. Producers, who are serious about using the systems concept of beef production, must keep the records necessary to analyze the profitability of different types of cattle and management alternatives. This means keeping close track of costs and returns for each cattle/management combination.

Costs that can be logically assessed on a per head basis, supplemental feed costs, and vet costs for example are relatively easy to figure. More difficult to apportion are fixed costs, those costs associated more with the operation as a whole than with individual animals — taxes, interest, and, to a greater or lesser degree, labor and equipment costs Despite the "fixed" nature of these costs, they must be accounted for if the use of different management practices or different types of cattle dictates a change in cow numbers. For example, if a particular operation can support a smaller number of large cows than small cows, then each large cow should be charged a greater fraction of fixed costs than each small cow.

While records on costs and returns can identify profitable and unprofitable cattle types and management practices, additional information is often required to determine why a particular practice or set of cattle is or is not profitable. For comparisons of cattle types, Table 2 can be of help. Other useful statistics include calving loss and weaned calf crop percentages, replacement rate, weaning weights, sale weights, herd size, time on feed, feed conversion, quality and yield grades, and market prices of the product types sold.

In this time of high costs and low returns, no serious producers can afford not to adopt the systems approach to beef production. Only by understanding the different components of the system and the effects those components have on one another can they make intelligent decisions regarding choice of cattle and management alternatives. Successful producers no longer have the luxury of simply following trends or maintaining the philosophy of "more is necessarily better." They must analyze their beef production systems, keep well designed records and be willing to act on the information their records reveal.

Adapted from a Beef Improvement Federation Fact Sheet prepared by Rick Bourdon, assistant professor of animal science, Colorado State University. Reviewed by Daryl Strohbehn, Iowa State University; Roger McCraw, North Carolina State University; Kenneth W. Ellis, University of California; Dixon D. Hubbard, Extension Service — USDA; A.L. Eller, Virginia Polytechnic Institute and State University; Harvey Lemmon, Georgia angus and hereford breeder; Al Smith, Virginia commercial producer; Jim Gibb, American Polled Hereford Association; and Darrell Wilkes, National Cattlemen's Association. Edited by Daryl Strohbehn, extension beef specialist; and Gene Hettel, extension communication specialist, Iowa State University.

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