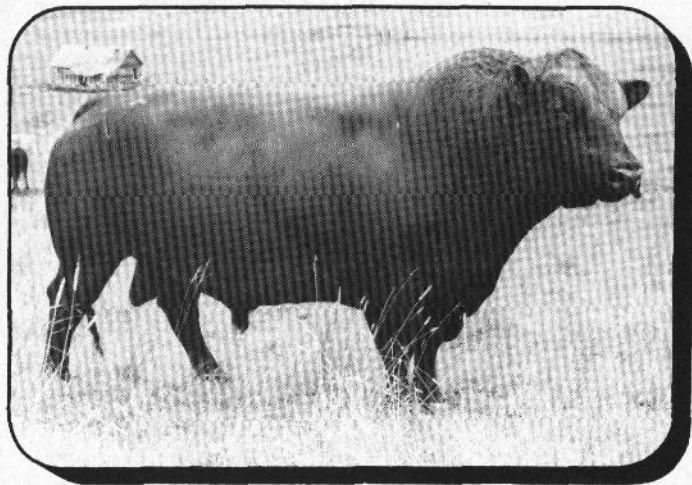


What can you learn from this breeder...

- * About inbreeding and hybrid vigor***
- * About long-term commitment to a breeding program***
- * About the pitfalls and promises of pursuing a distinctive breeder philosophy?***

**By Jim Cotton
Editor**

Linebred Foundation...



SHOSHONE BOB #2712, four-year-old linebred sire, son of Shoshone Beauigan JGECA 27, represents what Larry describes as Shoshone's "Reliable Intermediates." Yearling growth EPD of this predominant herd sire would range from plus 40 to plus 60, Milk EPD ranges from minus 5 to plus 5.

The line is considered better for all-purpose breeding and represents the product of eight generations of interrupted continuous selection toward reducing the range of deviation for balanced growth, deep fleshing, and maternal function while keeping the slaughter endpoints of size, weight, and quality intact. Abnormal extremes are avoided in maintaining this line with sires selected who mature about 45-50 percent over the preferred slaughter weight. "Experience suggests," says Larry, "this to be a good formula in order to sustain high fertility, libido, and productivity for overall performance."

"Bob" is owned in partnership with Gary Funk, Frazer, Mont.

common for the breeds, hybrids, crossbreeds embracing the packer to fail the commercial industry in its most important single requirement: a live calf economically produced.

Leonhardt's vision of the future would challenge the pendulum mindset afflicting producers of all breeds. The race to frame size provides a typical example. Single trait emphasis achieves impressive results, he allows, but usually at the expense of some other desirable trait(s) or at the risk of introducing some negative correlations. Breeders take risks if they don't explore ancestral depth he believes. Trying to change cattle to something better or different by using "anyone's bulls on everyone's daughters, or by mating phenotypic likeness to phenotypic likeness" can lead to a continual and non-fixed assortment of progeny.

Just because a mating shares a common ancestor does not insure prepotency, he would caution. And trying to respond to the trends or current sensation creates what he calls "pendulum activity, genetic chaos, and sustained mongrelization of many economically important traits within and among breeds."

While he recognizes the breed needs a range of variation across the nation's bands of climate and productivity, he's concerned this diversity will mask the need for seed stock that will breed more predictably. He finds it disturbing when he "gets calls from people with half or three-quarter bulls that have calf crops just as consistent as if they'd used a straightbred bull. When we have as much variation within a breed as we have between breeds, then I say we have to improve predictability."

Working for the commercial producer has impressed him with the economics of sending calf crops to market without having to renew and retool the cow factory through a major culling every year. The commercial

producer cannot afford the extravagance. Yet his dissatisfaction with calf crops that fluctuate unpredictably compel him to continually cast about for stability. Are his cows at fault or his bull selection?

So, Larry Leonhardt continues his study of pedigrees, a basic tool for the inbreeder searching for prepotency and its byproducts, predictability and continuity. "Pedigrees are of primary importance. How can we know where we're going without pedigrees? I think they're the single biggest factor if our purpose is to increase predictability."

If the nation's cow herd is essentially crossbred, the aggressive purebred breeder should be able to capitalize on the "knowns" of that market, thinks Leonhardt. Purebred seed stock should represent genetic order and predictability; crossbreeding is genetic disarray, and while many effective genetic changes have been achieved through crossbreeding, the crossbred cow herd cannot improve or replace itself with any reliability.

Therefore, the studious and alert seed stock producer should be strategically positioned to serve cattlemen backing away from the experiments and instability of recent years. How? What are the requirements?

- + An understanding of the principles of inheritance.
- + Intimated familiarity and willingness to study the genetic character of his particular seed stock.
- + Time (patience).
- + Applying advanced technologies.
- + A determined application (most important).

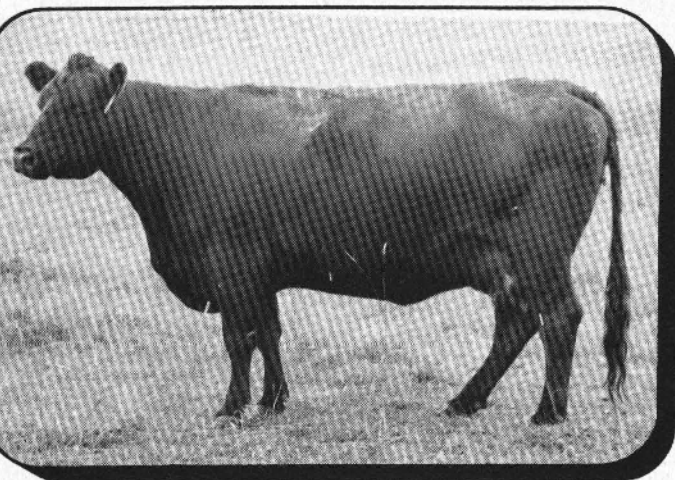
This is thinking on the long-term. And if the seven-year cycle of the purebred firm is valid, could the rise, fall, and disappearance of the seven-year breeder be attributed to strictly economics, taxes, and marketing? Or is there a basic lack of purpose involved, a commitment that's eroded because breeding plans are tied to one or two breed outliers or because there's no long-term plan at all?

A MATTER OF DOLLARS OR DISAPPOINTMENTS

Leonhardt thinks the seven-year cycle may result more from dissatisfaction with unrealistic goals and unfulfilled dreams than with financial considerations. He shares with other breeders the recognition that an outstanding bull or cow can be created from chance. But the ability to reproduce these outliers in numbers with consistency is the test of time and the source of more frustration than may be realized in the business. Accordingly, he focuses on lines and doesn't become wedded to one or two individuals in the program. "Individuals are mortal in one time and space while lines are immortal for continuity," he says. He strives then to market his bulls as representing a strain, not necessarily as a "son" of this or that great individual. The distinction is a hard one to convey to buyers accustomed to buying a son of the "bull who won at such-and-such show" or "who topped the test."

He finds the industry consumed with output, whether from the sale, show ring, or testing program. But, he questions if such provides the whole picture as to the worth of a breeding program. "The purebred industry is often too content to measure cattle by how much people are going to pay for them. If I can provide profitability for my customers, that's the key."

Links in the chain...



SHOSHONE ERICA, tag #1702, dam of the Shoshone Echo 1702 bull calf.

That's an obscure and vague handle to grasp, of course; customers don't volunteer such information. Leonhardt believes the best he can offer them in this imperfect situation is predictable parent stock. Specialized stock with the ability to renew themselves offers an alternative to the purebred animal expressing a wide genetic variation. It's a case, he says, of seed stock suppliers breeding for specialized cow lineages instead of wanting one kind to be the best for all things. "Lacking this, the crossbred cow may well continue to reign and cover up the purebred breeder's own neglected job."

"Harnessing hybrid power is an exceedingly simple principle which can offer improved consistency of product, a variety of product, a phenotype that exceeds the average of the genotype, manages weaknesses, improves predictability, and rightfully revitalizes the purebred role in beef production," he says of an approach designed to provide parent material for more consistency over today's crossbred stock. "That's the original intent of a purebred—to offer some method to improve the predictability of certain characters. You can't get renewable continuity from the heterozygote condition," he insists.

"We tend to think in terms of cycles and circles. We put all the bovines into the sphere and we come up with an average, such as EPD. Now, I don't necessarily look at cattle as individuals but rather as packages of germ plasm. We can't change the fact that cattle will not transmit all of themselves. That cow can't duplicate herself. So I deal in packages because it's a *randomized* half of herself that she transmits to her calf. The center of balance determines the average."

Accepting that reality plus sticking to Angus as the most totally promising and complementary of beef breeds, Larry decided to focus on a long-term course of harnessing hybrid power within the breed. It became a step-by-step process, breeding breeds within a breed. He sells only by private treaty these days to avoid bulls being purchased for the wrong purpose. He likes to counsel his clientele, pointing out the importance of reliable breeding value. "The bulls are not priced on the basis of their individual size and performance... but on the basis of their built-in reliability to transmit their EPD with more continuity."

BREEDS WITHIN THE BREED

Shoshone offers characteristics from three different lines.

The "Efficiency Experts" are from a paternal line, a term Larry prefers over "terminal." Their carcass and growth EPD can express levels up to plus 85. One of the products of this effort was the bull Shoshone Shanigan 0VY7, yearling growth rate leader in the Angus National Sire Evaluation for 1984, '85, '86, and second in 1987. Shanigan represents the fourth generation of paternal selection specifically for feed conversion. Both he and his sire, Shoshone Shannon HC3, have topped the Midland Bull Tests at Columbus, Mont., with their own individual performance. Yet Larry dismisses the feat unless the bull can transmit characteristics to the progeny.

Numbers from the Sire Evaluation do reveal impressive character for carcass. According to Larry, Shanigan's sire, evaluated sons, and immediate relatives average a backfat EPD of minus .02 while posting a marbling EPD of plus .40.

A close relative, Shoshone Samson VVR29, hit the top rung in the 1987 Summary with a plus .85 for marbling, a minus .02 for backfat, and a ribeye EPD of plus .12. According to Sire Evaluation discussion, breeders interested in carcass merit should search for those sires

**Poised for a lasting
improvement.**



SHOSHONE ECHO 1702, born March 4, 1987, and sired by Shoshone Balboa 1702. He carries a 38.96 percent inbreeding coefficient. He was weaned among a group of over 260 calves on October 26 and weighed 675 pounds with a 205-day adjusted weight (using the Dr. Brinks inbreeding adjustment factor) of 655 pounds, AHIR 205-day of 623 pounds, NR 105.



indicating negative EPD for fat thickness, positive EPD for marbling score, and positive EPD for ribeye area.

This line is selected and intensified for yearling growth. Inspection from the Sire Evaluation indicates the line is not one a producer would select to improve milking ability as the EPD for milk can range as low as minus 33.6.

Larry credits the Midland Test with helping identify and establish characteristics of the Paternal Line, namely centering around exceptional growth EPD. A number of representatives from this line helped Shoshone dominate at the Midland Test during the years 1975 through 1982 when Larry decided central testing was no longer functional in his performance work or marketing. During the era, though, there were some notable sales. Shoshone Viking GD60, still a favorite of many breeders across the country, topped the 1977 test and brought a price of \$50,000. A Schearbrook Shoshone son, Shoshone Monitor E3, topped the 1975 test, Shoshone Shannon HC3 led in 1978, and Shanigan topped it in 1980 with a group of three bulls selling for a total of \$75,000. Sales from four bulls in the 1979 test brought \$108,000. Shoshone Laredo topped the 1981 gain test and brought \$19,000.

"Paternal lines are needed to maximize overall efficiency utilizing heterosis. They optimize the beef product yet without changing the beef factory (the cow herd)." He selects his paternals to be as diverse as the maternals can tolerate to achieve optimum heterosis. Cornerstones are: rapid growth with a maturity curve to complement the maternal line; metabolic efficiency from high appetite and capacity; carcass quality and yield per WDA; ribeye as a measurement of muscling; and fertility. Females produced by paternal lines in a producer's herd should not be used for reproduction, he points out. He advises they'll not likely be efficient as mother cows since their parent lines are selected for energy conversion to beef, not milk.

The "Reliable Intermediates" should produce a yearling growth EPD of plus 30 to 60 with milk EPD ranging in a minus five to plus five. This line represents 50 percent of the herd and would fit the bulk of the Angus industry. Or, it would meet the needs of the majority of those commercial producers seeking a straightbred alternative to crossbreeding or outcrossing. Says Larry of this group and its place in the marketplace:

"Maximizing all beneficial traits offered... is not progression, efficiency-wise, but perhaps even regression as all the peaks and valleys provided by the genetic assortment are also presented from both positive and negative correlations. Generating continuity is the purebred's sole reason for being."

Leonhardt labels his maternal line "The Constant Exquisites," describing them as providing efficient maternal function and more reliable calving ease. These are mature cows weighing 800 to 1,000 pounds with a few 1,100-pounders. Criteria applied in developing and maintaining this line include reproductivity and pelvic shape; mothering ability and disposition; butterfat, udder, and teat structure; size (capacity to function yet smaller in

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 + "The dairy industry doesn't use that bull" +
 + until he's proven. We in the beef industry +
 + are so unprofessional, we're looking for +
 + dreams all the time." +
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stature to minimize maintenance); and longevity and freedom from problems. One of the goals of the maternal line is to relieve the customer of being an experimental breeder along with being a producer—reduce his trial and error. Paternal lines can be mated to these maternal units with a high degree of uniformity and efficiency expected particularly at slaughter. Line-crossed males should not be saved as bulls from this crossing as they will be essentially hybrid in genetic assortment, a classic heterozygote genotype resulting from mating two inbred lines.

The maternal line is tailored to provide the hybrid Larry calls his "Green" Line, a product of "Blue" and "Yellow" lines (primary colors) or what might result from Maternal Line influence and the producer's base herd. (Green is a complementary color and is produced when primary colors blue and yellow are combined.) The same approach is used when producing, say, a complementary orange line from primary colors ("lines") red and yellow. Yellow characteristics should include moderate growth with mothering ability, calving ease, structural soundness, medium stature, and the potential to wean calves in a range of 65-75 percent of the cow's weight with progeny capable of finishing at yearling age and 1,000 to 1,300 pounds depending on the paternal mating.

Maternal Line yearling growth EPD should range from plus 20 to plus 30 with milk EPD bracketed between plus 5 to plus 15. Larry conceives of his "maternals" as providing more output with less input. He realizes the breed has been pressured to provide bigger, faster growing calves. However, he contends the bigger cows and bulls selected to gain this ability also increase cow maintenance. He suggests a systems concept allows the cow factory to remain in constant harmony with its environment while producing a marketable calf without disrupting the cow's basic pattern.

"We have all witnessed that 'smaller' cow bringing in that good big soggy calf year in and year out. These events are surely the result of favorable heterosis, so these cows have to be genetically different. Otherwise, why do we all have too few of them and why are we ineffective in our ability to renew them with any sort of continuity? If we wish successive patterns, our only course is to diminish the variety of their size and shapes."

Cow size is relative in his view. "It's only needed in a system to complement profit. A 1,600-pound cow can be just as efficient as an 800-pound cow all other things being equal. The job of these cows you see here is to glean these hills, to have a calf every year, and to be as management-free as possible. If we expect to have a supercow out here and we don't support her genetics, she will hold back on her priorities whether reduced milk production or reduced reproduction. Environment shapes adaptability."

Larry gives credit to one particular ancestor in forming the Maternal Line, Qualton of Wye—"one of the most instrumental maternal sires I've used in terms of productivity, fertility, milking ability, structural correctness and soundness, longevity. He traces back to one of the oldest Pathfinder Cows in the breed."

ROOTS OF AND THEORY BEHIND TRU-LINE, INC.

"Wye Plantation was a stabilizer for me," Larry says of his formative years. He pays tribute to James Lingle, associated since 1938 with the farm at Queenstown, Md., and also another Eastern breeder, K.A. Clark, breeder of the Craigie Herd started in 1947 at Alderson, W.Va. "Tru-Line (the trade name Leonhardt has given to his system's approach to hybrid beef production) seed stock and systems should not be considered to be a reflection of the Wye Herd," he points out. "We have merely had the fortunate opportunity to draw upon that source for developing certain germ plasm." The records from Wye plus its 50 or more years' experience, trial and error, and identification of bloodlines which might prove feasible for Leonhardt's program saved years of generation turnover.

Three breeds within a breed have been described. Larry is actually working with four breeds, number four being the Kenneth Clark Craigie herd. "He sent me a sample before he died. It was the biggest compliment I ever received in my life. He thought I would be a propagator of his stock without disrupting his 40 years of work. Now, he didn't give them to me, but arranged that I would be entrusted with them."

From these sources and roots, Larry created his Tru-Line systems approach to hybrid beef production. Its symbol is the familiar rainbow prism array displayed in a circle to illustrate the primary colors and their blending into complementary colors. The parallel is of course that the complementary colors cannot be formed without a pure, primary source—hence the need for "pure" lines to form "complementary" lines.

Cows are eartagged correspondingly. The color of the tag indicates their part of the system or program. Cattle tagged with white have no program. Their role is to test the complementarity of one of the other colors.



Michael Leonhardt, 23, at the summer range in Montana near Red Lodge and the state's famous Beartooth Pass. The family is also engaged in farming with typically 250 acres of sugar beets, 250 of corn, and 200 plus acres of alfalfa being raised under irrigation at the Cowley, Wyo., location.

"This is the US of A, and I could have picked any breed I wanted to, but I chose Angus because I thought they had certain characteristics more readily available. But, I have more sorting to do, I need to keep refining, I keep making smaller circles. I've reduced a single herd into four inner herds, and I call it breeding breeds within a breed for commercial use by all breeds."

The theme keeps surfacing: refine the pure lines and cross those for more beneficial vigor. Leonhardt thinks the crossing and hybridization within a breed would be easier and more dramatic if the bloodlines were more distinctive. "Through no one's fault, we've been combining for all-around traits and continual change. So, we've flattened the curves and increased the circumference of the spheres at the expense of predictability."

As purebred breeders do not as a rule measure, or act upon, the distribution of their progeny year in, year out, the loss is one of identity. The radicals and the outliers are noted, saved, or promoted, but the threads within the herd that might signal continuity, prepotency, or stability are overshadowed.

"The composite breeds are supposed to put all these wonderful traits together in a new breed. That's regression. What we have to do is go the other direction and continually refine breeds to improve their predictability and

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 + "Multiple trait balance is difficult to maintain... when higher levels of production are pursued with priority selection on a few traits... (emphasis is then required to be placed on the neglected traits. This compromise often reduces the initial rapid gains made with single trait selection." +++++

renewability so the commercial industry can stay flexible," urges Larry. "The purebred industry should stay—if they're careful of what they select for—where they can provide the stability so the commercial producer can be flexible." It's linebreeding and it's inbreeding and wrapping genetics tighter than one would normally dare. "I'm linebreeding to lock in qualitative characteristics and this is of course a risky thing. But, we might as well know what's there.

"I wish I didn't have to inbreed," he continues, "but it frees up the process. It exposes any weaknesses. I want the latitude from people to know I'll never breed perfect cattle nor do I expect to breed fault-free cattle, but I hope to improve them by knowing at least what's there. There's no reason to breed the cow back to her son if the genes are not desirable. But I've seen what the cow transmitted. Once I saw what the traits were and it was constant, then I don't see the bull transmitting anything much other than that."

RATIOED PREPOTENCY SCORES are arrayed by Larry on sires presently in the pipeline and producing progeny. Strict accounting and accuracy is essential in an intensive breeding program of this nature.

ON SELLING AND SERVING THE CLIENTELE

No, it's not an approach for the faint of heart or impatient. Larry emphasizes the student of line or inbreeding to consider the value of the traits he's trying to send out into the industry. Plus, those traits must be unquestionably able to dominate when out there. If the traits are in an overdominant position in the purebred breeder's herd, he says, then there's likely more value when those traits go out into the industry. "If they're not in a predominant position, then they're of no unique value."

He thinks the fields are ready for harvest. Commercial producers are disillusioned with the neighbor's crossbred bull. Replacement heifers of the easy-keeping kind and steers worthy of a premium are sought after. The glowing promises ring hollow, and Larry accuses the mongrelization of the past decade as placing crossbreeding, the commercial producer's "genetic crutch," in jeopardy.

The falsehood of "all-around breed improvers and changers" weighs on both the customer shopping at Tru-Line and upon the guy selling the product. Larry tries to change the typical thinking.

"I like to tell the buyer it doesn't matter what bull you buy from that pen. For all practical purposes they're all the same genetic makeup. If you want those bulls in that pen to do it all, don't buy them because they won't." He tries to appeal to the buyer's sense of value over the long haul.

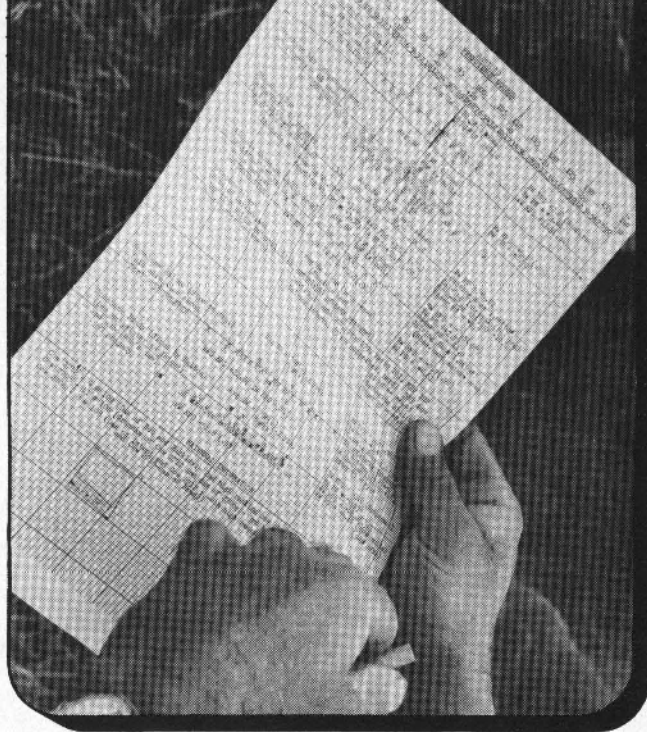
"The cow has to be functional, and if it takes us a long time to breed efficient, functional cattle, we want them to last. I can go to ancestry and the pedigrees and find those parents with longevity and structural soundness. When I sell my cattle, I don't price them on how high the EPD are. If the EPD are equal, I'll ask more for the one that offers the most continuity from his background. He should produce a more consistent product. The cheaper bull likely will give more variation in product."

RATIONALE AND APOLOGETICS

Amassing a higher degree of consistency for certain genetic characteristics is the purpose of inbreeding over generations. The nature of inbreeding is well-known. Through the years and since the principles of inheritance first became part of the common body of knowledge, there's been a reluctance to practice it widely because the loss of size, growth, or vigor was not commonly useful.

However, Nature seems to proceed quite well along a course of natural selection without resorting to extremes. And, Larry Leonhardt observes Nature clusters a larger percentage of its populations around the average, not the extremes. "In Nature, the bigger things get, the slower they seem to reproduce. It's not the biggest buck that breeds the does, it's the vigorous ones. Deer don't keep getting bigger. Are we measuring vigor in the beef industry? Seed stock producers might need to visit a major zoo to observe what animals are designed for.

"The reason the range man gets along so well is that he works with nature and studies her boundaries. Different environments dictate that we will always need different biological types. It remains the responsibility of the seed stock supplier to improve the genetic stability of each type. It is not his role to supply recombinated types from wide variation with the implication that he has somehow defied Nature and formed a 'super' parent. A 'super' animal, yes, a 'super' parent, no."



Larry thinks it's a mistake to always make the outlier or the hybrid the parent, assuming its outstanding performance or uniqueness will be passed on to the offspring. As has been well-documented, the genetic frequency or array is too diverse. Greatness or mediocrity are equally possible. The forces of action and reaction are constantly at play here with action dominating. Reaction in the form of weakness becomes more pronounced as it magnifies through the generations and eventually must be corrected. Frame size compromising early puberty or prompt rebreeding is a common example.

The Tru-Line philosophy is to enjoy the phenomena of hybrid vigor but not prematurely. Harmony with natural survival and natural genetic selection comes first. It's Larry's opinion the commercial industry is resisting cattle who have been "moved up" too far to fit their environment, resulting in a crash for reproductive and economic performance. "Even with supportive environments, the maximums in the dairy industry provide more than their share of problems, common among 'sprinters' as opposed to 'stayers'."

Tru-Line sires are selected then not for growth factors in the traditional sense but for continuity of the ancestry. "I'm... selecting from my field compatible traits, making strains of them, and making parents to carry them so we can recombine them in the commercial industry." Believing predictability is reduced in direct proportion to the variety of the parent's traits, it's the goal of Tru-Line to continually refine each of its strains toward higher homogeneous states from pools of pedigreed germ plasm.

Benefits to the commercial producer? Tru-Line's purpose is to reduce genetic speculation through pre-evaluated programs and thereby enhancing efficiency. The program proceeds through emphasis on lines, not just proven prepotent individuals. Heterosis is achieved by the commercial producer when he crosses the lines developed by Tru-Line. The genotype of the sires is "released" when a systematic combination takes place in the commercial herd; that's the only sense where Tru-Line might be described as in the crossbreeding or outcrossing business. It provides the genetic depth, prepotency, and production of pure lines for crossing.

Naturally, when winding genetics this tight, the potential for something to snap arises. Inbreeding becomes a sort of either-or situation. There's less and less

opportunity for an undesirable to be masked. The dominants and latents begin to stand out in bold relief. Demonstrating the potential is the case of Shoshone Shannon HC3, one of the Paternal Line bulls mentioned earlier. Here's a bull who, along with Shoshone Viking GD60, is one of only 10 sires "Tested Free of All Genetic Defects and Genetic Factors Monitored by the Association"—an elite and treasured seed source. Yet, the sire of Shannon, Shoshone Titan FD60, was discovered as a carrier of *osteopetrosis*, or marble bone disease.

Even here in this unfortunate turn of events, Larry has learned to be tolerant of the tightropes he treads. "If I can't get people to accept this philosophy today, I can understand that more than anyone else because of my own experiences. But with all my documentation, study, and observations, I can hardly keep still about it all."

Larry emphasizes that "defects" caused by a simple recessive are the easy ones to manage and he has some of his own theories about the mode of inheritance. "Geneticists are limited to the known, but theory is almost limitless by imagination; but we are all limited in our biological maneuvering by the total of what has evolved to this time. Until proven otherwise, I believe some sporadic effects attributed casually to either deleterious genes or an epistatic condition may just as likely involve gene transposition (when the same gene can provide a different effect dependent on the locus position)."

He's familiar with some genetic explanations describing the mechanics of how the phenomenon of

Older lines will be refined or put on the shelf and preserved for some future use when those qualities may again be needed.

heterosis or hybrid vigor occurs, but he says "they fail to offer a full enough explanation that coincides with observation, and I believe gene transposition is a factor as well.

"Gene transposition could account for the reason that the degree of homozygosity attainable in real practice is more self-governing or limiting than in theory. During research with mammals—despite reaching very intense levels of inbreeding—variation in the distribution of progeny persisted. These findings offer additional evidence to support harnessed hybrid beef production systems where uniformity can be maximized over alternate systems of mating type to type.

"Because the effects of inbreeding and outbreeding react so conversely, it could be a mistake to say that nature favors the outbred. The bottom line is not method, but total gene presence, which could stimulate a given set of genes to react differently when the hybrid (false) vigor is reduced, particularly involving the reproduction complex. In our attempts to keep up with the crossbred phenotype, perhaps we have indirectly selected false vigor via genetic differences. Perhaps selection of hybrid effects tied together with gene transposition and the limited understanding of negative correlations are the most confounding events to the purebred breeder. The EPD system in place today is a major advance in identifying what we have."

"It is obvious in nature that the male supplies the vigor, the female supplies environmental adaptability and population density. There is hybrid or false vigor and then there is the built-in vigor (soundness, power, spirit, brawn, mettle, a list almost without end), and we all have probably foregone the latter in favor of the more readily achieved hybrid vigor. At some point, size, growth, and

Some terms defined

Epistasis—the name given to nonlinear interactions, where the effect of one gene does not add to the effect of another to influence the phenotype of various kinds between any nonallelic genes.

Alleles—The gene is a portion of a DNA molecule and hundreds and even thousands of genes are carried on a single chromosome. The fact that chromosomes occur in pairs also causes genes to occur in pairs. Members of homologous pairs of chromosomes have a loci of the same position where similar genes (called alleles) are carried. Alleles are genes that occupy the same location on homologous chromosomes, but they affect the same trait in a different or alternate manner.

everything else can reach a point of diminishing returns. If we measured unilaterally all hidden costs as well, we would soon find that SIZE BY ITSELF has absolutely nothing whatsoever to do with efficient beef production. Size is only relevant to how we use it."

The 1702 calf pictured is a source of confirmation for Larry, a beacon for him into the future in his search for answers. "This 1702 calf is the culmination of years and years of effort. I can't put a dollar value on it, but if I paid myself a dollar a year, he's worth \$25. I've had a heckuva lot of failures, but this is the gratifying thing I've had with this calf, because he represents the future that will probably include even more intense concentrations. I'll probably put him right back on his grandmother."

Placing the right genetics in the right environment is where judgment and reality interplay. Larry must serve as confidant and advisor to his customers, analyzing their base herd and their previous purchases. Has he started them on a systems approach? What lines are they pursuing? Are the new cow lines at the half or three-quarter level?

So, he deals with many different circles, distributions, and realms of possibility both with his own operation and that of his variety of customers.

With the four herds, the goals and limits are structured, the resources limited, the decisions must be carefully weighed. Yet, the opportunities are ever-beckoning. There are simpler ways of approaching the registered industry. For example, why not focus on just a maternal line and avoid the complications of trying to identify and manage a carcass strain? Well, the challenge was there.

"I preferred to develop a paternal Angus strain rather than go out and choose another breed for carcass merit. Because I know my cattle, I wanted to produce a product for a percentage of a market, in this case Certified Angus Beef." Then, too, we suspect he may have thought the effort would be an education. Perhaps there would crop up some undiscovered genetic antagonisms or harmonies between maternal cattle and carcass cattle. Something to investigate.

And, Larry tempers his unique fervor with an understanding of the restraints that apply to any type of breeding business. There are markets to curry and new customers to cultivate. Those that practice a more conventional approach to purebred production and marketing get what they can when they can, but he questions their endurance. "Single trait selection will give you a great amount of progress in a relatively short period of time. But if you ever decide to stabilize, you'd better know there's a place for that or you'll find you're out of business. With inbreeding, you're making them both as good as they can be and as poor as they can be, and if that's not good enough, you'll never sell one.

"I know how I'm breeding my cattle for the next 50 years if I were to live that long. Now the individuals that make up that plan will change, but the plan is still there. The final product is the form."

AJ