

# Line Breeding to Outcrossing

## What's It All About?

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Traditionally, North American llama breeders have shunned all facets of line breeding. But, as the suri llama business community stands poised to formalize breed status to make the breed respected as a healthy livestock investment, owners must recognize that line breeding has given rise to nearly every breed of domestic animal that walks the planet. Even our painstakingly out-crossed modern llama herds descended from judiciously line-bred, pre-Columbian ancestors. This being the case, why do so many serious breeders uphold a tradition that has done nothing to create predictability, sustainability, and therefore value in their herds?

### Complications of tradition

In the early days of llamas in North America, out-crossing became the preferred *modus operandi*. The llama population was extremely small, and the "forefathers" of the industry were more conservationists of rare exotics than livestock breeders with the goals of predictability and uniformity in the herds.

As traditions have been handed down, the llama breeding community has inherited a disdain for any degree of inbreeding or line breeding, and a distinct bias in favor of out-crossing. While out-crossing has great value as a breeding tool, if it is not judiciously used it can quickly create a lack of uniformity and genetic unpredictability in a population.

Out-crossing decreases the chance that an individual's offspring will be similar to itself. In a breeding program where out-crossing is used generation after generation, outstanding suri llamas may emerge, but they will not be pre-potent for type. Some very successful breeders of other livestock regularly line breed, use a judicious outcross to "infuse new blood," and then go back to the line-bred family for the next generation. Alternating in this manner can be an excellent way to avoid the pitfalls of constant line breeding while maintaining a high level of uniformity in an established herd.

### "Urban legends" in the country?

To my knowledge, a "line" in the true sense does not exist in the North American llama population. Still, the term "line" is commonly used loosely and generally over-used. Llama breeders may refer to an animal as of the "Kantu line" when the animal is merely a great, great granddaughter of the legendary Kantu. Consider that after four

generations of out-crossing, that animal would statistically have inherited no more than 6.25 percent of its genes from Kantu. Only if Kantu appears on *both* sides of an animal's pedigree may that animal be accurately said to be "line bred to Kantu." (Understanding this principle alone makes it easy to see why we have only begun to tap the genetic power of some of these great suri sires and dams, and also why we are in no imminent danger of having a bottleneck of suri genetics. (See *Boys On the Side* in this issue.)

The term "line", when properly used, refers to a *group* of line-bred animals maintained as such for the purpose of concentrating the genes of an exceptional ancestor or group of ancestors. A well-maintained line demonstrates all the health, vigor, and reproductive soundness of the general population, but it is also pre-potent for the valued traits. Prepotency refers to an animal's ability to reproduce consistently its likeness in its offspring.

### **Selecting for the ideal**

The aim of line breeding is to produce llamas that are a desired type and which can reliably reproduce their characteristics in their offspring. When combined with proper selection, line breeding results in the production of individuals with a greater degree of homozygosis for those desirable traits of the common ancestor. It is this homozygosis that is the machinery of prepotency. Line breeding, when practiced properly, can be a powerful tool in producing pre-potent individuals and in "fixing" desirable characteristics in a herd.

Particularly important to the process of fixing traits and creating sustainability is the selection and creation of superior individuals that represent the ideal animal. Special attention must be paid to an animal's phenotype, how closely it represents the breed standard, and also to its parents. The ideal suri llama should represent the idealized animal phenotypically as set forth by the breed standard and be free of undesirable traits, such as light wool coverage and light bone. But further, the desired goal is that the animal should be the "spittin' image" of both its dam and sire. In short, it should already be the product of "like to like" breeding.

### **The bad comes with the good**

Unfortunately, undesirable characteristics are inherited just as easily as desirable ones, and those characteristics also can become "fixed" in a herd. Line breeding should be considered *only* if the common ancestor is truly outstanding, and defect-free. Any faults present in the common ancestor will become obvious in the line-bred offspring. In fact, the faults can be more serious in the progeny, since that generation is likely to be pre-potent for such traits and may, in turn, consistently pass on these defects. Thus, line breeding is the proverbial double-edged sword.

In the hand of a breeder skilled in the art of selection and unrelenting in culling practices, line breeding can very quickly sculpt a herd of masterpieces. But, in the hand of the unskilled, sentimental breeder with an untrained eye and a lack of understanding of pedigrees, the double-edged sword of line breeding can be the undoing of the breeder's enterprise.

### **Fame can be fleeting**

It then becomes of paramount importance for a breeder to undertake a thorough investigation of pedigrees before any line breeding program is considered. It might be *assumed* that a llama that had been a famous producer would naturally be a prime choice to whom to line breed, but this is not necessarily the case. A famous ancestor must be viewed in the context of the era in which it became famous. While it may have out-produced every animal of its time, it may still fall far short of standards and requirements expected of top producers today.

### **The importance of homework**

Line breeding, a mild form of inbreeding, does not pose the risk that many imagine. But a very real drawback of line breeding is the potential for "inbreeding depression". Inbreeding does not necessarily *cause* genetic defects; it simply exposes hidden recessive traits, many of which are deleterious.

Inbreeding depression is outwardly expressed as a loss of vigor and reduced reproductive fitness, and it typically increases as the degree of inbreeding increases. Not all species, breeds or lines within breeds have the same tolerance to inbreeding. Some withstand a high level of inbreeding without any adverse effects, others tolerate very little. For most domestic species, brother-sister mating is considered to be too close, while half-sibling pairings are considered to be safer. First cousin mating -- as well as granddaughter to grandsire mating -- can be very useful and safe, provided a breeder has done the necessary homework and the animals being used represent the ideal specimen.

### **In the interests of progress**

Considering the potential for inbreeding depression and exposing deleterious hidden recessives, why would one consider line breeding as a possible breeding program component? The answer is straightforward as evidenced among *all* purebred animals: line breeding is the surest way to create uniformity and prepotency for the traits we desire. Without it, the very machinery of domestication would grind to a halt.

With the decision to line breed comes the profound responsibility of stewardship and shaping the future of our camelid resources. Suri lama breeders choosing to enter this

bold frontier, this inevitable next phase of the llama breeding tradition, have at their disposal a treasure trove of unpolished genetic wealth.