

## Breeding Strategies

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Breeding of goats can involve different breeding strategies. Each of these is going to have different consequences for the herd, and wise producers will pick a strategy that fits their own philosophies and goals. No single strategy fits all situations, but each strategy is a wise choice for certain goals and production systems.

This discussion involves a variety of concepts. One concept, regardless of breeding strategy, is selection. Selection simply means using some goats for reproduction, and some for food (or whatever other use you can dream up for a non-reproductive goat)! Selection assures that more desirable goats (and the definition of these varies with situation and philosophy) produce more offspring than less desirable goats. Selection is one aspect of the machinery of improvement. Other concepts include the breeding strategies: inbreeding, line breeding, line crossing, and crossbreeding. These will have slightly different definitions depending upon who is talking, but the important fact is that the pairing of animals for reproduction can have varying outcomes depending on the relationship of the animals mated.

### Line breeding

One breeding strategy is Line breeding, which is really just different from inbreeding in degree. Both of these involve the mating of related animals (either distantly related or closely related). Inbreeding can be arbitrarily set as the mating of first-degree relatives (offspring and parents, or siblings), although this is only one possible definition among many. Line breeding can then be considered as the mating of related animals, but of less close relationship than first degree.

Line breeding (or inbreeding) results in uniformity of offspring, especially if adopted as a long-term strategy with appropriate selection. Uniformity of appearance and performance of line bred goats springs directly from the fact that line breeding increases genetic uniformity since parents are related. The uniformity can be for very good looks and performance, or for very bad looks and performance - the starting strain as well as selection practices will determine the relative quality of the end product. In addition, the degree of relationship of the parents helps to influence the degree of uniformity in the offspring (for good or ill).

.A very important historic note is that linebreeding and inbreeding are the usual strategies for the establishment of breeds. These two breeding strategies increase uniformity, and therefore predictability, of any population of animals. Predictability is the major attribute of breeds that breeders find useful. The predictability and consistency of any breed is why most breeders choose it - they want a specific type of goat producing a specific product.

The strength of linebreeding is that it increases homogeneity, and predictability. When coupled with selection (which it usually is) the result is hopefully a productive, predictable gene pool. This is the essence of the value of a purebred animal - predictability of production. Potential problems of linebreeding (and these are more common with inbreeding) include loss of general vigor, and especially loss of reproductive performance. Obviously, selection can help offset these. As a result, many linebred and inbred resources (breeds or strains) are indeed productive, vigorous, and reproductively sound.

### Crossbreeding

Crossbreeding is a philosophic and biological opposite to linebreeding, and involves the mating of animals of two different breeds. Crossbreeding is a fascinating phenomenon, partly because different things happen depending upon which stage of crossbreeding is considered. The first stage is the initial cross. A useful example comes from cattle, and when Angus and Hereford cattle are crossed the initial result is a very, very uniform crop of black baldy calves. These have benefited from the specific

combination of the genetic array of the parental breeds, and each calf gets half from each breed. Since each parental breed is uniform, and each calf gets half from each breed, every calf is pretty much like the next. This first calf crop is reaping the benefits of homogeneous parental breeds.

The trick is that if these calves are in turn used for reproduction, variability then increases since these calves are half one thing, half another. Using only color as the marker, these calves (when interbred) would produce black, black baldy., red, and Hereford pattern calves. The initial consistency is gone, and the result is a variable group of calves.

Variability is not all bad, and if combined with selection the excellent individuals can be skimmed off the herd and used to good advantage in show and other situations. They may indeed have excellent type and performance. What they lack, though, is the ability to consistently pass along this excellence to the next generation. They are something of a dead end, even though in themselves they may be wonderful, productive animals.

Many of the advantages of crossbreeding are somewhat the disadvantages of linebreeding: increased vigor and increased reproductive efficiency. Conversely, the disadvantages of crossbreeding are the advantages of linebreeding: consistency and predictability.

## **Linecrossing**

Linecrossing is the crossing of different lines within a breed, and while it has some of the same consequences as crossbreeding, it does contain this within a single breed. As a result, the variability is not as great as a cross between breeds, so that the boost from hybrid vigor is not as great. This technique can be used to good advantage in certain breeds, such as the Angora goat, where interbreed crossing would make no sense at all. With linecrossing the benefits of crossbreeding can be achieved, without loss of breed character and type. Consistency of production is still diminished though, and each individual situation will indicate whether this is a good tradeoff or not.

The phenomena associated with crossbreeding and linebreeding are going to have differing consequences for different breeders, largely due to differences in philosophy of breeders. That is, what do you want, and how do you want to get there? These questions are essential for all goat breeders, but are frequently not asked. In the absence of a guiding philosophy and set goals, breeding programs fail to make the progress that is possible with such guidance.

Uniformity of progeny is important to nearly every commercially based goat breeding operation, whether this be mohair, cashmere, dairy, or meat. Reasonably uniform kid crops that perform predictably are of great value to farmers, who can target management for the average level of production the goats are going to achieve. Obviously the kids are not going to be entirely uniform, and the better will always be retained in favor of the worse. However, as the variation diminishes, the top and the bottom performers of the kid crop approach one another (hopefully by the bottom coming up toward the top), so that the casual viewer is struck by the uniformity of the kid crop.

A few years back I was in Texas visiting Robert Kensing. His goats easily demonstrate the result of a consistent and long-term program of line breeding and selection. We were looking at groups of 1997 kids segregated as to keepers and culls. The culls were uniform, growthy, productive goats that would have done well for a Dumber of farmers (me included!) The keepers were likewise uniform, and even better and growthier than the culls. The point of the story is that this kid crop did not occur by chance but resulted from a careful, focused breeding program driven by a consistent selection philosophy over twenty five years. The selection decisions that breeders make today will determine the kid crop twenty five years from now.

Linebreeding takes time and commitment, while crossbreeding can be a quick fix and is a tempting strategy for a variety of reasons. One outcome of crossbreeding is initial phenomenal results, especially if the parents that are recruited for the crossbreeding are halfway intelligently selected. The boost of crossbreeding comes from hybrid vigor, and can easily be seen as the modern quest for meat goats comes to full flower. People now have available a number of distinctive related breeds, and these are going to produce growthy, productive crossbreds. These crossbreds, alas, will not in their own turn produce so excellently. This is due to their mix of genetic inputs from their parents - which come from different breeds, breeds.

## Summary

The result of all this is that crossbreeding does not make sense if the goal is consistent production generation to generation. Crossbreeding does make sense, in many circumstances. One of these is the production show animal. While something of an exaggeration, of a terminal (meat or show the ideal meat goat producing system would be some sort of small, fertile, line female that could be mated to a large, growthy, meaty paternal line. All of the kids should be reasonably uniform, making an appealing lot for sale. While they may not in their own turn produce uniform offspring, they themselves are uniform and the clever breeder can take advantage of that. Note well, though, that crossbreeding systems such as this depend on a source of the female line as well as the male line. Crossbreeding basically "uses up" genetic material without contributing to its maintenance. Crossbreeding therefore depends upon some segment of the industry being committed to purebreds - and purebreds of different breeds for different niches. The importance of this cannot be overstated, and we all owe a debt of gratitude to dedicated, purebred breeders.

Is crossbreeding bad? No, certainly not, although if it uses up adapted breeds as breeders go for the fad of the moment it can lead to diminished choices for future goat breeders. A good example of this is the feral goats of Britain that have been incorporated into cashmere producing systems. Some of these ferals may have been the remnants of the old type of North Atlantic goats (Old English, Old Irish, various Scandinavian breeds). It is too early to say if we lost something that might have been useful, but it is not early to say that we have indeed lost something.

Too few breeders have long-term commitments to linebreeding and the development of consistent, productive lines that are predictable for performance. Most of the older, high- reputation breeders of most breeds have indeed used this strategy (coupled with selection) to produce the sorts of goats that breeders today highly desire.

Every breed can benefit from several breeders using slightly different strategies, philosophies, and methods. It is healthy, for a breed to have some breeders linebreeding and others linecrossing, This allows for, successful combinations to be developed in a variety of locations and conditions, and all of this is good for goat breeds and goat breeders. A single program and philosophy will not fit all situations, and breeders need to encourage some diversity of approaches and techniques.

**Table comparisons of inbreeding/linebreeding and outbreeding**

<b>Trait</b>	<b>inbreeding/linebreeding</b>	<b>outbreeding</b>
<b>Uniformity</b>	<b>Good</b>	<b>Poor</b>
<b>Fertility</b>	<b>Poor (to good with selection)</b>	<b>Good</b>
<b>Growth</b>	<b>Poor (to good with selection)</b>	<b>Good</b>
<b>Predictability</b>	<b>Good</b>	<b>Poor</b>
<b>Overall vigor</b>	<b>Poor (to good with selection)</b>	<b>Good</b>
<b>Longevity</b>	<b>Moderate</b>	<b>Good</b>