

Let's Talk Linebreeding

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From *Tally Ho*. July-August 1997

One of the most bandied about terms among Basset Hound breeders today seems to be linebreeding. Despite its widespread use, however, linebreeding is frequently misunderstood and miscommunicated; in fact, it is not altogether uncommon for an outcrossed pedigree to be mistakenly viewed as linebreeding by the novice. The present discussion defines linebreeding and how we can more accurately describe our linebred litters.

LINEBREEDING AND INBREEDING: A FAMILY AFFAIR

INBREEDING and **LINEBREEDING** involve the mating of animals within the same family. Breeding relatives is used to cement traits, the goal being to make the offspring homozygous (pure) for desirable characteristics. Homozygous dogs tend to be prepotent and produce offspring that look like themselves (Walkowicz & Wilcox 1994).

Willis (1989) defines **INBREEDING** as the mating of animals "*more closely related to one another than the average relationship within the breed.*" Inbred pairings would include brother/sister (the closest form), father/daughter, mother/son and half-brother/half-sister. **LINEBREEDING** involves breeding relatives other than the individual parents or brothers and sisters. Typical linebred matings are grandfather/granddaughter, grandmother/grandson, grandson/granddaughter, great-granddaughter/great-grandson, uncle/niece, aunt/nephew and cousin crosses. Linebreeding is a less intense form of inbreeding. Because of their focus on a dog's potential genetic contribution, inbreeding and linebreeding are termed genetic breeding systems.

Figure 1 GENETIC BREEDING SYSTEMS		
<p>INBREEDING: Matings involving parents and siblings. Brother/Sister (the closest form) Father/Daughter Mother/Son Half-Brother/Half-Sister</p>	<p>LINEBREEDING: Matings involving relatives other than parents and siblings. Cousins (have one or two Grandparents in common) Nephew/Aunt Niece/Uncle G. Granddaughter/G. Grandson Grandson/Granddaughter Grandfather/Granddaughter Grandmother/Grandson *Linebreeding past the 4th generation has little effect*</p>	<p>OUTCROSSING: The breeding of unrelated animals. Works best if one or both are inbred or linebred.</p> <p>Matings involve unrelated animals.</p>
HIGH	Degree of Intensity	LOWER

DEFINITION: For a dog to be linebred there must be an ancestor in the pedigree that is common to both the sire and the dam. Figure 2 illustrates this concept. Kelly is linebred because the dog, Brahms, appears twice in the sire's side and once in the dam's side of the pedigree.

COMMON MISCONCEPTION: A pedigree may show either the sire and/or the dam to be linebred but no ancestor common to both the sire and dam. This is outcrossing, not linebreeding (see Figure 3).

Similarly, because the same kennel prefixes (Windy, Hill, Castle) are common to both the sire's and dam's ancestors, the newcomer may mistakenly view the pedigree as linebreeding.

WHERE TO DRAW THE "LINE"?

Breeders do not always agree on what constitutes linebreeding, with some feeling that common ancestors within the first five or six generations is linebreeding. Willis (1989) indicates that the farther back linebreeding is in a pedigree the less intensive it will be, pointing out that a dog appearing 12 times (out of a possible 32) in the 6th generation of a pedigree would have a Coefficient of Inbreeding (CI) of only 1.8% (by comparison, a sire to granddaughter cross has a CI of 12.5%). The CI tells us the proportion of genes for which the inbred ancestor is likely to be homozygous that is carrying the same genes from each parent. (Remember that homozygous animals have a higher potential for reproducing themselves.) In Willis's (1992) view, a common ancestor farther back than the 2nd or 3rd generation will have little influence on the litter. Linebreeding beyond the fourth generation has even less genetic impact.

HOW MUCH BANG WILL WE GET FOR OUR BUCK (OR BASSET!)

Several modern writers (Walkowitz & Wilcox 1994; Willis 1992, 1989; Onstott 1962) view linebreeding and inbreeding as essentially the same and differing only in degree of intensity. Whether one considers inbreeding and linebreeding to be the same or feels they are two distinct breeding systems, quantifying the degree to which an animal is linebred (or inbred) provides important information regarding its potential genetic contribution. As Willis (1989) states: "*When describing inbreeding [or linebreeding] breeders often say their dog is inbred or linebred without*

further qualification. This is a very inadequate description. We need to know which dog the animal is inbred [linebred] to and the degree of inbreeding [linebreeding]." Put another way, how much "bang" will we get from our linebreeding?

DESCRIBING YOUR BASSET'S LINEBRED PEDIGREE:
READING, WRITING AND A LITTLE ARITHMETIC!

Willis (1992) suggests that a concise yet meaningful way to express the extent of linebreeding (inbreeding) is to number the generations of the animal in question. The common ancestor(s) is assigned the generation number as he/she appears in the pedigree. The parents are the first generation (1), the grandparents are the second (2), great-grandparents are the third (3), great-great-grandparents are the fourth (4) and so on. Figure 2 illustrates this concept.

FIGURE 2 LINEBREEDING			FIGURE 3 OUTCROSSING				
	(1)	(2)	(3)	(Sometimes mistaken as linebreeding)			
Kelly	Sire: Neil	Barry	Brahms	Rover	Castle	Castle King	
		Fanny	Nancy		Sire: Windy	Prince	Castle Queen
			Brahms		Edward	Windy	Castle King
	Dam: Belle		Zella		Maiden	Castle Queen	
			Alert		Windy	Windy Will	
		Brahms	Mary		Thomas	Hill's Lisa	
	Chime	Emma	Hill's	Windy Will			
	Raven	Pam	Mary	Brown's Cora			

As previously stated, Kelly's pedigree is an example of linebreeding, with Brahms appearing on both the sire's and dam's side. On the sire's side Brahms appears twice in the third generation (3). We can write this as 3.3. On the dam's side, Brahms appears once in the second generation (2) and this is written simply as 2. Willis has suggested the following written and verbal formats for expressing the extent of linebreeding in a pedigree:

WRITTEN FORMAT	VERBAL FORMAT
<i>We would write:</i> "Kelly is linebred on Brahms 3.3/2."	<i>We would say:</i> "Kelly is linebred on Brahms three, three TO two."

In the Written Format notice we separate the sire's and dam's side of the pedigree by using a slash mark (think of a pencil making a slash mark); in the Verbal Format the word "TO" is used to separate the sire's and dam's side (think of talking "to" someone). This verbal and written format tells us the dog on which Kelly is linebred and the extent of the linebreeding. Smaller numbers indicate that a dog is more closely linebred; larger numbers of 4 and above (Willis 1989) indicate a lesser extent.

LINEBREEDING AND PEDIGREES: A FINAL CAVEAT

Linebreeding and inbreeding are essentially the same, differing only in degree of intensity. (In Willis's view, common ancestors beyond the 2nd and 3rd generations will not greatly influence the resulting litter.) We have described the ease with which an animal's extent of linebreeding may be expressed by means of written and verbal models. Perhaps this format will be "adopted" by those Basset Hound breeders whose interest lies in linebreeding. In addition to facilitating the description of a linebred pedigree over the phone, it certainly provides important information regarding the potential outcome of a breeding. In this regard, two things bear repeating: (1) linebreeding (and inbreeding) are only as viable as a breeder's knowledge of basic genetics (a topic which will be addressed in future columns) and (2) a linebred pedigree is only as valuable as a person's ability to determine the virtues and faults of the dogs it contains. When we add the final ingredient of rigorous selection hopefully we are on the way to producing better Basset Hounds!

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