

2008 Fiber Scan & Lab Study Report

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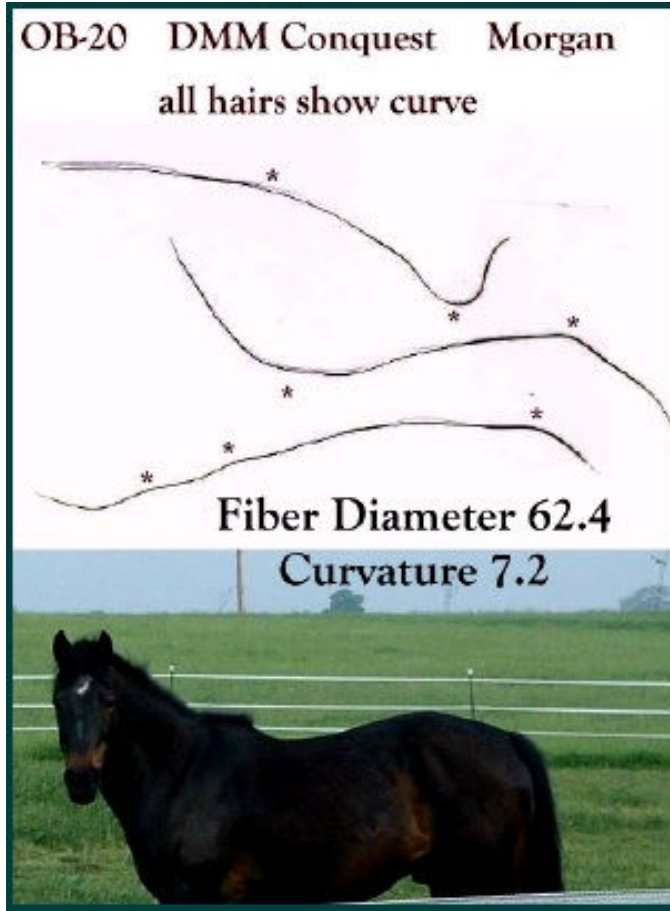
The fiber studies done in '06 and '07 concentrated on the spinning qualities of Curly horse fiber using lab tests of fiber diameter and curvature measurements. In '07 we tested different samples areas of the body coat looking for the finest fibers at base of ears, chest and belly areas. These samples were scanned on a flat bed computer scanner and compared to Smooth Coat Curly horses and other non-Curly breeds. The fiber scans and the fiber lab tests on a few other breeds and Smooth Coats showed curvature in the measurements which prompted the '08 study on non-Curly breeds considered straight-coated horses.

The objective of the 2008 Fiber study was to fiber lab test and fiber scan other breeds of horses that appear to be straight haired breeds so we understand what the normal range is for curvature and fiber diameter measurements of their body hair and compare that to Curly Horse ranges. In the fiber scan studies a close up of the hairs are taken and a photo of the horse is archived also if a photo was available. Fiber Diameter and Curvature measurements were calculated and added to the scans.

The horses in the study consisted of Thirty (30) non-Curly breeds considered to be straight haired breeds including: 14 Missouri Foxtrotters, 1 Mule, 1 Arab x Paso Fino, 1 Paint x QH, 1 Morgan, 1 Morgan cross, 2 Quarter Horses, 1 Mini horse, 1 Thoroughbred, 1 Holstiener, 2 Peruvian Pasos, 3 Arabians, 1 Pony of the Americas. (*Note- 4 samples were not lab tested because fiber samples were too small. This included 2 MFT, 1 Peruvian Paso and 1 mule). Five (5) Curly coated other breeds (non-Curly breeds considered recessive for coat curl) including a Paint, a BLM Burro and 3 MFT's were measured. Four (4) Smooth Coat Curly horses were also included. Eleven (11) Dominant Curly coated horses were also included. 1 Suri Alpaca. All hair samples were sent to Yocom- McColl Fiber Labs in Colorado for testing the fiber diameter and curvature of the hair samples.

Fiber Scan Results- All hair fibers scanned showed forms of curvature in varying degrees from almost straight to very strongly curved. The non-Curly breeds showed on average less curvature and the Curlies showed the most curvature. The Suri Alpaca resembled the Curlies in curvature in the scans with twist & corkscrew shapes of fibers. Four other fiber animals were included in the scans to show the relationship of their curvature measurements to the Curlies. They include Huacya Alpaca, Suri Alpaca, Llama and Mohair Goat.

Example of Fiber Scan



Lab Testing Results- Fiber Diameter measured in microns was obtained on all hair samples as well as curvature measurements. Horses average fiber diameters were all above 30, showing horses have a coarser fiber. The fiber industry standard is under 30 microns for finer fibers used in textiles. The finest horse fiber was a Curly, Chip's Lil Lightning Bolt at 38.2. The Suri alpaca tested had the lowest fiber diameter 30.8. The second finest horse fiber was an Arabian 39.9. The coarsest horse fiber belonged to a Missouri Fox Trotter 99.7.

Range of Fiber Diameter:

All horses tested~ 38.2 to 99.7

Non-Curly breeds~ 39.9 to 99.7

Dominant Curly horses~ 38.2 to 66.1

Smooth coats~ 41.2 through 65.6

Curvature measurement- All horses in the study had an average curvature measurement.

Range Of Curvature:

All horses tested~ 5.2 to 21.7

Non-Curly breed visibly straight haired~ 5.2 to 16.8

Non-Curly visible curly coat (ie. Recessive Curly)~ 8.4 to 10.9.

Smooth Coat Curlies~ 6.8 to 9.9

Dominant Curlies~ 8.2 to 21.7.

The horse with the lowest curvature measurement was a Missouri Foxtrotter 5.2, the horse with the highest curvature measurement was a dominant Curly 21.7. The highest curvature measurement on non-Curly breed was a Mini stallion at 16.8

In a phone discussion with Angus of Yocom-McColl Fiber Labs, he revealed that all fiber animals used for commercial textile production had curvature measurements above 50 and those below 50 are considered too straight to be used to produce textiles that hold their shape. Since all horse samples were well below the 50 range standard for textiles, all horses' measure in the very low curvature range including Curly horses. Angus discussed some fiber animals that most resemble Curlies curvature and they are the Huacaya Alpaca and the Suri Alpaca, especially the Suri Alpaca because its fiber has a twist to it that creates long dreadlocks. The curvature measure of the Suri Alpaca is in the teens also like many Curly horses. The Huacaya alpaca has a fiber diameter and curvature very similar to our Curlies in the 20 range but does not have the twist to it's fibers and has an appearance of a plush, teddy bear like coat because the fibers are long and the weight of the fibers pull out the curl at the ends. The huacaya crimp (curvature) is tighter near the skin.

Angus also said that even though the curvature measure is so very low on Curlies and especially some of the other breeds, the curve they have is there and showing measurable curve to their hairs. Since the non-Curly breeds did not show a measurement of zero, they also had some curve to their hairs. He could see the curvature even though it was very slight on some of the samples. The curvature measurement in horses is very very low. Our highest curvature measurement was from a Brillo Pad Curly at 24.2 in last years study. This is the highest measurement to date, but still way below the 50 curvature range of the textile industry standards. He also commented that curvature is also hard to see on some very high curvature fibers that measure at 150 for curvature. Without a magnifying glass the crimp is not visible because it is so small and tight.

Overview- All of the horse hair samples showed low curvature. The most common measurement for non-Curly horse breeds was between 8 to 10. The average curvature measurement for Curlies was in the teens. Smooth coats fell below 10. There were no straight hairs measuring zero.

The lower the curvature measurement, the straighter the hair appears visually and also will be a coarser hair on average. Most of the curvature measurements on other breeds

appearing straight fell within the range of curvature for Smooth Coats, Curlies and other breeds that show a visible curly coat. Dominant Curly horses generally showed a higher twist to their hairs when they had higher curvature measurements. Low measurements on Curlies did not show as much twist. The highest curvature on another breed, the Mini stallion did not show twist and has flatter looking hairs and appears fluffy coated visibly. Some other breeds and Smooth Coats also show a very weak, low twist. Tightness of twist with curvature may need to be examined in how it affects visible curl in our Curlies. A full report with fiber scans will be available on the ICHO webpage- <http://curlyhorses.org>

2008 Fiber Study~Lab Testing Results

CODE	Name	Breed	Visual Coat type	Fiber Diameter	Curvature Measurement
*OTHER	BREEDS		Visually Look straight	-30=finer +30=coarser	0.0 =straight, 0.1 & over has curve
OB-2	Rio	MFT	S	67.4	8.3
OB-3	Midnight	MFT	S	78.7	8.6
OB-5	Queen	MFT	S	66.7	7.5
OB-6	Daisy	MFT	S	76.0	9.7
OB-7	Penny	MFT	S	99.7	8.1
OB-9	Fargo	ArabxPF	S	42.8	12.0
OB-10	Arrow	QH	S	65.5	9.8
OB-11	Julliette	Holstiener	S	55.6	9.7
OB-13	Joan's	Arab	S	56.9	10.3
OB-14	Fanny	QH	S	55.0	7.4
OB--15	Tiffany	TB	S	50.6	9.8
OB-16	Pisado	PP	S	80.3	8.4
OB-17	Mini	Mini	S fluffy	44.6	16.8
OB-18	Talon	Arab	S	43.4	8.6
OB-19	Dreza	Arab	S	39.9	9.9
OB-20	Conquest	Morgan	S	62.4	7.2
OB-21	General	POA	S	53.9	8.5
OB-22	Flynn	Paint/QH	S	41.6	14.3
OB-23	MerryLegs	MorganX	S	43.6	9.8
OB-24	Elfin	MFT	S	58.8	6.0
OB-25	Ribbon	MFT	S	62.5	7.9
OB-26	Molly	MFT	S	67.5	6.5
OB-27	QueSeRa	MFT	S	60.7	8.7
OB-28	Aysha	MFT	S	59.6	8.4
OB-29	Millie	MFT	S	54.9	10.9
OB-30	Solaris	MFT	S	74.6	5.2
All other	breeds	showed	Curve, No	Straight 0.0	Hairs found

Range	5.2 to 16.8				
Other	Breeds	showing	curly	coats	
COB-1	Pistol	Paint	C	48.8	10.1
COB-2	Pink Floyd	Burro	C	77.4	10.2
COB-3	Toy Boy	MFT	C	60.9	10.9
COB-4	Jasmine	MFT	C	53.9	9.7
COB-5	Ruby	MFT	C	56.6	8.4
SA-1	Suri	Alpaca	C	30.8	10.3
All show	curvature	range	8.4 to 10.9		
SMOOTH	COAT	Curlies			
SC-1	Crystal	SC	SC	41.2	9.9
SC-2	Lio	SC	SC	63.7	8.8
SC-3	Rowan	SC	SC	63.9	9.4
SC-4	Starr	SC	SC	65.6	6.8
All show	Curvature	Range	6.8 to .9.9		
DOMINANT	CURLIES				
DC-1	Buzz	C	C	50.0	21.7
DC-2	Bill	C	C	47.2	11.4
DC-3	Guy	C	C	49.2	10.4
DC-4	Sesko	C	C	50.9	10.2
DC-5	Maizzi	C	C	65.7	8.2
DC-6	Katee	C	C	66.1	9.0
DC-7	Lila	C	C	48.5	10.7
DC-8	Nagi	C	C	53.8	9.8
DC-9	Apo	C	C	47.9	14.8
DC-10	Deva	C	C	50.0	12.8
DC-11	Lightning	C	C	38.2	17.8
All show	Curvature	Range	8.2 to 21.7		

Complete '06, '07, '08 Fiber Diameter & Curvature measurements, listed from lowest to highest

Fiber Diameter Range. Shows the relationship between Fiber Diameter & Curvature measurement.

Name & Code ID E-ears C-chest B-belly N-neck	Breed	Fiber Diameter (FD) listed from lowest to highest measurements	Curvature Measurement high numbers show the most curvature	*Horses that have most curve of 20 + in each fiber diameter range
<i>10 FD Range</i> Angora Rabbit AR02	rabbit	14.6	53.3	
<i>20 FD Range</i> Buffalo B04	buffalo	22.6	70.1	
Yak Y01	yak	27.2	49.8	
Noble O08	MFT	29.0	22.7	*22.7
<i>30 FD Range</i> Cisco's Pistol	Paint x	30.00	19.7	
Suri Alpaca SA-1	alpaca	30.8	10.3	
Sterling D09	D Curly	31.1	19.6	
Llama L03	llama	31.4	24.4	
April Showers D19E	D Curly	31.6	15.2	
Gypsy Magic 0017	D Curly	32.5	17.3	
S Rockette D20E	D Curly	32.7	13.2	
Unkn Curly 005	D Curly	33.4	22.6	*22.6
GoTaddyGo D17E	D Curly	34.2	13.6	
GetOODodge D16E	D Curly	35.6	22.1	*22.1
PrinceCharles D18E	D Curly	35.6	13.7	
NavajoChurro	Sheep	35.7	44.3	
Mohair Goat	Goat	35.7	16.2	
CPPetite D06E	D Curly	35.8	14.7	
CPPetite D06C	D Curly	36.2	15.0	
JDOCurl D24N	D Curly	36.8	11.8	
Xeque D01E	D Curly	37.3	19.2	
Unkn Pony 002	D Curly	37.3	15.6	
Prince Charles D18B	D Curly	37.8	13.1	
Spunky BF01	SC Curly	37.8	10.9	
KatrinaF 0012	D Curly	37.9	22.4	*22.4
GetOODodgeD16C	D Curly	38.0	20.0	*20.0
Lightning DC11	D curly	38.2	17.8	
Unkn Curly 004	D Curly	38.7	22.2	*22.2
Huacya Alpaca	Alpaca	38.8	22.0	

JBMoon D42N	D Curly	39.0	13.6	
Dreza OB19	Arab	39.9	9.9	
<i>40 FD Range</i>				
Flash BF03	SC Curly	41.1	13.1	
Penny'sCrystal SC1	SC Curly	41.2	9.9	
Unkn Curly 006	D Curly	41.3	16.5	
Flynn OB22	PaintxQH	41.6	14.3	
CCBabe D36N	D Curly	42.0	16.0	
UJack 0013	D Curly	42.0	11.4	
SRockette D20C	D Curly	42.1	10.5	
Fargo OB9	ArabxPF	42.8	12.0	
SPSunrise 0018	D Curly	43.2	16.4	
SGMagic D04C	D Curly	43.3	12.7	
Talon OB18	Arab	43.4	8.6	
MerryLegs OB23	Morgan x	43.6	9.8	
Awesome D030	D Curly	44.1	10.1	
Mini Stallion OB17N	Mini	44.6	16.8	
AMBuentsno D26N	D Curly	45.0	16.7	
JMWalk D31N	D Curly	45.1	14.0	
Frontier D40N	D Curly	46.0	10.1	
CODigger D22N	D Curly	46.0	17.9	
AShowersD19C	D Curly	46.2	11.4	
SPSunrise D05C	D Curly	46.2	9.3	
WFrannie D33N	D Curly	46.3	8.6	
JMMoon D34N	D Curly	46.5	9.0	
SJPatches D07C	D Curly	46.7	17.4	
ZSilken SC05N	SC Curly	47.1	9.4	
Bill DC2N	D Curly	47.2	11.4	
PrinceCharles D18C	D Curly	47.3	11.8	
Apo DC9N	D Curly	47.9	14.8	
ZGLady D13	D Curly	48.2	15.5	
Lila DC7N	D Curly	48.5	10.7	
Cisco'sPistol COB1N	Paint x	48.8	10.1	
AThyme D28N	D Curly	49.1	8.2	
CiscoPistol M03body	Paint x	49.2	10.3	
GTadyGo DC3N	D Curly	49.2	10.4	
PARose D08shoulder	D Curly	49.9	24.2	*24.2 brillo pad
<i>50 FD Range</i>				
BuzzLY DC1N	D Curly	50.0	21.7	*21.7
DevaPockets DC10N	D Curly	50.0	12.8	
Tiffany OB15body	TB	50.6	9.8	
GTadyGo D17C	D Curly	50.7	10.1	
DCCocoa D10body	D Curly	50.8	16.1	
Sesko DC4N	D Curly	50.9	10.2	

Xarina D3E	D Curly	51.4	9.9
LillysMM D8body	D Curly	51.4	12.1
CPPetite D06B	D Curly	51.9	12.6
Xeque D01C	D Curly	52.1	16.6
JDMCRC			
D29NDarkhair	D Curly	52.7	9.2
CinnamonIce	D Curly	53.3	17.5
D9body			
Nago DC8N	D Curly	53.8	9.8
GetOODodge D16B	D Curly	53.8	15.2
Jasmine COB3N	MFT	53.9	9.7
General OB21N	POA	53.9	8.5
AprilShowers D19B	D Curly	54.6	9.6
GTadyGo D17B	D Curly	54.6	10.4
Cinn'Ice D12body	D Curly	54.7	13.5
WSedrick D41N	D Curly	54.9	9.0
Millie OB29back	MFT	54.9	10.9
SunCatcher D39N	D Curly	55.0	9.1
Fanny OB14body	QH	55.0	7.4
Xeque D7B	D Curly	55.5	13.7
Julliette OB11body	Holstiener	55.6	9.7
CGDigger D43N	D Curly	55.8	7.4
Xeque D01B	D curly	55.9	13.8
Ruby COB5	MFT	56.6	8.4
DDIt SC03	SC Curly	56.8	7.8
Joan's Arab OB13	Arab	56.9	10.3
RConnection D29B	D Curly	57.8	8.4
Xarina D3C	D Curly	58.1	10.9
GTaddyGo D1 body	D Curly	58.6	14.6
DevaPocketsD10B	D Curly	58.8	13.3
SPSunrise D05B	D Curly	58.8	9.6
Elfin OB24side	MFT	58.8	6.0
Aysha OB28back	MFT	59.6	8.4
60 FD Range			
QueSera OB27	MFT	60.7	8.7
DCatcher D23N	D Curly	60.7	8.3
Unkn Curly D3body	D Curly	60.7	13.4
ToyBoy COB3back	MFT	60.9	10.9
SGMagic D04B	D Curly	61.6	10.2
Conquest OB29N	Morgan	62.4	7.2
Ribbon OB25back	MFT	62.5	7.9
Priscilla D32N	D Curly	62.7	8.6
Lio SC2	SC Curly	63.7	8.8
Rowan SC3	SC Curly	63.9	9.4
SRockette D20B	D Curly	64.6	7.2

JimmyDee D14	D Curly	64.7	10.0
Arrow OB10N	QH	65.5	9.8
Starr SC4	SC Curly	65.6	6.8
Maizzi DC5N	D Curly	65.7	8.2
Katee DC6N	D Curly	66.1	9.0
DevaPocketsD10B	D Curly	66.3	14.5
Xarina D3B	D Curly	66.7	9.4
Queen OB5N	MFT	66.7	7.5
DPocketsD10side	D Curly	66.8	12.8
Rio OB2N	MFT	67.4	8.3
Molly OB26back	MFT	67.5	6.5
Manny SC16body	SC Curly	67.8	7.9
70 FD Range			
Xarina D21body	D Curly	70.2	10.7
TMoon D20body	D Curly	70.4	11.5
TTMBeauD11body	D Curly	73.5	10.0
GloryPWD15body	D Curly	74.2	7.9
SolarisOB30shoulde r	MFT	74.6	5.2
Daisy OB6N	MFT	76.0	9.7
PinkFloydCOB2	blmBurro	77.4	10.2
Midnight OB3N	MFT	78.7	8.6
80 FD Range			
PisadoOB16 body	PeruvianP	80.3	8.4
90 FD Range			
Penny OB7N	MFT	99.7	8.1

Curvature Averages in each Fiber Diameter Range

20's Fiber Diameter Range

1 Non-Curly 22.7 curvature
no Curlies in this range
no SC in this range
Highest curvature measurement in a Non-Curly.

30's Fiber Diameter Range

19 Dominant Curlies: average curvature 17.0 [8 were over ave, 11 under ave.] (5 over 20 curvature)
2 Non- Curlies: average curvature 14.8 [1 over ave, 1 under ave.]
1 SC Curly 10.9

On average Dominant Curlies showed more curvature in the 30's range of fiber diameter and SC Curlies showed the least curvature in this range.

40's Fiber Diameter Range

24 Dominant Curlies 13.1 average curvature [10 over ave., 14 under ave] (1 over 20 curvature)
7 Non-Curlies 11.7 average curvature [3 over ave, 4 under average]
3 SC Curlies 10.8 average curvature [1 over ave, 2 under ave]

On average Curlies show more curvature in the 40's range of fiber diameter and SC Curlies showed the least curvature in this range.

50's Fiber Diameter Range

26 Dominant Curlies 12.2 average curvature [12 over ave, 14 under ave] (1 over 20 curvature)
10 Non-Curlies 8.9 average curvature [4 over ave, 6 under ave]
1 SC Curly 7.8 curvature

On average Curlies show more curvature in the 50's range of fiber diameter, and SC Curlies showed the least curvature in this range.

60's Fiber Diameter Range

11 Dominant Curlies 10.1 average curvature [4 over ave, 7 under ave]
8 non-Curlies 8.4 average curvature [4 over ave, 6 under ave]
4 SC Curlies 8.2 average curvature [2 over ave, 2 under ave]

On average Curlies show more curvature in the 60's fiber diameter range, and SC Curlies showed the least curvature in this range. Although the curvature values were very close for Non Curlies and SC Curlies in this range of fiber diameter.

70's Fiber Diameter Range

4 Dominant Curlies 10.0 average curvature [2 over ave, 2 under ave]
4 Non-Curlies 8.4 average curvature [3 over ave, 1 under ave]
No SC's in this range

On average Curlies show more curvature in the 70's range of fiber diameter and Non-Curlies showed the least.

80's Fiber Diameter Range

1 non-Curly 8.4 curvature
no Curlies in this range
no SC in this range

90's Fiber Diameter Range

1 non Curly 8.1
no Curlies in this range
no SC in this range

*Overall as Fiber Diameter increased, Average Curvature decreased.

Average Curvature Measurements in Fiber Diameter Ranges

FD range	CAveCurve	NCAveCur	SCAveCur
20		22.7	
30	17	14.8	10.9
40	13.1	11.7	10.8
50	12.2	8.9	7.8
60	10.1	8.4	8.2
70	10	8.4	
80		8.4	
90		8.1	

Graph shows average curvature for Each horse group for fiber diameter Range.

Curly horses have a closer range of fiber Diameter. Other Non Curly breeds show A wider range of fiber diameter.

Smooth Coat Curlies show a close range Of fiber diameter.

The Curlies show a higher average of Curvature measurements than non-Curlies and Smooth Coats.

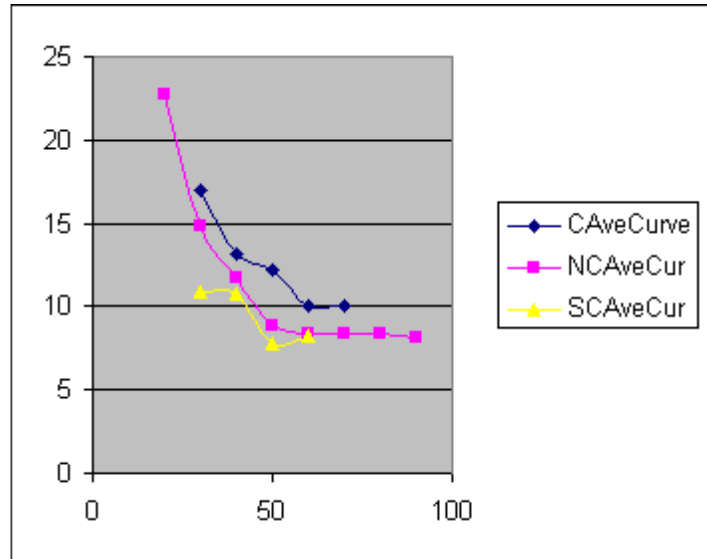
C= Curly horse Average Curvature
 NC= Non Curly Average Curvature
 SC= Smooth Coat Curly Average Curvature

Conclusions-

All horses lab tested in '06, '07 and '08 studies had a fiber diameter and curvature measurement, no straight haired horses measuring zero curvature were found. The hair fiber diameter is inversely proportional to the hair curvature measurement in the majority of horses. The finer the hair fiber, the more curvature is present and the coarser the hair the less curvature present, this was also true for the other fiber animals tested. A few Curlies did not follow this pattern as they had higher fiber diameter and highest curvature measured, one was a Brillo Pad Curly and the other was not.

Curvature averages were also calculated for Curlies, Non-Curlies and Smooth coat Curlies for each range of fiber diameter. In each fiber diameter range the Curlies had the highest average for curvature. Curvature values that were in the same range, were Curlies

Fiber Diameter and Average Curvature Graph



that fell below their average and Non-Curlies and Smooth Coats that were above their average curvature.

The Curlies have a closer range of fiber diameter than the Non-Curly breeds. Non-Curly's showed the widest range in fiber diameter measurements.

The Smooth Coats have a smaller range of fiber diameter and curvature measurements than Curlies and Non-Curlies. Curlies had the most high number values for curvature.

This showed up in the 30's range of fiber diameter. Only one Non-Curly had a curvature measurement as high as a Curly. Although all horses showed curvature, the Curlies had the higher measurements overall.