

GORGEOUS GREYS

A GUIDE TO BREEDING GREY ALPACAS

- ◆ GREY BREEDING ARTICLES & RESEARCH
- ◆ GREY BREEDERS RESOURCES
- ◆ FIND BREEDERS OF GREY GENETICS



PRECISION

OUR GOALS

At Precision Alpaca Group we aim to produce luxurious, ultra fine fleeces that exhibit an advanced style and superior density on conformationally sound, true to type animals. We aim to produce these elite fleece qualities in all colours, not just white. We believe that producing this style of fleece will enhance the commercial viability of alpaca fibre production.

OUR GREYS

Precision strives to breed elite greys. This is not possible without a solid female base. Boasting females such as Shanbrooke Miss Temptation, Shanbrooke Grey Caviar, 3x Sydney Royal Champion grey fleece and 2x Colourbration Supreme grey fleece winner Vision Aphrodite, Colourbration Supreme Champion Vista Ninera, and Bardella Park Shaded Serenity who tested at 14.4 μ , 2.6SD second fleece, results that would be the envy of the most elite whites. Precision proudly displays exceptional quality in grey, with the best genetics Australia has to offer.



Max Mathews, Taryan Mathews, Erika Kostiakos & Con Kostiakos

Phone: 0417 845 480 (Max)

Precisionalpaca@gmail.com

39 Budds Lane, Baynton, Victoria 3444

PRECISIONALPACA.COM

ALPACA



During 2018, Shanbrooke Grey Commander excelled in the show ring. Results speak for themselves: Champion Intermediate Male at Canberra Royal, Champion Grey at Sydney Royal, Supreme Grey at Carousel of Colour, Premier Grey at AlpacaFest, and finally Supreme Champion Grey at the Australian Alpaca Spectacular. This male is going from strength to strength, and has now joined the elite Precision Grey Stud line up.

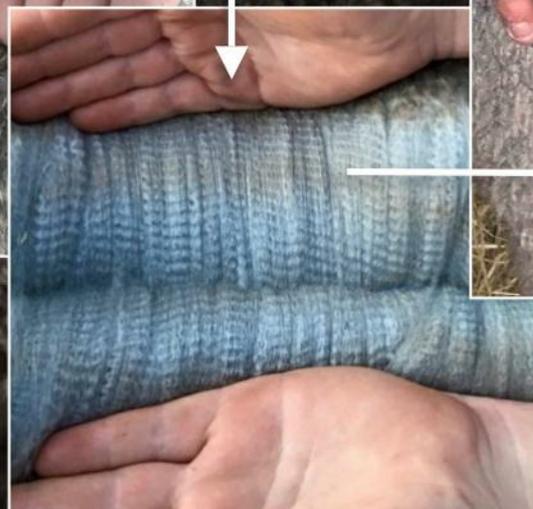


IT'S ALL IN THE GENETICS

Precision's enviable quality has not come about by chance. Precision has spent years developing an elite grey gene pool. This consists of some of the best grey genes Australia has to offer, as well as some of Australia's most envied white genetics, allowing us to present a unique and exclusive line up of exquisite greys. The proof is in the generations of elite.



Morning Star Gigi
10 years of age



Morning Star Rigel
5 years of age



Shanbrooke Grey Commander
2 years of age

Publisher

Camelid Connections Magazine - Speciality Publications
 by Oak Grove Graphics
 ABN 84 171 413 342

PO Box 4059, Candelo NSW 2550
 Telephone +61 (0)2 6493 2036
 Email: info@camelidconnections.com.au
 Web: www.camelidconnections.com.au

Editor/Designer

Julie McClen telephone 02 6493 2036
 Email: julie@camelidconnections.com.au

Designed and Produced

By Oak Grove Graphics
 PO Box 4059, Candelo NSW 2550
 Telephone +61 (0)2 6493 2036
 info@oakgrovegraphics.com.au
 www.oakgrovegraphics.com.au

Copyright

All material appearing in this publication is subject to copyright.
 Reproduction in whole or part is not permitted without the written
 permission of the publisher and the author.

Liability

Views expressed by the contributors to this publication, and the
 advertisements appearing in this publication, are not necessarily endorsed
 by the publisher.

Every care is taken in compiling the contents of this publication, but the
 the publisher or editor assumes no responsibility for the accuracy of
 information contained in the text or advertisements.

The reader should always consider if information provided in articles or
 advertising in this publication is correct for their situation, and the
 publisher and editor assumes no responsibility for any outcomes resulting
 from the use of such information.

Contents

Introduction.....	5
The Breeding Of Grey Alpacas.....	6
Take The Guess Work Out Of Breeding Greys	10
Products Of Interest.....	14
Solid Grey.....	18
Registering Greys.....	22
Observations From A Grey Breeder.....	24
Alpaca Colour Genetics.....	30
Lethality Of The Grey Gene In Alpacas.....	36

Advertisers

Precision Alpaca.....	2/3
Qozco Alpacas.....	9
Baarrooka Alpacas.....	13
Riverport Alpacas.....	15
Oak Grove Graphics.....	16
Grey Dream Alpacas.....	17
Greenwood Alpacas.....	20
Kibworth Park Alpacas.....	21
Chregan Alpacas.....	34

FRONT COVER PHOTOS

Main fleece background - Susan Tyler 'Deep Blue', Morning Star Alpacas

Inset left - Esme Graham, Paltara Park Alpacas

Inset centre and right - Jan Rendall, Babazeeka Alpacas

GORGEIOUS GREYS

Grey alpacas have stamped their mark on the Australian Alpaca industry, and captured the imagination of many alpaca breeders who strive to achieve in their breeding programs that at times elusive grey fibre.

Just as there are many variations in grey alpacas, with rose, lavender, dark and silver greys, some with spots or tuxedo patterning, and some on occasion even uniformly grey all over; there are also a variety of opinions on how to breed grey alpacas, and in research into the genetics behind what creates this fascinating coloured fibre.

We have brought together articles that discuss the many aspects of breeding grey alpacas, as well as advertisements from many breeders of grey alpacas across Australia's for you to consider.

We hope you find this publication a helpful guide and a resource for sourcing grey genetics, whether you are new to breeding grey alpacas or you are already deep into the fascination with grey fibre.



The Breeding of Grey Alpacas

By Elizabeth Paul March 2019

Introduction

There are two pigment colours, yellow and black. The expression of both pigments across the animal is generally called agouti, and this produces the grizzled grey shade common to small wild animals such as rodents and marsupials. In large domestic animals agouti results in a more defined pattern, with the main body colour being reddish brown, produced by more intense yellow pigment, with black “points” IE muzzle, mane and tail, lower legs. This pattern is called bay in horses, and most fawn and all brown alpacas exhibit the same pattern. When analysing mating data I combine both fawn and brown under the heading Bay.

Grey In Alpacas

Grey and whitespotting genes are generally dominant alleles which produce an effect on top of the base colour. The appearance of grey fleece is not caused by a “grey” gene producing grey pigment, but usually by a diluting gene which alters the arrangement or amount of pigment within the fibre. This allows more light to pass through the fibre thus lightening the colour. Diluting genes are most effective on dark pigment, since diluting yellow colour only results in a lighter yellow.

There are at least two forms of grey in alpacas, the more common of which is what I call classic grey, where the alpaca is born with a grey coat and a white face, framed by a “bonnet” of its base colour, and a white neck. The appearance of the pigment granules in the “grey” fibre shows that they are clumped together and shifted over to one side of the fibre. This allows more light to pass through the fibre which visually softens the base colour to greyish tones.

A silvergrey alpaca is black, and a rosegrey alpaca is dark mahogany brown (ie dark bay) as the base colour. Classic grey on a fawn colour base may show up as a white faced fawn roan or rosegrey. The clumping effect of the grey gene also often produces blue or partial blue eyes in greys. Note again this is not “blue” pigment, it is simply the effect of clumping the black pigment together altering the light reflection.

There is another form of grey where the alpaca is born all black, and starts to grey out on the body, but the head, neck and legs remain quite black, even in an old animal. This form is called black headed roan. It is not common, but where present the greying effect often starts at the groin, and spreads through the saddle. It is usually noticed by owners after first shearing. Neither of these greying genes is quite the same as grey in horses, where the foal is also born dark and greys out, but the greying usually starts on the face and spreads more evenly across the whole body, eventually turning the whole horse more or less white at advanced age.

Grey Breeding Results

In Table 1 I have compared the colour breakdown of Herd Book 1, where all the alpacas were imported, with data from the next 20 herd books concerning crias born and registered here with 2 parents listed. While 15% of the original imports were grey, only 6% of crias registered over the next 20 years were grey.

TABLE 1	WHITE	BAY	BLACK	GREY	APPROX TOTAL
HB 1	22%	50%	12%	15%	4000
HB 2-20	35%	47%	13%	6%	150000



Table 2 shows the production of grey progeny from various matings. Only 3% of all matings are between two greys, which produce approximately 63% grey progeny. A further 10% of matings between a grey and a non-grey produce 30% grey progeny, and matings between non-greys produce less than 2% greys, with one exception. These are the combined results of 20 herd books and approximately 150,000 registered matings, and they are consistent between herd books.

If the diluting gene which produces the grey pattern is a simple dominant allele, then mating two greys both heterozygous for this allele should produce greys in the ratio.

MATING	PROGENY COLOURS				
	WHITE	BAY	BLACK	GREY	% MATINGS
G X G	1.5%	22%	12%	64%	3%
G X NG	10.5%	43%	15%	31%	10%
NG x NG	37%	48%	12%	1.6%	87%
W X Blk	8.5%	72%	11%	8.3%	2.5%
G X Blk	4%	70%	33%	43%	2.5%
HB 2-20	35%	47%	13%	6%	0



3 greys: 1 non grey or 75% grey. The greys would have the genotypes of 1 being homozygous for grey and 2 being heterozygous, making up the 3 greys. Normally for a simple dominant allele in homozygous form only one dominant allele of the pair is active, even though both alleles present in the genotype are dominant. However the grey x grey mating results consistently show that they only produce approximately 2 greys: 1 non grey. In my opinion this is because the grey allele is a partial lethal gene, meaning that both dominant alleles are active in homozygous form. Pigment is present in other systems besides the hair, and the alterations in these systems may be too severe to allow the homozygous embryo to survive.

Grey in alpacas has striking similarities to the merle condition seen in dogs. Blue merles are heterozygous, and in the dog world they are not (or should not) be mated together, to avoid the production of homozygous merle pups, which are usually nearly all white, blue eyed, deaf, or with other problems. We don't see this effect in mating two greys, as they produce less than 2% white progeny overall, nor do we get numbers of dead or defective grey crias being born. If the homozygous condition is so severe that the embryo is lost very early in pregnancy, then a grey female may be more prone to losing a pregnancy when mated to a grey male. Black x grey matings should overcome this problem, if it exists. Note that there is no colour/sex bias, ie a mating between a grey male and a black female is exactly the same colourwise, as a mating between a black male and a grey female.

If homozygous grey exists, then the only way to prove that a male was homozygous for grey, would be to mate him to large numbers of black females and see if he produced 100% grey crias. Since black x grey matings produce approximately 42% grey crias, it seems unlikely that there are homozygous greys.

Blue eyed White

No discussion of grey breeding can be considered complete without including the issue of blue eyed whites. Note there is no single "bew deaf" gene. In my opinion, most pinkfooted, blackeyed white alpacas are very dilute fawns, or have multiple white spotting genes, or a combination. Mating results for white x grey show that 25% of the progeny are white. These crias will almost certainly be blue eyed whites, as the combination of grey dilute and other diluting and/or whitespotting genes overwhelms the pigment system. They are not homozygous for grey, but represent the most extreme viable form of grey.

Bews are deaf, because the pigment granules in the hairs of the inner ear have been clumped and/or reduced, and this affects the transmission of sound waves. The deafness is not due to eg genetic nerve degeneration.

Bews are in general fertile, and usually have no more problems in mating and pregnancies than other colours. However, they are deaf, and in order to reduce the number of bews in the national herd, any bew being used for mating should be mated to full black. The aim is to get a coloured cria, which may be grey or multi, but more importantly it will not be deaf, because the pigment system has been restored. The cria can then be mated on into its colour group. Breeders should actively avoid doing white x grey matings, or grey x very whitespotted mates, as these are the matings most likely to result in a bew. Any mating between any other colours which inadvertently produces a bew should not be repeated. Note also that most bews come through the white herd, and the presence of actual grey in their background is likely to be too far back to be easily traced, if at all.

From the mating results, white x black although only about 2% of all matings, produces about 8% grey progeny, and is the only nongrey mating that does so. This is a clear indication that the white parents in these particular matings are in fact bews, since the grey cannot come from the black mate. (The exception would be a blackheaded roan, which would most likely be registered at birth, as full black.) It is worth noting that one of the most successful foundation white males with over 100 matings to his name, produced 20% grey crias mostly over darker females. He was in fact a bew, although it was not an issue at the time. He had several white sons who were also bews, (by their mating results) and those males are very likely to be present in the background of many greys today.

Conclusions

It must be clearly understood that grey progeny can only be produced, when at least one of the parents is carrying the dominant gene, but the expression of the gene depends on whether the colour base is dark enough to show it up. If two non-grey parents produce a grey cria, then at least one of them must be carrying for the gene, however unlikely that may seem (always assuming of course that they are the actual parents).

Grey x grey matings will produce the highest number of grey progeny. However, grey x black is also a useful mating, and grey breeders would be well advised to have a black male on hand, to overcome the possibility of grey females slipping pregnancies too often to grey males. Other colours may produce greys but in very low numbers, usually because the colour base is much lighter. Grey x white or mostly white mates should be avoided by all breeders as these matings are more likely to produce a deaf bew. The main consideration if using a bew for breeding, should be to mate to black and produce a hearing, coloured cria.

References

Paul, Elizabeth- *"The Alpaca Colour Key"* - 2011
Kainos Publishing Co.

All photos courtesy of Arcadian Alpacas

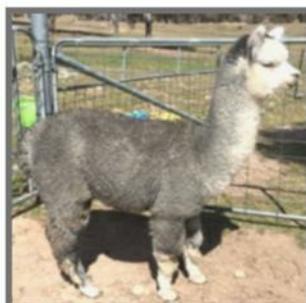




Ongoing success in the show ring confirms that our use of top genetics is achieving our objective by producing quality grey Suri and Huacaya Alpacas with correct conformation, and dense soft fine fleeces with great handle and lustre. Awards in a 2 year period include 4 Colour Supreme Champions, 8 Champions, 3 Res Champions, and 3 Best in Colour including Best Grey Huacaya at the National 2015, Royal Canberra 2017 and Boorowa 2017.

With over 200 animals to choose from we can offer packages to suit your budget:

- Female suri and huacaya pregnant to elite quality males such as Hidden Lake Outlaw, Surilana Gonzalo, Hidden Lake Silversmith and Softfoot Parrell
- Broad Ribbon Grey stud males- suri and huacaya
- Wethers for guards or pets
- Raw fleece, yarn or hand knitted garments - www.eliteaustralionalpaca.com



Val Johanson 0412887857 | alpacas@qozqo.com | www.qozqo.com

Take the Guess Work out of Breeding Greys

Shades of Alpaca Grey: a genetic tool to identify classic grey alpacas

By Dr. Kylie Munyard B.Sc. (Hons) PhD - First published 2018

School of Biomedical Sciences, Curtin Health Innovation Research Institute, Curtin University, Australia
K.Munyard@curtin.edu.au

Grey is a popular pattern in alpacas, for many reasons, but can be controversial due to the huge diversity seen in the pattern. So that we are all “on the same page” with terminology, first of all we need to be clear that “grey” is a pattern, not a colour. The grey pattern can occur over any base colour. When the base colour is black the combination is described as silver-grey, and any other base colour produces rose-grey. Roan is another pattern often mistaken for grey, and is called “modern grey” in the US. Therefore, to (hopefully!) avoid confusion, I call the pattern that causes silver- or rose- grey “classic grey”.

Late last year Dr Samantha Brooks (University of Florida) and I set out to try to find the genetic cause of classic grey in alpacas; funded by the Morris Animal Foundation, the Alpaca Research Foundation & Curtin University. We started by examining what was already known about the pattern. Four main pieces of information emerged;

1) An analysis of thousands of breeding records by Elizabeth Paul led to the conclusion that classic grey was inherited as an incomplete dominant (an animal only needs one copy of the mutation to have the classic grey pattern), and that no “pure breeding” classic greys had ever been recorded, so that having two copies of the mutation for classic grey was probably lethal.

2) The production of classic grey cria from one white and one solid parent meant that the classic grey pattern was present in at least some white/ light fawn animals, but wasn't able to be seen.

3) Elizabeth Paul's breeding-record analysis also showed that blue-eyed-white (BEW) alpacas are probably caused by one copy of the classic grey mutation plus a copy of a white spotting pattern like tuxedo.

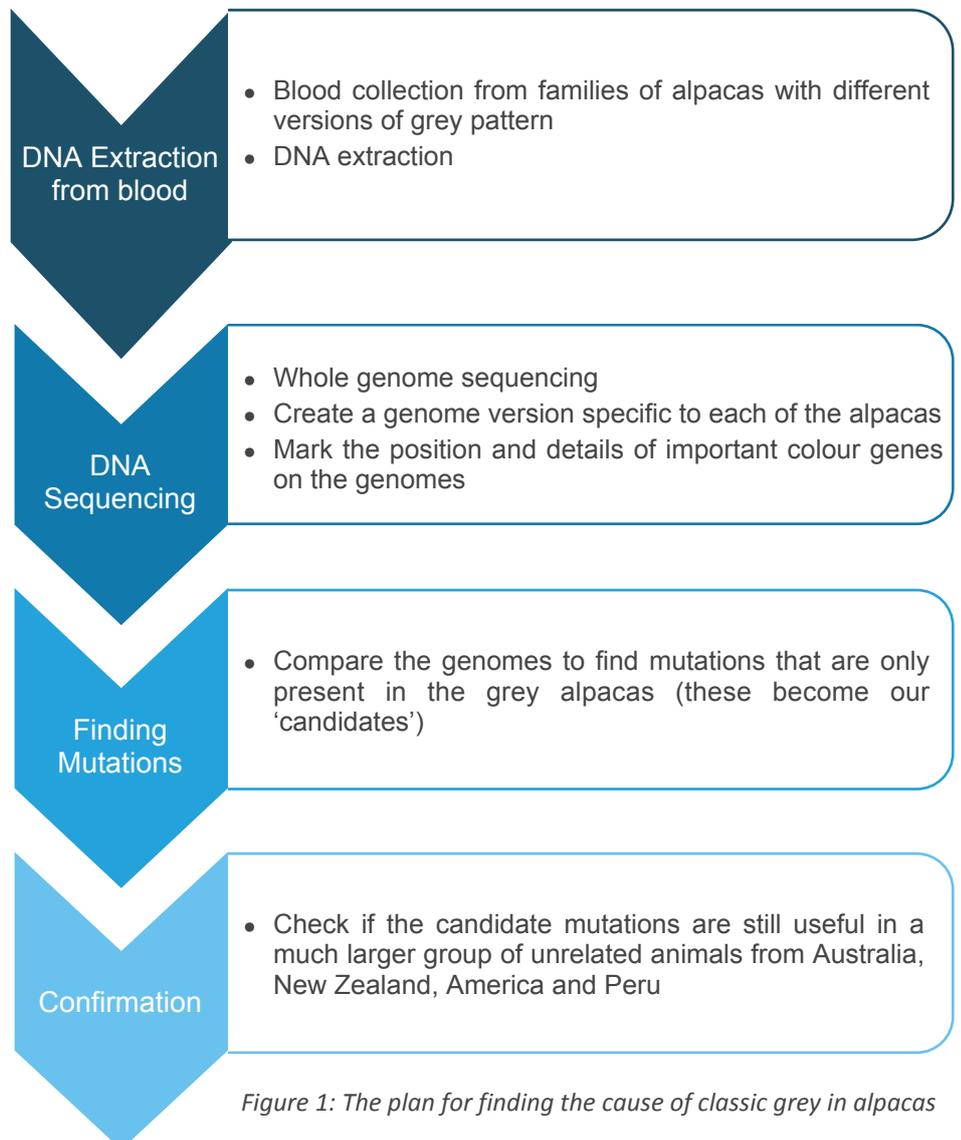


Figure 1: The plan for finding the cause of classic grey in alpacas

3) Elizabeth Paul's breeding-record analysis also showed that blue-eyed-white (BEW) alpacas are probably caused by one copy of the classic grey mutation plus a copy of a white spotting pattern like tuxedo.

Colour/ Pattern	# Tested	Two copies (%)	One copy (%)	No copies (%)
Black	61	0	1 (1.7)	60 (98.3)
Black & Tan	2	0	0	2 (100)
Tuxedo	9	0	2 (22.2)	7 (77.7)
Classic Grey	89	0	89 (100)	0 (0)
Roan	17	0	0	17 (100)
Brown	20	0	0	20 (100)
Bay	40	0	0	40 (100)
Chestnut	6	0	0	6 (100)
Fawn	89	0	12 (13.4)	77 (86.6)
White	152	0	14 (9.2)	138 (90.8)
BEW	9	0	9 (100)	0 (0)
Total	494	0	127 (25.7)	367 (74.3)

TABLE 1: The mutation status and colours of the animals checked for the classic grey mutation

4) A few years later, research by Drs Felicity Jackling and Belinda Appleton showed that all BEW animals had one copy of a specific genetic pattern they called BEW1, and also a copy of a different specific genetic pattern called BEW2. The vast majority of classic grey animals in the study had BEW1. BEW1 & BEW2 were both near a gene called KIT.

So, this information led Samantha and I to the conclusion that the KIT gene was a good place to look for mutations that caused or contributed to classic grey. Therefore, we studied the sequence of the KIT gene in a group of alpacas in detail. A brief outline of the experiment is shown in figure 1.

We started with just six alpacas, three black and three classic silver-grey. Lots of mutations were present (47 in total), but only one had the characteristics that we were searching for. That is; it wasn't found in any of the black animals, all of the classic grey animals had one normal copy and one mutant copy, and it was predicted to change the way the protein worked.

With the help of our Honours student Matt Jones, we then developed a fast, accurate and cheap method to test for this mutation. So far we have tested over 480 alpacas, from multiple farms on four different continents. To our

complete surprise and great excitement, the mutation was a perfect predictor for classic grey (Table 1).

So, what can we conclude from our research? Well, the data strongly supports our conclusion that the mutation is the cause for the classic grey phenotype in alpacas. Why? Firstly, all classic grey alpacas tested had one copy of the mutation, as was expected from the breeding data.

Secondly, all BEW alpacas had one copy of the mutation, again as expected, based on the idea that BEW is caused by a combination of a classic grey allele and a white spotting allele. Third: the mutation was not found in any animals with the roan pattern, indicating that roan is not caused by the same mutation as classic grey, and is a separate pattern rather than a variant of classic grey. Finally, the absence of any animals with two copies of the mutation supports the idea that two copies of the classic grey mutation is lethal.

Approximately 10% of the 241 white and fawn animals we tested had one copy of the classic grey mutation. These are "cryptic grey" animals in which the base colour is not dark enough to show the pattern, and this is the first time that they have been able to be identified. The pedigree for the cryptic grey animals, where available, was investigated.



Figure 2: Dark cryptic grey.

These pedigrees also supported our interpretation, because the cryptic grey animals were shown to have either: a classic grey parent/grandparent, or produced classic grey offspring, where the other parent was definitively non-classic grey. Perhaps the most unexpected finding was that it's possible to have cryptic classic greys that are so dark that the pattern doesn't show. Two of the nine "tuxedo" animals were found to have one copy of the mutation. When we re-examined photos of all of the tuxedo animals, we realised that the ones that had a copy of the classic grey mutation had a distinctly different "look" compared to the others (Figure 2).

We also checked the colour of the parents, grandparents etc. of all of the tuxedo animals, and only the two unusual ones had any classic grey in their pedigrees. The single black alpaca with the mutation was from Peru, and we could not get any more samples, or re-examine the animal, so we can't rule out a sampling or recording error.

In summary, we have developed a fast, cheap, and reliable way to assess whether an alpaca has the mutation for the classic grey pattern, even when you can't see that pattern. This method will allow breeders to effectively select for, or against, the classic grey pattern (and BEW), as desired. It may even open up broader genetics for those wishing to select for classic grey. It will also allow breeders who have a "difficult to classify" grey to be sure if it is classic grey or roan (or both!). Also, testing would reduce the incidence of BEW animals, by reducing the chance of accidentally mating a cryptic classic grey with a tuxedo.



All of these alpacas
are grey



Bibliography

- Brooks S. & Bailey E. (2005) Exon skipping in the KIT gene causes a Sabino spotting pattern in horses. *Mammalian Genome* 16, 893-902.
- Dürig N., Jude R., Holl H., Brooks S.A., Lafayette C., Jagannathan V. & Leeb T. (2017) Whole genome sequencing reveals a novel deletion variant in the KIT gene in horses with white spotted coat colour phenotypes. *Anim Genet.* Apr 26. doi: 10.1111/age.12556.
- Gauly M, Vaughan J, Hogreve S. & Erhardt G. (2005) Brainstem Auditory-Evoked Potential Assessment of Auditory Function and Congenital Deafness In Llamas (*Lama Glama*) And Alpacas (*L. Pacos*). *J. Vet. Intern. Med.* 19: 756-760.
- Haase B., Brooks S.A., Schlumbaum A., Azor P.J., Bailey E., Alaeddine F., Mevissen M., Burger D., Poncet P.-A., Rieder S. & Leeb T. (2007) Allelic Heterogeneity at the Equine KIT Locus in Dominant White (W) Horses. *PLoS Genetics* 3, e195. | Haase B., Brooks S.A., Tozaki T., Burger D., Poncet P.-A., Rieder S., Hasegawa T., Penedo C. & Leeb T. (2009) Seven novel KIT mutations in horses with white coat colour phenotypes. *Animal Genetics* 40, 623-9.
- Haase B., Obexer-Ruff G., Dolf G., Rieder S., Burger D., Poncet P.-A., Gerber V., Howard J. & Leeb T. (2010) Haematological parameters are normal in dominant white Franches-Montagnes horses carrying a KIT mutation. *Veterinary Journal* 184, 315-7.
- Hauswirth R., Haase B., Blatter M., Brooks S.A., Burger D., Drögemüller C., Gerber V., Henke D., Janda J., Jude R., Magdesian K.G., Matthews J.M., Poncet P.-A., Svansson V., Tozaki T., Wilkinson-White L., Penedo M.C.T., Rieder S. & Leeb T. (2012) Mutations in MITF and PAX3 Cause "Splashed White" and Other White Spotting Phenotypes in Horses. *PLoS Genetics* 8, e1002653.
- Holl H., Isaza R., Mohamoud Y., Ahmed A., Almathen F., Youcef C., Gaouar S., Antczak D.F. & Brooks S.A. (2017) A Frameshift Mutation in KIT is Associated with White Spotting in the Arabian Camel. *Genes (Basel)* 8. | Jackling F.C., Johnson W.E. & Appleton B.R. (2014) The Genetic Inheritance of the Blue-eyed White Phenotype in Alpacas (*Vicugna pacos*). *Journal of Heredity* 105, 847-57. | Jackling F.C. (2014) A Genetic Investigation of Congenital Defects in Alpacas. PhD Thesis, University of Melbourne, Australia.
- Paul E. (2011) *The Alpaca Colour Key*. ISBN: 978-0-9871614-0-6. Kainos Print Australia.

Grey Suri Dispersal

Also ask us
about our
Harlequin
greys

**Opportunity to purchase
world-renown suri genetics**

**11 suris, including 1 Stud Male sold.
Grab your elite grey NOW!**

Baarrooka is dispersing our grey herd to concentrate on white and black suris. All of our greys, including stud males are available for sale.

Our grey lines are based on Peruvian genetics from males imported from the USA:

- ILR ABF Eminance's Gray Knight (medium silver grey) - undoubtedly Australia's best performing grey suri
- ILR ABF Riptide's Ultimate Black (solid true black) - half Accoyo
- ILR Sierra Bonita's The Bachelor (solid true black) - very fine, elite black genetics

Plus a new acquisition:

- Lowanna Solstice - dense fleece on a strong frame

Package discounts are available. Free agistment for overseas buyers.



Contact Julie on 0407 889 669 or jwilkinson@baarrooka.com.au for sale lists or to arrange a visit to inspect.

More details on our Sale Page at www.baarrooka.com.au



BAARROOKA

Grey Products of interest

The Alpaca Colour Key

By Elizabeth Paul

The Alpaca Colour Key describes the inheritance of coat colour in alpacas, which have the widest range of colours of any fibre producing animal.

It contains notes on basic biology and genetics, fibre structure and the pigmentation process.

The body of the book presents an explanation of the fascinating colour patterns found in alpacas, including rarer colour such as grey, blue eyed white and spotted patterns; and the probable colour outcomes of matings between alpacas of both the same and different colours.

Not easy to find in print anymore in Australia but well worth making the effort to find. It is available online overseas though - Google will help you out!



Soft Alpaca Toy - Silver Grey

Soft Alpaca Toy – Silver Grey
\$25.00

DESCRIPTION

Soft Alpaca Toy – standing approx 25cm high.
Made in New Zealand.

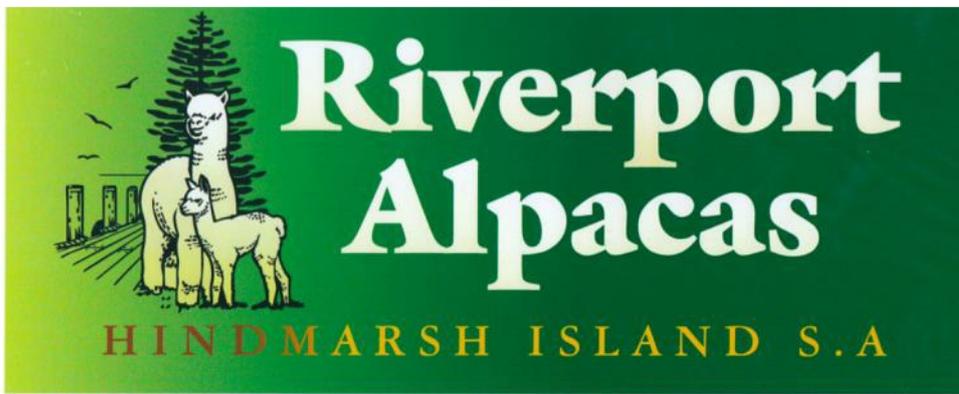
Not made of 100% alpaca.

Available from www.kyonaalpacas.com

The Alpaca Colour Key



Elizabeth Paul



Home of **Riverport Hematite**, multiple broad ribbon winner at the National shows in 2013,14,15,16 and 2017 in both the halter and fleece classes.

In 2018 his daughter Mosaic won National Supreme Grey fleece and his son Nero won National Supreme Black fleece.

Click or tap this page to visit our website @ Riverport-Alpacas.com



Beautiful Websites FOR Beautiful Animals

A website today is the basis of most business marketing - a website helps you sell your alpacas and promote your stud males to the widest audience possible. Are you missing out on potential buyers?

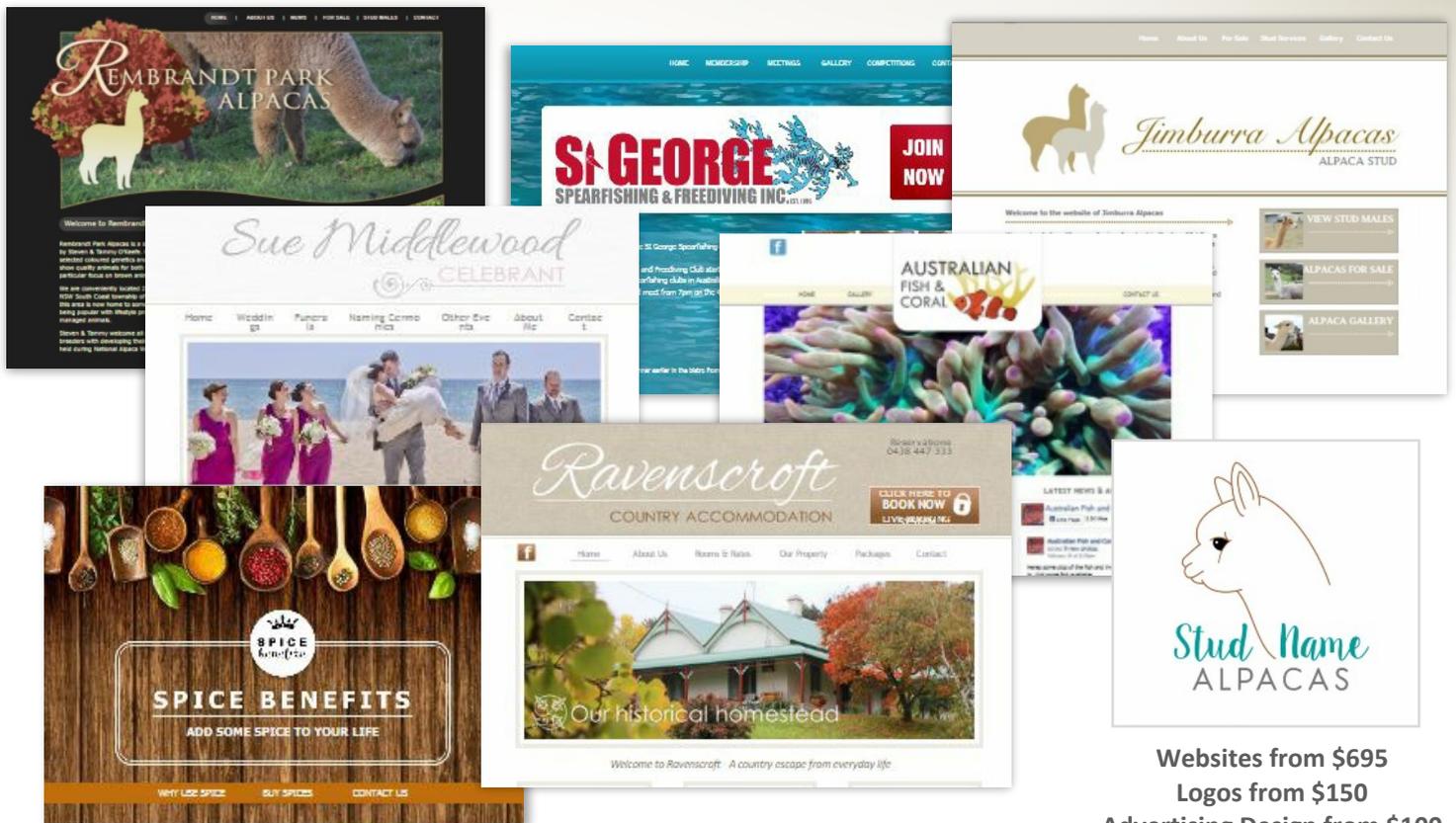
WE KNOW ALPACAS

Here at Oak Grove Graphics we understand what it takes to make a great alpaca stud website because we are alpaca breeders just like you! In fact our own alpaca website is our only advertising for our alpacas, and it has enabled us to thrive despite being geographically isolated from the main concentration of alpaca studs, it brings us regular clients from interstate and even from Europe!

AFFORDABLE PRICES

We design the whole range of business marketing tools, we design custom logos, business cards, advertising and of course web sites. We also designed this magazine and design the Camelid Connections magazines. Our prices are some of the best you will find anywhere - contact us for a free no obligation quote & probably a bit of alpaca talk as well!

We make websites for all types of businesses and here are some examples of the diversity in style we offer. From self maintained sites to we do it all for you options, we design sites that are attractive, functional and individual like you.



Websites from \$695
Logos from \$150
Advertising Design from \$100



WEBSITES | LOGOS | ADVERTISING

www.oakgrovegraphics.com.au

EMAIL: julie@oakgrovegraphics.com.au | PHONE: 02 6493 2036

Grey Dream

ALPACAS

Grey Dream Alpacas located in Marulan NSW are grey breeding specialists. Grey alpacas are our passion and we concentrate solely on breeding for quality grey alpacas and recently acquired the Wyona Alpaca grey herd introducing some exciting grey genetics into our herd.

We have breeding females and potential stud quality grey males for sale.

STANDING AT STUD - Quality males consistently producing grey progeny

Wyona Calliente



Green Gully Giovanni



Vista Azulo



Follow us on facebook



Phone 0428 426 204

Solid Grey

By Denise Moysey - Arcadian Alpacas

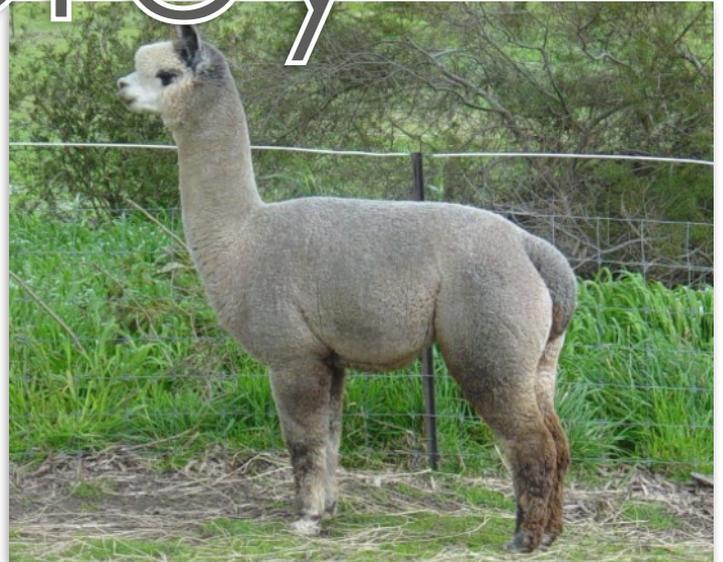
Not impossible, just 'Invisible'!
A personal odyssey began for me in 1995, the quest to breed a solid grey alpaca, but as sometimes occurs, when it actually happened it came as a complete surprise.

A lot of discussion has been had in recent years about what is a true grey and what is a roan alpaca. Does an alpaca need to exhibit the classic pattern of white face and light tuxedo to be considered a true grey? Are roans just a colour fault, are greys really just a type of multi anyway?

Personally, I suspected that a large part of the discussion problem stemmed from people's failure to recognise that grey and rose alpacas are really just roan variants. Alpacas do not have grey like in horses, which are born a colour and gradually grey and lighten with age (like human hair). The white face and tuxedo of alpacas is simply a pattern/marking gene and, although very commonly linked with the grey and rose colouration in alpacas, I couldn't believe that it was required in order to produce grey. (NB not all coloured alpacas with white fibres fit into the roan category however, and a white fibre colour-fault does occur, causing further confusion in the discussion).

Roan definition: (Wikipedia) Roan is a coat colour found in many animals, notably horses, cattle and dogs. It is defined generally as an even mixture of white and pigmented hairs that does not grey out or fade as the animal ages, therefore grey or rose alpacas fit this colour type. For example the silvery greys are variants of blue roan ie, basically black pigmented fibres with a varying % of white fibres.

A significant motivation for the pursuit of a 'solid grey' has been my strong belief that with colour variation comes change of fibre type and micron eg, the cream-shaded fibre on vicuna fawns is significantly different to the fawn saddle. Likewise, the white/light colour on the chest of greys is different to the main fleece. Logically, the more similar the colour, the more chance you have of similar fleece qualities. Marks and colour variations are not tolerated in other-coloured alpacas and they should not be tolerated in greys either. Furthermore, in the event that you did not get the expected grey progeny, but some other colour, the likelihood of undesirable markings in that animal is significantly reduced and the likelihood of solid colour is increased.



Even silver grey



Dark-headed dark grey



Solid black roan

Our luck has been to have two grey male bloodlines which combine well to produce even-coloured greys. The cross has also produced some dark grey animals with dark faces and solid roans.

Then came April 9th, 2012. At sunrise, scanning the birthing paddock through my binoculars, I could see that a new cria had been born overnight and was up, walking about amongst the girls, but, in the twilight of dawn, I couldn't make out the colour very well and it didn't get any more clear as I got closer. Or, more exactly, I couldn't believe what I thought I was seeing.

The cria had obviously not rolled about after its birth and the birth membrane had dried and was still wrapped tightly around its body like crisp tissue paper. For the first time ever my initial action was not to lift the tail to find out the sex of this new cria - it was to peel off the fine 'paper' in great excitement to discover what colour the bodyfleece was, because the head, neck and legs were evenly grey and, underneath that dried membrane, so was the body! Only then did I lift the tail, and, in another 'first' I was happy to see that this cria was male! Welcome to the world, Arcady Invisible.

So there he was, our first solid grey alpaca. His colour is so even, so unexpected and unusual in the world of alpacas, that the general consensus from people who have seen him is, quite simply, WOW!

It seems unlikely that he is the first or only one of a kind, but he is most certainly very rare and we can only look forward to the future, and his potential progeny, with great anticipation.



Newborn Invisible



At 10 weeks old



Fleece at 10 weeks

PEDIGREE

Sire: Solid Black Roan

Grandsire: Even Light Grey

Granddam: Medium Grey with a couple of large dark marks, white sclera, throws roan or solid roan, not silvers.

Dam: Solid Black (not blue-black)

Grandsire: Rose Grey

Granddam: Solid White with coloured background

If you want to further challenge your thoughts on alpaca colour manifestations, consider the full sister to Invisible's SBLK roan sire.

She is a vicuna-shaded MBR roan with the classic white face marking of a grey, but also with some colour on her nose and white sclera in her eyes. She has already produced one appaloosa cria and one varnish roan patterned cria (also with white sclera) to the same SW sire.

2019 Update: Arcady Invisible now stands at stud at Sun Star Alpacas in Germany and his first European crias are due soon.



GREENWOOD

ALPACA STUD



— HERD DISPERSAL —

For sale from \$850 - left to right:

Merrak KC GREY IAR 227385 - Paddock mated to Greenwood ICON (MG) IAR 192027 Due September 2019

Meadowvale Park PRINCESS LEIA IAR 217049 - Paddock mated to Greenwood ICON (MG) Due September 2019

Greenwood ELLIE MAY IAR 192039 (cria)

Manna-Gum Farm ELVYN IAR 215335 - Paddock mated to Greenwood ICON (MG) Due September 2019

Also available at right:

Follyfoot Farm Greenwood BABUSHKA IAR 211268

She is mated to Pengarook Knight Shadow and spitting off POS
This mating should produce an A Grade Show animal. Knight Shadow
has gone to 37 Shows with 37 1st place and 16 Best & Champ wins.

Her cria is Greenwood CheyeEtta IAR 192040

Sire Greenwood Icon IAR 192027



ALL OFFERS CONSIDERED





KIBWORTH PARK



ALPACAS

Home of Kibworth Park Tresco and Orrapoorra Trumpeter sires of multiple broad winner ribbons.

2015 saw Kibworth Park move to a new location on the peaceful waters of Lake Boga northwest Victoria, this move has enabled us to expand our grey breeding program improving our grey genetics over the last 3 years and we are continuing to work hard at producing low micron and dense fleeces.

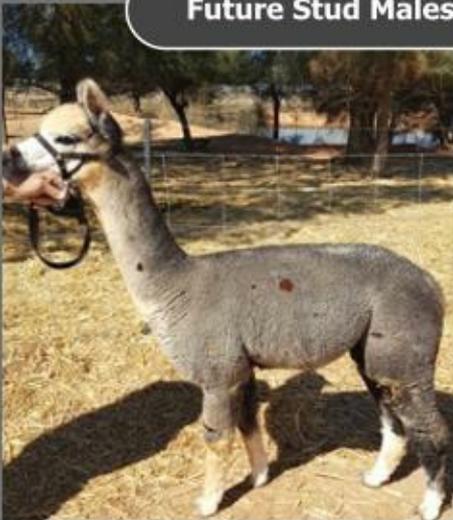
We continue to strive to build on our success.

We will be introducing new genetics to our herd to enhance Kibworth Park grey breeding program.

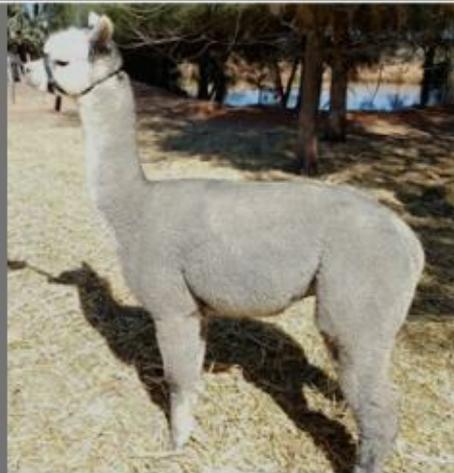
Kibworth Park will continue to show, bench marking our animals with what is happening in the industry.

2019 will see a new and improved website and the introduction of our online shop providing access to a vast range of top quality toys, rugs, and clothing.

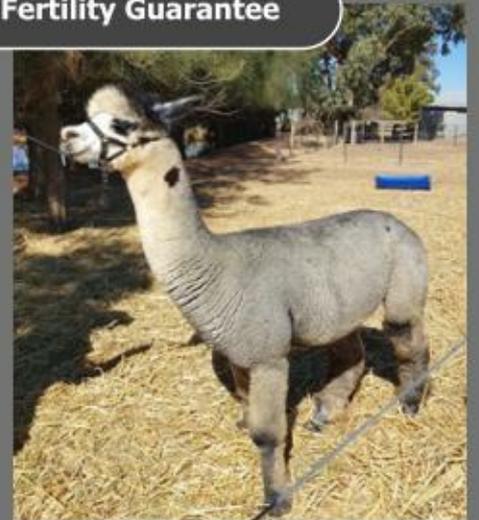
Future Stud Males For Sale | POA | Certification and Fertility Guarantee



Kibworth Park Classic Star
IAR 237533



Kibworth Park Windchester
IAR 227528



Kibworth Park Beauchamp
IAR 178033



www.kibworthpark.com

KIBWORTH PARK
ALPACAS
Producers of Fine Australian Alpaca
Alpaca Fleece and Products



REGISTERING GREYS



Grey alpacas have the most variations in colour listed on the Australian Alpaca Association's colour chart guide.

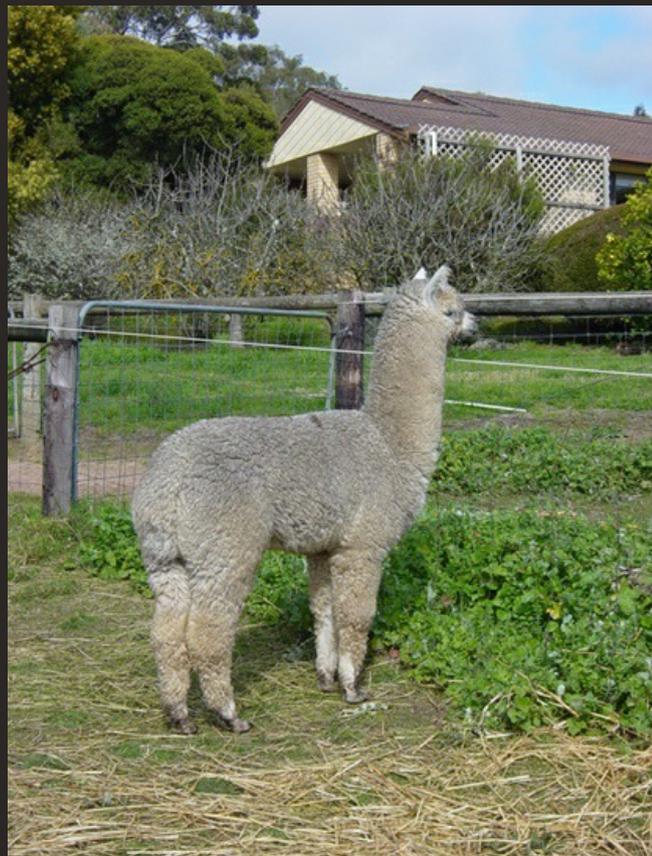
When registering a grey cria with the AAA via the eAlpaca online herd management system you are presented with the option to list firstly the colour as a solid, fancy, tuxedo or appaloosa. Then you can select a colour or colours from the following options light grey, medium grey, dark grey and rose grey.

As shown on the colour chart guide opposite, in addition to the light, medium and dark grey options a rose grey can be one of three colour variations. Combine these colour options with the potential for grey cria to present as a slightly or sometimes much different colour of grey after their first shearing, and the breeder of grey alpacas has a more complicated choice for registering their grey cria than any other colour group.



When registering greys it's also important to be aware that the outer tips of the fleece like all colours can vary on young animals especially due to the effects of the sun on the fibre which can lighten the exterior fleece to quite a degree.

When is a grey a roan? An alpaca is considered a roan instead of a grey when it has a majority of one colour fibre with different coloured fibres scattered throughout, whereas a grey is more an even mix of either black or fawn fibre mixed with another colour of fleece.



WT White 100	
LF Light Fawn 201	
MF Medium Fawn 202	
DF Dark Fawn 204	
LB Light Brown 205	
MB Medium Brown 209	
DB Dark Brown 301	
DB Dark Brown 410	
BB Bay Black 360	
BK True Black 500	
LG Light Grey 401	
MG Medium Grey 402	
DG Dark Grey 404	
RG Rose Grey 408	
RG Rose Grey 211	
RG Rose Grey 306	



“ The breeder of grey alpaca has a more complicated choice for registering their grey cria than any other colour group. ”

Observations

From a grey alpaca breeder

By Susan Tyler - Morning Star Alpacas
(now Wirritin Alpacas)

What follows is the result of 24 years of breeding greys and is practical, not scientific. I'm sure that over time we will know more and that what I have written will be out-of-date.

BREEDING GREYS

Greys are pretty, with their faces framed in colour, each distinct, and they are relatively rare. The colour is also intriguing: greys seem to appear like magic out of matings of other colours, while, on the other hand, when mated to other greys they produce solid colours as well as greys.

So, there is a surprising amount written about breeding grey alpacas. But although there are no true-breeding greys, that does not mean breeding them is difficult.

I think it is harder to breed blue-black without colour faults or pure whites with no other coloured fibre than it is to breed greys.

The most important thing to note in breeding grey is that greys have a base colour. You are first breeding that base colour. You are not breeding white with coloured fibres but black or brown or fawn with white fibres.

GREY, TUXEDO, MULTI, AND BLUE-EYED WHITE

It is well known that greys pop up from matings using blue-eyed whites, and greys often have blue or grey in their eyes. However mating greys to greys does not produce blue-eyed whites. We have done a great many matings of

grey to grey and have never produced a blue-eyed white from them. It probably happens but would be rare. You may produce blue-eyed whites if you breed together greys that have all-blue eyes and also a multi pattern with ventral white.

The white faces, necks and legs on many greys are not usually an indication of a multi pattern or tuxedo. They are largely irrelevant in breeding greys or the solid base colour.

Blue-eyed whites are probably the result of having two white patterns on the same animal. The absence of a pigment that is also associated with nerves can make the animal deaf. Greys are no more likely to be deaf than fawns. The only greys more likely than solid colours to be deaf are those with a multi pattern and also blue eyes. A small percentage of alpacas are deaf to some degree no matter what the colour.

The AAA recently defined tuxedo to include all multis or fancies that are not appaloosas. Here, though, I will use it to refer to the pattern of white somewhere on the face, possibly the front of the neck, and on the lower legs below the knee and hock. It is expressed more or less, and may be restricted in expression to only a small dot of white on the head or a foot.

GREY AND ROAN

The term "white-spotting pattern" refers to any white fibre distribution on a coloured coat. It includes genetically managed white markings of all sorts, including grey, roan, tuxedo, appaloosa, piebald, and extreme white piebald.

Theoretically, any coat of dark fibres with white fibres regularly interspersed is roan. So it would be possible to call all such alpacas roan and then describe them further.

The terms are arbitrary and people have different ideas about grey and roan. Here, to be clearest I will from now on refer to "classic grey" as an animal with a significant percentage of white fibres through the coat and a pattern that shades to white on the face and usually front of neck. I will use the term "modern grey" to refer to animals without the shading to white on face and front of neck (these may still have white markings) plus a high percentage of white fibres through the coat so that they look grey on the outside. I will use the term "roan" to refer to animals that look brown or black or fawn but have a (lower than in a classic grey) percentage of white fibres through their coats (these may also have white markings) obvious only when the coat is opened. It is sometimes hard to draw a line between roan and solid with a colour fault. Many coloured animals have at least a few white fibres or other colour fibres in their coats by the time they are two.

Classic greys are usually darker at birth than they end up, as you can see in these two photos below of the same animal at one month and as an adult.



Silver grey crias may look like tuxedo blacks at birth. We have been hard-pressed to locate any white fibres in some and don't know their true colour until after shearing. It is only the fuzzy edges of the colour areas that make it clear they are grey. The photos below show a girl soon after her birth, before first shearing and after a later shearing.



Tips are often faded to red at birth or fade in the first few weeks; so many silver greys are registered as rose grey. Our soils are orange, so the animal on the right is stained. His topknot is white, not orange.



I don't know whether the additional white fibres are secondaries that get long enough to be visible over time or are coloured fibres that turn white. In most grey fleeces most white fibres are finer secondaries. To my knowledge there is no grey fibre but only mixed white and coloured fibres.

Here is a photo of a sample of a first fleece showing the amount of change that can occur. Spots also appear or disappear.



The amount of white on the face and neck can vary from little to a lot but is still the same pattern.



Classic greys change from darker to lighter in their first two years. Then when they are older, primary fibres, which are mostly coloured, are longer and make the animal look darker, but the fleece itself does not get darker.

Below is a grey shorn on the left, and on the right in fleece, with dark primaries making her look darker.



Their colour is shaded a bit over their bodies. For example, you will often notice a change at the last rib from darker to lighter, or a streak of darker colour or a small spot in this area, as you can see in these photos of Platina, first as a cria and then both sides.



They are often lighter on the edges of their hind legs and hips. Classic greys often have spots. Patterns with darker legs and with lighter legs are both common. Those above, of Platina, show the paler legs, while that below on the left, of her daughter, shows the darker points.



The classic grey pattern usually includes a darker cap on the animal's head (although pale greys, often produced from silver grey/rose grey matings, may be pale or white on their heads (as Elyson Mercury is on right), with just a slightly darker dot in the topknot.

On most classic greys the white areas fill in with colour to some extent as the animal ages. Some that start out with white faces and neck fronts end up grey throughout—a lighter colour than the rest of their bodies, but not white.

Spots are normal on greys, as are patterns. Along with patterns shading to dark or light on the legs, there are patterns with white on the lower legs. This is common and not something to worry about.



However, this sort of pattern below with ventral white is actually a fancy pattern and grey, so be careful unless you want it!



In roans the white fibres are very fine and close to invisible on lighter colours. On dark colour they show up gradually, most obviously first on the neck, which often turns a darker shade, too. If white markings are present they are hard-edged.



On paler animals it can be hard to distinguish a very pale rose grey from a roan or from a vicuna fawn or a multi. Sometimes it is clear after their first shearing, sometimes it is clear at birth but not later, but other times the colour of such animals remains puzzling, perhaps being more than one colour.



The colour may be deep on the backline and become paler further down the body. Darker roans may have still darker base colour on their necks, heads, and legs, while their necks tend to show roan first. The colour on their heads and necks seems sometimes to darken over time. White markings on the darker roans are hard-edged.

I have little personal experience of either modern greys or roans, so from here on I will be writing only about the classic greys, clearly grey on the outside and shading toward white on the face and usually the front of the neck.

There are a great many colours of alpacas, far more than our list allows, and there are some rare and quite beautiful colours.

GREY PLUS TUXEDO EQUALS CLASSIC GREY?

One explanation of classic grey is that it is a combination of grey/roan plus tuxedo pattern, with the genes so close that they usually travel stuck together. Modern greys and roans then are the result of the tuxedo component being missing in some animals.



The white areas on a classic grey are also not really white but often have coloured fibres, and the colour may increase with the animal's age.

Tuxedo can be anything from white face and front of neck plus white socks to just a dot of white on the nose or thin ringlets on the feet (as in the mother, on the right). Interestingly, mating a tuxedo to a grey may result in more white on the offspring, as in this case. This female produced a wide variety of colours when mated to different grey males.



My observation doesn't bear this out. The white areas on a classic grey are not sharply defined with permanent borders as with a tuxedo coat.

The patterns of classic grey also are not those you would expect of tuxedo. Classic grey has the half white neck and full face pattern much more often than you would expect from tuxedo and shows limited pattern much less often.

Generally, matings of classic grey to classic grey do not produce tuxedo white markings more often than non-grey to non-grey matings. Matings of classic grey to solid coloured do not produce non-grey tuxedo patterns more often than matings of solid colours to solid colours.

Random spots on the body of a dark coloured non-grey animal, such as a white spot on the shoulder of a black animal, are not tuxedo markings and do not seem to be something to avoid in breeding for grey. Even clones have different markings. Small spots also appear or disappear.

Roans and modern greys may have different patterns, such as the darker neck and head, combined with very smooth colour over their barrels.

If you mate an animal with white markings on face and feet (even this small white spot on her face, not visible until she was mature) to a classic grey there is a significant risk of producing blue-eyed whites or tuxedos with a larger percentage of white than the tuxedo parent. However this may be an individual animal matter. Another female here with much more white on her face produced solid black regularly with grey males.



So I think of classic grey as a separate pattern. This, though, does not explain how roans and modern greys appear from time to time from grey/grey matings.

Eventually we will learn what is going on from the geneticists.

BREEDING CLASSIC GREY

It is possible that classic grey is homozygous lethal. This would explain why greys do not breed true. This means that all classic greys have one grey and one non-grey copy of a gene, with the homozygous grey embryos lost, leaving one third base colour offspring and two thirds grey. These losses do not mean that you have stillborn crias or late abortions. Mostly the losses would be early embryos, and the number

of these losses would disappear in the normal luck of breeding alpacas. I've heard that in ET, embryos from grey/grey matings have a 10% greater chance of being lost between 10 and 14 days.

In breeding classic grey it is sometimes advised to breed the grey to the desired base colour rather than to a grey in order to avoid making blue-eyed whites or risking abortions.

We haven't had blue-eyed whites born from grey/grey matings. We also don't seem to have misfortune more easily with grey/grey matings than with base colour/grey matings.

If you prefer to breed classic grey to base colour you should get around 50% classic grey and base colour rather than 66% grey with mating grey to grey. Our figures for mating grey to non-grey give about 50% grey progeny, but there are not enough results to be sure

It is possible that blacks and bay browns from grey matings may produce grey at a higher rate than if from non-grey ancestry.

The particular pattern of your classic grey may influence outcomes, but you won't really know this until you do a number of matings. A number of grey stud males from white matings have bold patterns with a lot of white on the legs. This does not seem to be significant. On the other hand, some "signature" markings may show up. One of our males had a bit of fawn on the top of his back and we have had crias with this; another of our males had some almost invisible speckles on one hip. These also showed up on offspring occasionally.

Altogether we have had about 2/3 grey from grey/grey matings. Within this 2/3 I place a small number of very obviously roan (or modern grey) animals and a few pale fawn greys. Of the 1/3 who were not grey about 2% had white markings on heads or below knees. Of the solid colour progeny about a quarter had some roaning or speckles or other colour inconsistencies. Many solid colour animals without grey ancestry also have roaning, speckles, or colour inconsistencies. I have not found that dark solid colour animals with roaning produce grey better than those without roaning, but the sample is too small to judge well.

IMPROVEMENT

It is often suggested to breed to white and pale colours in order to improve the quality of the dark coloured animals. Since whites consistently win at shows over other colours, except for the palest fawn, it is alluring to use them. Breeding white to grey you risk making blue-eyed white. This is not such an awful result—some prominent lineages go back to blue-eyed white females, and a number of well-known grey males are out of blue-eyed white dams. BEWs are not popular, though, and you also do not know what colours they carry until you have offspring. They are by no means

reliably "crypto greys". If you mate them to solid dark colours you will find out what they can do. We had one who made greys well.

In breeding to whites and light fawns you run into animals who offer no genetic possibility of making dark colour and into animals who carry some dilute factor. Many greys and dark coloured animals with part Peruvian pedigrees carry dilute factor. When you add several doses together you end up with a pale animal.

Breeding greys to whites or light fawns also risks making base-colour coats with white markings. The whites and light fawns may have markings you cannot see.

It is also an option to seek out pale animals with roaning, striped or dark toenails, dark skin, or other characteristics that suggest they are invisibly grey or carry dark colour. However, there are problems with doing this. It is hard to get back to your dark base colour, particularly to blue-black. Mostly you will get more pale animals. Also, quality changes with colour.

Unless you are very lucky you do not get something halfway in between your grey (or black) and your white (or light fawn) in quality. The result will be different. It will be hard to judge what the difference will be in advance. If it were easier or more reliable to do this there would be more dark coloured and grey animals winning championships at shows by now. Instead, two decades have not produced many browns and blacks and greys that compete at the same level as whites. There is now not as great a difference as there used to be between the best coloured animals and the whites and light fawns, but it is still there.

Note that grey and black fleeces on full siblings will be different. Over time you will likely find it easier to figure what the difference means.

If you are going to experiment it is more advantageous to use high quality light coloured females with grey males than to use high quality light coloured males over grey females because it is wise to conserve the rarer colour. Your silver greys are also black base colour, so recessive, which means it could take several generations to get back to your black base colour. Doing this with grey and wanting both the dark base colour and the grey makes it doubly hard. You are inevitably going to produce fawn, because that may be the darkest colour in light coloured females, and you will also have to struggle against patterns and almost invisible colours.

Light colours are epistatic to dark. So you will see the lightest colour expressed. Certainly you can do this, but it will take time and large numbers. You need to be able to keep your fawns and wait for them in turn to have offspring, and so on.

Over time if you mate grey females to light colour males you will have an increasing percentage of fawn and pale roan in your herd, especially if you pick the "best" to go on with regardless of colour.

If you have a small operation it might be wise to buy the successful results of someone else's experiments!

If you want blue-black, red-brown with black points, browns without shading to paler tints, cold silver grey, and genuinely pink rose grey, then you need to keep in your herd the animals who can make these colours, even if they are not otherwise your best animals.

Improvement does continue even if using only greys and dark colours.

At any rate, we have mated greys to greys and non-greys. We ignored spots and markings and still ended up with a good percentage of smooth coloured greys and solid non-greys. A white foot on a classic grey doesn't mean you will get any white markings on base colour progeny. Matings of grey to other colours seem more likely to produce patterns and spots in your greys, while mating greys to greys over several generations tends to produce somewhat smoother colour, but there is not a lot in it. I don't know whether you can breed for spotless colour successfully. Limiting the breeding herd in that way leaves fewer animals of good quality to use.

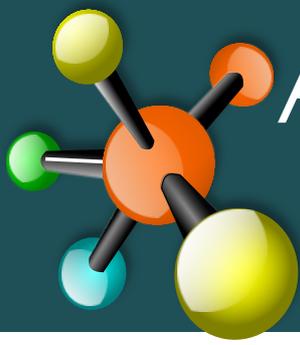
We paid attention to base colour and to grey. I had thought that possibly pale greys, often from rose grey/silver grey matings, bred to each other might reliably make more pale grey, but they don't. Dark, medium, and light silver really aren't much different in breeding, though to get dark grey it helps to start with at least one dark grey parent. It is mostly the base colour plus the grey that counts. A pale colour isn't better in fleece because more like a white (instead the dark primaries stand out). However, rose greys are likely to have better fleeces than silver greys. The black fibres tend (overall) to be stronger micron, and silver grey fleeces are likely to be a little less fine and even than rose grey fleeces. However, on any particular animal the darker shaded areas may be softer. Spots on your greys may be quite different, in fineness and even in length.

The base colour can be blue-black, fading black, brown, or fawn. The easiest base colours to work with are black and deep red-brown with black points. The hardest base colour to work with is fawn.

If you have whites and light fawns and want to move to dark colours and greys, I'd advise using a solid black or brown male with grey in his background, then, if you want grey, mate the solid colour progeny to grey. White fibres in the male's coat are probably not significant, but you don't need to avoid a male with them.

Such are my thoughts, if they are of any use to you.





Alpaca Colour Genetics: Mendel meets Molecular

By Dr Kylie Munyard B.Sc (hons), PHD - First published 2015

Over the past 7 years the team at the Alpaca Molecular Research group at Curtin University has been researching the inheritance patterns and molecular causes of colour in alpacas.

Using a combination of Mendelian genetics principles, molecular genetics techniques, objective chemical analysis of the fibre and observation of skin and nail colour we have been able to arrive at a model that, we think, describes most of the colour variation in alpacas. The current nomenclature for alpaca colours contributes to the confusion. One person's fawn is another's light brown, and one person's mid-brown is another's red-brown. We therefore also propose a new set of names for base colour varieties that reflects the genetic basis of the colour.

Alpaca colour genetics can be broken down into two parts, base colour and pattern. There are only two genes that control the base colour of the animal, MC1R and agouti. However, there are several genes that control the many patterns that are possible (e.g. classic grey, roan, greying, tuxedo, piebald, appaloosa, vicuna, dilution). Any base colour can co-exist with any pattern, more than one pattern, or none of the patterns.



Does brown really exist in alpacas?

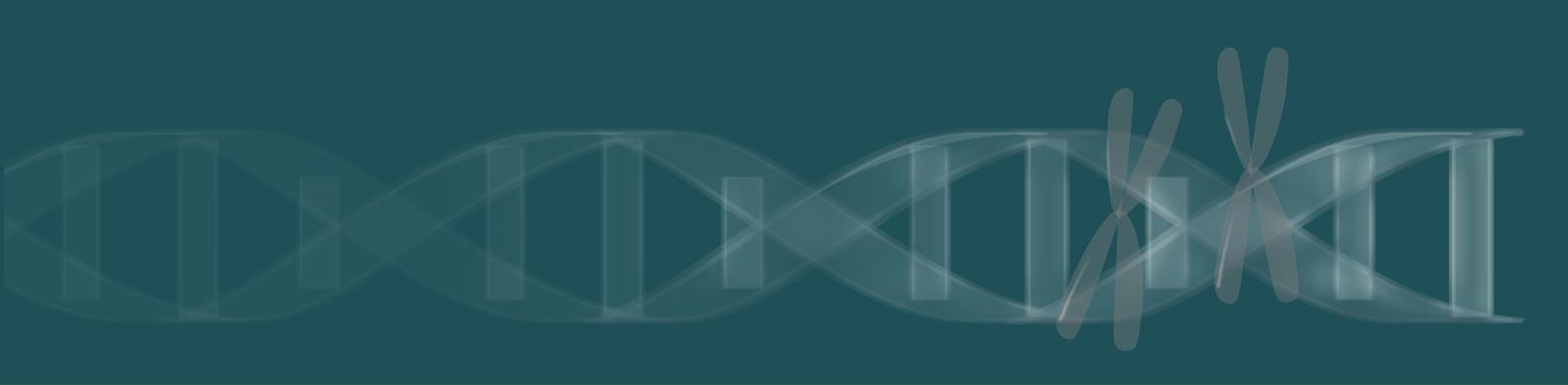
Base Colour

The base colour in alpacas ranges from white to black, through fawn and brown, with or without black on the extremities. The base colour arises because the genes MC1R and agouti work together in the pigment producing cells to tell the cells what colour pigment to produce. Mammals can only produce two types of pigment, yellow and black, and all the variety of colour is produced by differing amounts and locations of these two pigments.

Agouti variants are probably responsible for most colours in alpacas. Our data suggests that agouti has four variants in alpacas, each of which leads to a different colour outcome. The difficulty in assigning an accurate colour classification (that is, determining which agouti variant is present) is that there is a range of colour intensity for each variant. The most dominant agouti variant, 'A' produces white through to fawn fibre.

The next most dominant variant, 'Ab' which we propose to call 'bay' is characterised by a tan/brown body with black on the extremities (the same as bay in horses). Next in the hierarchy is 'at', which we propose to call 'black & tan'. This one produces a black body with tan on the undersides, similar to a Doberman dog, and could be considered to be a reverse of bay. Finally, the most recessive agouti variant is 'a'.

An alpaca with only 'a' present will be black, and should more correctly, from a scientific point of view, be called recessive black. All animals with an Agouti base colour have black skin regardless of the colour of their fibre. Because each individual has two copies of its genome, each gene can have up to two variants in a single animal. Therefore, these four variants can occur in 10 different combinations, leading to the huge range of different shades of base colour. The use of the term 'brown' to describe any alpaca colour is very misleading. From a scientific/genetic point of view, 'brown' describes a colour that is caused by a defect in black pigment, which makes the black pigment look brown. Our research has shown that the vast majority of alpacas described as brown are actually different shades of yellow. In fact we have not found ANY true brown alpacas, but we haven't tested them all, so we are being cautious in saying 'most'. The darker 'brown' alpacas are actually yellow with differing amounts of black mixed in. We have shown that:



- White and fawn alpacas have only small amounts of the yellow pigment, and negligible amounts of black pigment;
- Brown, dark brown and black brown alpacas have mixed yellow and black pigment in different proportions, and
- Black alpacas have about the same amount of yellow pigment as fawns, but have much more black pigment, so that the black pigment masks the presence of the yellow pigment.
- MC1R is a relatively simple gene, it either allows (via the dominant wild-type variant 'E') or prevents (via the recessive variant 'e') the production of black pigment. So, agouti sets the base colour, then MC1R variants determine if the black part of the agouti colour will be allowed to occur or not. With white (AA) and fawn (AAb), the fibre contains only negligible traces of black, so the only visible effect of the preventative MC1R variant is on the skin, this is how you get a pink-skinned white alpacas. Preventative MC1R variants have a greater effect on bay (AbAb), black-bay (Aba or Abat), black & tan (atat or Ata) and black (aa) alpacas. Bay coloured alpacas become chestnut (AbAb ee), just like in horses. Black-bay (Aba ee or Abat ee) could be anything from chestnut to fawn in colour.



Bay



Chestnut

Black, when accompanied by preventative MC1R variants (aa ee), becomes chestnut through to white, depending on how much yellow pigment was hidden by the black pigment. All of these dark base outcomes are determined by how much of the yellow pigment is present, the more yellow pigment, the darker the fibre colour. These darker 'ee' alpacas will have dark skin, but it will be only as dark as the fibre, and will not be black.

Nature has added a twist to this story. Some animals with pink skin (genetically) will develop black pigment as they age, in response to sun exposure. So, it can be hard to tell if an older animal has a) skin the same colour as its fibre, b) pink skin, or c) black skin. If we add the two MC1R variants, which can occur in three different combinations, to the 10 agouti variant combinations, we now get 30 different colour outcomes possible from just these two genes. That is more than enough to explain all of the normal base colours in alpacas. Our research has identified the DNA signatures of the two different MC1R variants, and two of the four agouti variants.

Patterns

All of the patterns in alpacas are caused by genes creating a variation to the base colour. All of the pattern genes have a wild-type variant that does nothing, plus one or more variants that cause the pattern. Each alpaca will have two copies of every pattern gene, this could be two wild-type (do nothing) variants, or one each of wild-type and pattern-causing, or two pattern-causing copies. The patterns are classic grey, roan, greying, appaloosa, vicuna, tuxedo, piebald, blue-eyed white and dilution.



Silvergry at rear, rosegrey at front, classic grey inset

Classic Grey (M)

Silvergry and rosegrey are the result of a single pattern variant acting on different base colours. In our lab we call this pattern classic grey and the gene symbol is 'M' (named after the pattern 'merle' that it resembles) until the gene identity is confirmed. Classic grey is used as a term as opposed to simply 'grey' to differentiate it from the well-known greying characteristic found in many other species (and possibly in alpacas too). Silvergry (aa E- Mm) is a classic grey variant on a black base colour. Rosegrey is a classic grey variant on any other base colour. This explains the huge variety of different rosegreys that are seen. The typical signs of a classic grey are that the neck and legs are paler than the body, the body is a diluted version of the base colour, and that the overall depth of colour of the animal often increases with age. They also commonly have a pale face, and a non-diluted bonnet of colour on the head. When you examine the fibres under a microscope they are not a mixture of white and black fibres, instead the fibres are diluted to different degrees from white to the fully intense base colour. Some classic greys have spots or patches of undiluted fibre in random places. The classic grey variant is easy to see on a dark background, but can be very hard to see on a pale background, and impossible to see on a white. Genetically one copy of the classic grey variant is required to be present to cause the classic grey

pattern (Mm). In genetic terms it is an incomplete dominant. Pedigree analysis by Elizabeth Paul has shown that the presence of two copies of classic grey (MM) is lethal at the embryo stage of development. Hence, you don't get any 'true breeding' classic greys. Our analysis of pedigrees, combined with work done by Dr Belinda Appleton suggest that there may be at least three different classic grey variants, each of which produces a different version of the pattern.



Silvergry Suri

Roan (Rn)

Roan is in many ways the reverse of classic grey pattern. Roan animals have a diluted body with undiluted neck and legs. Microscopic examination of the fibre shows that the roan pattern is caused by a mixture of fully pigmented and white fibres. In contrast to classic grey, a roan will get paler with age, and the body may end up almost completely white.

Roan animals are rarely born with the pattern showing, that is, a black roan will be born black, and will develop the typical dilution effect over time. The roan pattern can occur on top of any base colour. Similar to classic grey, the roan pattern is most easily seen on a dark background, and in our experience, white and fawn roans may not even be recognised as such. Roan is not the same as progressive greying, although it can be hard to tell these two patterns apart.

Roan is also an incomplete dominant. Only one roan variant is needed to cause the pattern (RnRn). However, preliminary data suggests that when two roan variants are present the pattern progresses more quickly, and is not lethal (in some species homozygous roan is embryonic lethal). Breeders wishing to get 'whiter than white' fibre could introduce the roan pattern into their herd to remove any traces of pigment from the fibre.



Black Roan

Greying (G)

Age-related greying occurs in most species, and is caused by the premature death of stem-cells in hair follicles. It is not clear whether this kind of grey occurs in alpacas as a distinct separate pattern, or if the milder forms of greying are a third variant of the roan pattern. The physical attributes are similar to roan, except for the differentiation of effect between the body and legs. The inheritance pattern is unknown.

Appaloosa (Lp)

Appaloosa is not, as most people think, a pale background with coloured spots. It's a dark background (what is perceived as the spots) with pale spots (what is perceived as the background). Appaloosa can also occur on top of any base colour, and you can clearly see the bay base colour distribution of black and yellow pigment in some appaloosas. The pattern of inheritance has not been proven, but it is probably dominant or incomplete dominant. That is, one copy of the appaloosa variant is enough to cause the pattern (LpLp), and two copies will cause the same pattern (LpLp). Similar to all of the other patterns, appaloosa can't be seen on a white alpaca.



Appaloosa

Vicuna

Vicuna is an intriguing pattern. This is the pattern where a fawn alpaca has white undersides with white extending onto the body behind the front legs. We have not completed a thorough analysis of this colour, and are hoping to do so as soon as possible. Two hypotheses to explain this pattern are currently under consideration. The first is that vicuna is a separate pattern in its own right, and the second is that it is simply a manifestation of the black & tan agouti base colour with non-permissive MC1R variants.



Vicuna Colouring

Tuxedo/Piebald

Animals with white patches are tuxedo or piebald. This is the only pattern that is localised to specific regions of the body. In effect the presence of a tuxedo or piebald variant leads to white spots of varying number, size and shape. It is not definitively known if tuxedo and piebald are caused by different genes, or by different variants of the same gene.

It is also assumed that these two are distinct patterns. However, the evidence suggests that the tuxedo pattern is restricted to the head, neck and legs, while the piebald pattern occurs on the body as well, and tends to cross the dorsal mid-line. Both tuxedo and piebald are dominant, that is, only one copy of the pattern variant needs to be present to cause the white pattern. Therefore, in any mating where one parent is white and the other is a solid colour and the cria is tuxedo or piebald, it is probably the white parent that has contributed the white spotting pattern. However, even a tiny amount of white on a solid animal is an indication that it is actually tuxedo or piebald.



Tuxedo Piebald Examples



Blue-eyed white

Blue-eyed white (BEW) is the most controversial of all alpaca patterns. The evidence indicates that classic grey is strongly implicated in this pattern.

If a BEW is mated to a solid dark colour, the most common outcomes are classic grey or tuxedo, which suggests that BEW is a combination of two pattern variants that leeches all of the colour from the animal.



BEW or Blue Eyed White

Dilution

The final pattern being discussed is not really a pattern at all, but it does affect the base colour of the animal, so it fits in this section. Our research has shown that animals with the exact same gene variants present at A and E can be different colours. For example, fawn versus dark fawn. Therefore, there must be other genes acting to dilute out the colour in a uniform way. These genes are known to occur in other species, 'D' in dogs causes black to appear steel grey, and brown (real genetic brown) to appear milk chocolate coloured, and red to appear champagne. In horses you see the very striking palomino and silver dilutions. Each of these dog and horse dilutions is caused by a variant of a single gene. We are currently analysing gigabases (i.e. billions of bases) of alpaca RNA sequence to try to find a gene or genes that have a similar effect in alpacas.

Summary

The colour of an alpaca is controlled by its genes.

If you evaluate colour in an objective way, you can usually work out which genes, and which variants of those genes, are creating the colour you see. If you also include information about an animal's parents and offspring, the success in predicting colour will increase markedly. DNA tests for these genes can be used to determine the genetic potential (in terms of colour) of an animal, and therefore allow a breeder to plan matings to produce (or not produce) a particular colour.

We suggest that the names used to describe alpaca colours should reflect the genetics of those colours, so that there is more effective communication and more precise records, leading to higher predictability in breeding outcomes.

Acknowledgements

This research was funded by RIRDC, and is presented in full in the 2011 RIRDC Report 'Inheritance of White Colour in Alpacas - Identifying the genes involved' by Kylie Munyard.

In addition, two PhD students, Natasha Feeley and Rhys Cransberg, significantly contributed to this work as part of their PhD studies.

NOTE: This article was written in 2015 prior to the follow work outlined in the article on page 10 entitled:

Take the Guess Work out of Breeding Greys (2018)
Shades of Alpaca Grey: a genetic tool to identify classic grey alpacas

CHREGAN
Grey Mist

Certified Stud Male
DOB 2/11/14
IAR 193098

Fleece Stats
2015 19.1, 4.4, 98.3
2016 20.9, 4.4, 97.0
2017 23.8, 5.1, 89.0
2018 26.9, 5.4, 77.8

PRICE: \$1500

A well grown male with correct confirmation on a macho frame. Grey Mist grows a very long soft handling fleece (4th Fleece 110mm) & is a consistent light grey in colour. Progeny- 2 so far both grey.

Show Results
2016 Int. Male - Gunning 3rd | Boorowa 2nd
2017 Adult Male - Gunning 1st | Boorowa 2nd
Senior Male - Carousel of Colour Goulburn 3rd
Hawkesbury Show - Fleece Grey 18-30mths 2nd

To enquire call Megan on 0410 536 135

Lethality

of the Grey Gene in alpacas

By Elizabeth Paul - Erewhon Alpacas



In alpacas, the gene which produces grey is a dominant gene, but it is not a colour gene. It is a pattern and diluting gene. It overlays the base colour to produce the typical white face, neck and legs of a grey, but it needs a dark colour base to clearly express the diluting effect. The base colours are black, which produces silvergrey, and dark brown or mahogany bay, which produces rosegrey.

Lighter fawns with white faces can also be rosegrey, but the diluting effect on the lighter base colour is lost. Most typical greys therefore, should be considered as part of the dark colour herd.

Colour Chart:

In the Australian colour registry, only the colour of the blanket or saddle is considered when determining a grey. No mention is made of looking for white faces or legs. The colour classifications are Light Grey, Medium Grey, Dark Grey to encompass all shades of silver grey; plus Rose Grey and Roan which are now separate on the chart.

It must be clearly understood that grey progeny can only be produced, when at least one of the parents is carrying the dominant gene. If two non-grey parents produce a grey pattern cria, then at least one of them must be carrying for the gene, however unlikely that seems.

A lethal gene is a dominant gene which is lethal in the homozygous condition, meaning that an embryo with the homozygous condition will either not be born, or will die at birth. An example of this is roan in horses, where the roan pattern is controlled by a dominant allele R. Roan horses have the genotype Rr, and in a mating between two roans, the expected normal Mendelian ratio of 3 roans to one non-roan does not occur. The ratio is two roans to one non-roan, ie only 66% roan instead of the expected 75%. In studying breeding results, the 66% ratio is taken as an indicator that the gene in question could be a homozygous lethal.

AAA Database:

Grey in alpacas is the rarest colour recorded for the entire Australian and New Zealand national herds in the AAA database. Progeny results are recorded in the database .

All alpacas registered in the database are not necessarily all the alpacas born during that year. A cria can only be registered in the database, if both of its parents are also registered, and if the sire is also DNA certified. DNA certification is not required for dams, unless there happens to be a dispute over a cria's parentage, or nowadays for ET records.

Only about 11% of all matings recorded involve at least one grey parent, which produce about 30% grey progeny overall. Grey x grey matings are only about 2.5% of all matings recorded. They produce about 65% grey progeny, with about 15% each of black and dark brown (bay) as the non-grey components. Being essentially dark alpacas, greys produce only very few lighter fawns and whites, and this is consistent with the results of Dark x Dark matings in the non-grey herd.

'Hidden' Greys:

I am fairly confident that most alpacas listed as grey, actually do conform to the most typical appearance of grey. Australia appears to have very few black headed roans. The ones that I know of, (less than 10) were born and registered as black, and turned grey over more than 12 months. The colour registration can be changed by the owner, but few people probably bother to do this. I would be almost certain that there are no black headed roan males registered as stud sires in the AAA database. There

are also a number of greys, which do not have the white face, but which have grey fibre running through the fleece, at birth. These would probably be mistaken for blacks, or named as roans, if so they would be listed as RG/Roan

There would be a few more whitefaced fawns which are possible rosegreys. These would really only be discovered, if they were mated to dark colour and threw eg a silvergrey. Up to now, most Australian breeders would have registered a white faced fawn as Fawn or W/Fawn, or Fancy, because of the emphasis placed on solid colours. The sire of my own silvergrey sire, is a streaky fawn, most probably a fawn rosegrey. The dam of my sire is solid dark mahogany, and could not have passed on the grey pattern.

Production of grey crias from the non-grey herd, is extremely low, less than 5% of progeny, except for matings between White, and Black or dark brown, which give up to 7% grey progeny. The whites in these matings are almost certainly blue-eyed whites, as there is a very strong connection between blue-eyed whites and greys.



Grey Mating Results:

Progeny Results of All G X G Matings = 1825

Grey	Brown	Black	Fawn	White
1169	272	286	55	43
64%	15%	15.6%	3%	2.3%

However, because of perceived errors with rosegreys in the database, I have also included the mating results for only silver greys (listed in our database as LG, MG and DG). Most silvergrey alpacas in Australia/NZ would be classified as MG.

Progeny Results of SG x SG Matings only = 527

Grey	Brown	Black	Fawn	White
342	43	127	7	9
64.8%	8%	24%	1.3%	1.7%

If both greys are true silver grey, ie black based, then we would not expect brown crias. However, some of these silvergreys could be very pale lavender rosegreys, and some are no doubt grey on black bay, giving a silver grey with dark brown underbelly, rather than a silver grey based on blue black. These could account for some of the brown progeny.

Greys produce very few fawn cria, because they are essentially dark. From the herd book results, darks are very unlikely to produce lighter fawns or whites. However, some of the lighter or fawn rosegreys, could produce solid fawn because their colour base is fawn rather than dark. I have not been positively told of two typical greys producing a blue eyed white cria.

These results indicate that something must be affecting the production of greys from grey x grey matings, and the most likely reason is that grey is in fact a homozygous lethal. Grey mated away from grey, generally produces less than 50% grey, indicating that greys are heterozygous.

I have included the sex bias on progeny results, to illustrate that breeders are more likely to register males in equal numbers, from grey x grey matings, than from other colours.

Sex Bias	Males	Females
All X All	35%	65%
Grey X Grey	47%	53%

GORGEOUS GREYS

A speciality publication from the producers of Camelid Connections Magazine, the magazine that provides educational, interesting and informative articles for lovers of Camelids.

www.camelidconnections.com.au

