Rabbit Genetics

Rabbit Genetics For Broken, Solid, And Charlie Patterns
There are several genes involved in determining the color and pattern of a rabbit's fur. The topic of rabbit color genetics is sufficiently complicated to warrant whole books on the subject.
This page will consider only the En/en gene, which determines whether a rabbit will be a solid, broken, or Charlie.

What Are Solids, Brokens, and Charlies Anyway?
To say that a solid rabbit is the same color all over, isn't exactly accurate. Some solid rabbits, such as smoke pearl are one color on the back and are shaded on the nose, ears, feet, tail, etc. Otters can be white, tan, or light gray on the tummy, behind the head and around the nose and eyes. But one thing that all solids have in common is that their pattern is not interspersed with white fur (not accounting for Himalayans).
Broken patterned Holland Lops can be any color of Holland Lops, except that the colored portions occur in a patched or a blanketed pattern with white fur in between (blanketed is more common in Holland Lops). Ideally, a broken patterned Holland Lop should have a balanced marking on its nose (no preference is supposed to be given for a full butterfly). The ears should be totally colored and the front feet should be white. The fur around the eye should be appropriate for the color of the rabbit, uninterrupted with white. The amount of colored fur should fall between 10 and 70 percent, and should be evenly distributed.
Although a broken pattern Holland Lop will be faulted for incomplete butterflies, white fur on the ears, and incomplete color surrounding the eye, they should not be disqualified unless there is complete absence of color in nose markings, around eyes, or on ears. Since color and markings together only count four points out of 100, a fault in these areas should not weigh heavily. However, a disqualification means that the rabbit cannot compete at all.
Charlie is a special type of broken patterned rabbit. Later, we will discuss how Charlies are genetically different from patterned rabbits, but for now, suffice it to say that Charlies look like sparsely patterned brokens, often having less than 10% color on a field of white fur. Charlies who have more than 10% color may be shown with other brokens. (By the way, they are called Charlies after Charlie Chapman, because of the sometimes abbreviated moustache that resembles his.)
Some broken Holland Lops may look like Charlies, but Charlies are distinctively different genetically. These rabbits are false Charlies. If either of a rabbit's parents is solid, the rabbit cannot be a Charlie, as will be discussed below. If a rabbit ever produces even one solid offspring, it is not a Charlie. You will see why shortly.

What Are They, Genetically Speaking?
The broken pattern gene, En, is dominant over the solid pattern gene, en. Thus, it

takes only one broken pattern gene to produce a broken. With two broken pattern or En genes, you get a Charlie. Thus a solid rabbit is en-en, a broken is En-en and a Charlie is En-En. That's pretty basic and not hard to understand, but let's look a little bit at what it takes to produce each pattern and what happens when we breed the various patterns together.

What Happens When You Breed?

Let's just see what happens when you breed a solid to a solid. Since both parents have only the en gene to pass to their offspring, all of the kits will be solid.

Now let's change one of the parents to a broken. It does not matter whether the dam or the sire is broken while the other is the solid. With just one En gene and three en genes, you might be tempted to say that there is a 3/4 chance of a solid, but that's not what happens. The broken's En gene will match with the other parent's en about half of the time. So, on the average, you will get 1/2 broken patterned Holland Lops and 1/2 solid pattered Holland Lops. Refer to the table below:

When I first started breeding Holland Lops, I assumed that breeding two broken patterned Holland Lops would yield a litter of all brokens. When I was told that they could produce solids as well, I couldn't visualize how that would happen. But once you see the combinations, as listed below, it is easy to see that, **on the average**, 1/2 of the offspring from two brokens will also be broken and 1/4 of the offspring will be solids. The remaining 1/4 will be Charlies, the sparsely patterned broken.

Now that we've brought up Charlies again, you might be curious to know what happens when you breed a Charlie to a solid or a Charlie to a broken or a Charlie to a Charlie. Let's start with the solid. This type of breeding has some special uses, which I'll discuss below. The Charlie parent, and again it does not matter whether it is the dam or the sire, will have only En genes to give to the offspring. The solid will have only en genes. Therefore each of the offspring will have En-en genes and will be broken.

The next combination, Charlie to broken, yields 1/2 Charlies and 1/2 Brokens.

The last possible combination is Charlie to Charlie. As you can guess, all of the kits will be Charlies, since both parents have only the En gene to contribute to each kit.

To sum up, refer to the following chart to see the odds of producing solids and brokens based on the pattern of the parents:

Parent 1	Parent 2	Kits
Solid	Solid	100% Solid 0% Broken 0% Charlie
Solid	Broken	50% Solid 50% Broken 0% Charlie
Solid	Charlie	0% Solid 100% Broken 0% Charlie

Broken	Broken	25% Solid 50% Broken 25% Charlie
Broken	Charlie	0% Solid 50% Broken 50% Charlie
Charlie	Charlie	0% Solid 0% Broken 100% Charlie

What Does This Mean To Your Breeding Program?

Probably the most common breedings will be solids to solids, and solids to brokens. Some breeders never breed broken to broken or rarely do because they do not want to produce Charlies. There are few, if any, good reasons to breed a broken or a Charlie to a Charlie.

You can determine from the chart above that your barn could become unbalanced between solids and brokens if half of your breedings are solid to solid, and half are solid to broken. Eventually your solids would outnumber your brokens 3 to 1.

That's where a good Charlie can be a real boon to a breeding program. When you breed a Charlie to a solid, you know that all of the kits will be broken. Occasional Charlie breedings can help keep your number of broken offspring in line with your solid offspring, should you find you are producing a higher proportion of solids than you would like.

Another great use for a Charlie buck is to use him as a backup sire. For example, if you are breeding a solid doe (this technique does not work with a broken), with a solid buck who is unproven, you can add a breeding from a proven Charlie to either increase the litter size or increase the chances that the doe will catch. Any solid kits would belong to the solid buck and any broken kits would belong to the Charlie.

This technique could also be used when a solid buck refuses a solid doe for a second breeding. Many breeders breed their does twice to increase the chances of pregnancy and to increase the litter size. But less sexually assertive bucks may not be able to arouse the doe a second time or may not show interest in mating a second time in one day. The Charlie buck could be used for the second breeding. Again, the solid kits would belong to the solid buck and the broken kits would belong to the Charlie buck.

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Rabbit Fur Colors Genetics

Rabbit coat color is primarily determined by five genes. Luckily, the denotations for the genes are easy to remember. They are A, B, C, D, and E. Thank goodness for small favors. Unfortunately, it gets a little more complicated from here.

Before going further, let's brush up on our basic high school genetics. Each parent
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donates one of a pair of each type of gene to its offspring. The offspring have two of each gene; one from each parent. Dominant genes are expressed (you can see the characteristics in the rabbit) and recessive genes are carried to be possibly passed on to offspring. Each gene, regardless of its dominance or recessive quality, is passed on to roughly half of the offspring.

The Agouti Gene

. . .The "a" gene comes in three forms: "A," which is responsible for agouti rabbits; "at," which is responsible for otters, tans (rare) and martens; and "a," which is responsible for "self" colored rabbits. The agouti rabbits include chestnut, opal, chinchilla and ermine, among others. The "at" gene produces black otters, sable point martens, blue otters, and the like.

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The most common four colors of Holland Lops are self colors (produced by the "a" gene). They are black tortoiseshell (also referred to as "tortoiseshell" or just "tort"), blue tortoiseshell (likewise "blue tort"), black and blue. Other self colors include sable point, smoke pearl and seal.

The Black-Chocolate Gene

. . . Any Holland Lop you see either belongs to the black family of colors or the brown (chocolate) family of colors--regardless of the main color that you see when you look at the rabbit. The vast majority of Holland Lops you will see at a show or at the typical barn belongs to the black family. Black family colors include black.

The "B" color gene is pretty straightforward and easy to understand, especially compared to the "C" gene, or even the "A" or "E" color genes. That's because it comes in only two varieties: the dominant "B" and the recessive "b." "Easy" is relative, when it comes to genetics! But let's just dive right in.

Any Holland Lop you see either belongs to the black family of colors or the brown (chocolate) family of colors--regardless of the main color that you see when you look at the rabbit. The vast majority of Holland Lops you will see at a show or at the typical barn belongs to the black family. Black family colors include black (I bet you weren't surprised by that one!), blue, black tortoiseshell (tort), blue tortoiseshell, sable point, ermine and chinchilla. Chocolate family rabbits include chocolate, lilac, and lynx, among others.

Black family rabbits are either "BB" or "Bb." Unless you see a chocolate color in a rabbit's pedigree, it's fairly safe to assume it is "BB." Chocolate family rabbits are always "bb." And chocolate family rabbits cannot carry the black gene "B." That's it. All Holland Lops are either "BB," "Bb", or "bb."

When you breed a true-breeding black family rabbit, that is, a black with two dominant "B" genes, to another true-breeding black family rabbit, you will always get a true-

breeding black family rabbit. Another way to say that is that "BB" x "BB" always yields a "BB." Each parent has only the dominant "B" to give its offspring.
When you breed a chocolate family rabbit to another chocolate family rabbit, we have the similar situation. The parents have only "b" to give to the offspring, who are all "bb." Thus "bb" x "bb" yields "bb."
Things get a little more interesting when you breed a true-breeding black family rabbit with a chocolate family rabbit, such as when breeding a black tortoiseshell to a lilac. One hundred percent of the offspring will be black family rabbits that carry the chocolate gene.
The black-chocolate color genes are very straightforward. There are only three combinations ("BB," "Bb," and "bb"). Understanding what the chances are for producing chocolates when breeding different rabbits can help in your breeding plan, especially if you are breeding again to black tortoiseshells to improve type. There is a corresponding color in the chocolate family for each color in the black color family.

Black Color Family BB or Bb	Chocolate Color Family bb
Black	Chocolate
Blue	Lilac
Black Tortoiseshell (Tort)	Chocolate Tortoiseshell
Blue Tortoiseshell (Blue Tort)	Lilac Tortoiseshell
Chestnut Agouti	Chocolate Chestnut (Cinnamon)
Opal (Blue Agouti)	Lynx (Lilac Agouti)
Orange (Orange Agouti)	Chocolate Orange
Fawn	Lilac Fawn
Chinchilla	Chocolate Chinchilla
Squirrel (Blue Chinchilla)	Lilac Chinchilla
Ermine (Frostpoint)	Chocolate Ermine
Blue Ermine (Blue Frostpoint)	Lilac Ermine
Sable Point	Chocolate Sable Point
Blue Sable Point	Lilac Sable Point
Siamese Sable (Black Sable)	Chocolate Sable
Smoke Pearl (Blue Sable)	Lilac Sable

The Color Gene
The C gene is responsible for rabbits being full color, chinchilla, seal, sable point, pointed white, or ruby-eyed white (REW).

The Dense/Dilute Gene
. . . So what are dilute rabbits? They are just like dense rabbits except that there is less pigment in each hair. In the black color family, two dilute genes will turn the black to blue. In the chocolate family of rabbits, two dilute genes will turn the chocolate to lilac. "Carries Dilute" is a notation you see on rabbits for sale. Why is that worth mentioning on a "for sale" rabbit? Well, if you are like me, dilute rabbits are among your favorite colors. So what are dilute rabbits? They are just like dense rabbits except that there is

less pigment in each hair.
In the black color family, two dilute genes will turn the black to blue. In the chocolate family of rabbits, two dilute genes will turn the chocolate to lilac. For every black color, there is a corresponding blue color. For every chocolate color there is a corresponding lilac color.
Some **black** color family **dense** colors are black tortoiseshell, black, black sable, chinchilla and orange. Some **chocolate** color family **dense** colors are chocolate, chocolate tortoiseshell, cinnamon, and chocolate sable point.
Some **black** color family **dilutes** are blue, blue tortoiseshell, squirrel, and smoke pearl. Some **chocolate** color family **dilutes** are lilac, lilac tortoiseshell, lynx and lilac ermine.
A broken black tortoiseshell (dense) and a broken blue tortoiseshell (dilute) are shown here.
The dominant d-gene is the "dense" gene denoted as "D." Dense color gene rabbits can be either "DD" or "Dd." We can refer to the "DD" rabbits as "true-breeding" and to the "Dd" rabbits as "carries dilute." The "dilute" gene is recessive and is denoted as "d." Dilute rabbits are always "dd" and cannot carry the dense gene. There are just three different combinations of the dense/dilute gene: "DD," "Dd," and "dd."
The d-gene works just like the b-gene, since there are only two types of genes, one dominant and one recessive. If you understand how the b-gene works, you already understand the d-gene.
We'll start with the easy part first. If you breed two true-breeding dense color gene rabbits ("DD") together, you get all "DD" offspring. Each parent has nothing but a "D" to pass on to the offspring. Likewise, if you breed two dilute color gene rabbits together ("dd"), you get all "dd" offspring.
But what happens if you breed a true-breeding dense color rabbit ("DD") with a dilute bunny ("dd")? Then all of the offspring will be dense, but will carry dilute.
The combinations above address only the dense/dilute aspect of a rabbit's color. The actual dense or dilute shade also depends also on the A/at/a, Bb, C/chd/chl/ch/c, and Es/E/e genes. When you are trying to breed for a particular shade, it may be helpful to understand which colors only vary by the d-gene. For example, black rabbits have the genotype aa B- C- D- E- while blue rabbits have the genotype aa B- C- dd E- (the dashes represent unknowns that could be equally dominant or recessive, but have no effect on the phenotype [phenotype=the color you see]). Black and blue are just alike except for the difference in the d-gene. The chart below lists Holland Lops colors with the dense color in the left column and the corresponding dilute color in the right column.

Dense Color Family	Dilute Color Family
Black	Blue
Chocolate	Lilac
Black Tortoiseshell	Blue Tortoiseshell

Chocolate Tortoiseshell	**Lilac Tortoiseshell**
Chestnut Agouti	**Opal (Blue Agouti)**
Chocolate Chestnut (Cinnamon)	**Lynx (Lilac Agouti)**
Orange (Orange Agouti)	**Fawn**
Chocolate Orange	**Lilac Fawn**
Chinchilla	**Squirrel (Blue Chinchilla)**
Chocolate Chinchilla	**Lilac Chinchilla**
Ermine (Frostpoint)	**Blue Ermine (Blue Frostpoint)**
Chocolate Ermine	**Lilac Ermine**
Sable Point	**Blue Sable Point (Blue Point)**
Chocolate Sable Point	**Lilac Sable Point**
Siamese Sable (Black Sable)	**Smoke Pearl (Blue Sable)**
Chocolate Sable	**Lilac Sable**

The "Dd" gene is responsible for a lot or little color in the hair shaft. Dense colors are black and chocolate family colors. Dilute colors are blue and lilac family colors. Knowing the d-gene phenotype of a breeding pair of rabbits can help you predict whether the offspring will be true-breeding dense, dense carrying dilute, or dilute. Perhaps you will get some of each. For every black or chocolate rabbit color, there is a corresponding blue or lilac color. You can use your knowledge of the d-gene and the color families to help you produce the colors you desire.

The Extension Gene

The E/e gene controls whether the basic color on the rabbit (black, blue, chocolate, or lilac) is extended all of the way to the end of the hair shaft or whether the basic color stops and another finishes the hair shaft (such as the orange color on the back of a black tortoiseshell). When a rabbit has full extension, it tends to look the same color all over, such as with a blue rabbit. When there is non-extension, such as with a black tortoiseshell, the rabbit takes on a shaded look since the shorter hairs on the belly, guard hairs, feet and muzzle get only the basic color.

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look for a different reason (check out the sable gene, for example).
I left out the steel gene, that is, the Es gene, on purpose. It's a variant on the extension gene that has a surprising twist. Usually the gene that is found in nature is the dominant variety. But with the steel gene, it is actually dominant over the "E" full extension gene found in nature. You need only look for steeling in full-extension animals: black, blue, chocolate, lilac, etc. It will never show up in "e-e" rabbits: black tortoiseshell, chocolate tortoiseshell, blue tortoiseshell, etc.
Only one color of rabbit is called simply "Steel." It has the genotype A- B- C- D- Es-. It is genetically a steel-tipped chestnut. All other colors are "steel-tipped," such as a "steel-tipped black."
A fourth e-gene exists, but is used only for creating tri-colored rabbits. It is the Ej gene, which I will not deal with further since it is fairly rare in Holland Lops.
Since the Es steel gene is dominant over the other two "E-e" genes we'll discuss, there are three genotypes for the steel phenotype: "Es-Es" (which may mysteriously cause the steeling not to show up), "Es-E" (steel carrying extension), and "Es-e" (steel carrying non-extension). There are two genotypes for full extension phenotypes: "E-E" (true-breeding full extension) and "E-e" (extension carrying non-extension). As with all least recessive genes, there is but one genotype to have a non-extension phenotype: "e-e."
Let's look at what happens when we breed a full extension rabbit that carries the non-extension gene with a steel-tipped rabbit carrying the non-extension gene (E-e x Es-e). Since it only takes one Es gene to make a rabbit steel-tipped, 1/2 of the offspring, on the average, will be steel-tipped. The other half is split between the full extension (carries non-extension) and the non-extension varieties.
By knowing which colors only vary by the e-series genes, you can make good choices in your breeding program when you are trying to produce a particular color. If you want to produce a black otter, for example, you will never get one by breeding a blue tortoiseshell with a sable point marten since both have two non-extension genes and a black otter requires at least one "E."

Steel (Es)	Extension (E)	Non-Extension (e
Steel-tipped Black	Black	Black Tortoiseshell
Steel-tipped Blue	Blue	Blue Tortoiseshell
Steel-tipped Sable	Sable	Sable Point
Steel-tipped Smoke Pearl	Smoke Pearl	Blue Point
Steel-tipped Chinchilla	Chinchilla	Ermine
Steel	Chestnut	Orange

The Es gene is dominant over the E gene, which is fairly unusual. Two E's genes together can hide the steeling effect, making the steel gene seem to pop out of

nowhere. Steel-tipping can only be found in, and carried by, full extension colored rabbits. It cannot be carried by a tort, for example.
Colors such as black and black tortoiseshell (tort) are related since they only vary by the e-series gene. Using your knowledge of how these genes are related can help you in breeding for certain colors and for determining rabbits colors as well.

The Dwarf Gene

There is no doubt that Holland Lops are challenging to breed. Among the challenges--slow maturation, wide variety of quality in resulting kits, multiple characteristics to manipulate--is the dwarf gene. The following information on the dwarf gene applies to other types of dwarf rabbits as well as Holland Lops, but it is important that the Holland Lop breeder thoroughly understands the dwarf gene.
With regard to the dwarf gene, Holland lops come in three types: true dwarfs, false dwarfs, and peanuts. Peanuts do not grow and always die, usually within a few days, but occasionally last a week or two. False dwarfs are also called "normals" and can make good brood animals. Show rabbits are typically true dwarfs.
False dwarfs are more likely to be long, have longer ears and back feet, and often exceed four pounds in adulthood. These are tendencies and not absolute proof of being a false dwarf.
The rabbits that most often do well on the show table are true dwarfs. They tend to be truer to type--shorter, with shorter ears and back feet, more balanced, and more likely to fall within the allowable show weight range of two to four pounds.
You will recognize peanuts in your litter by several characteristics. First, at birth peanuts weigh about 3/4 of an ounce, whereas other kits weigh about 1 1/2 ounces or more (the two newborn bunnies to the far left in the picture are peanuts). Peanuts may have bulging skulls with ears that are set further back. Also their hips are often underdeveloped and their back legs may cross. Since the peanuts will die anyway (they lack growth tissue so they never develop), some breeders remove them from the kindling box as birth. Others allow them to remain with the litter until they die a natural death. But either way, peanuts are ultimately a non-issue on your quest for ideal true dwarf Holland lops.
So how do you breed for true dwarfs? You might be tempted to think that breeding a true dwarf to a true dwarf would yield a litter of true dwarfs. But that's not how it works. First, we need to know that a true dwarf has one true dwarf gene (or just "dwarf gene") and one false dwarf (or "normal gene"). A false dwarf has two normal genes and a peanut has two dwarf genes.
If you breed two true dwarfs together, **on the average**, one of four would be peanuts, two of four (or 1/2) would be true dwarfs, and one of four would be false dwarfs. Since the peanuts will certainly die, two out of three of the **surviving** kits would be true dwarfs and one out of three would be false dwarfs. Remember, these numbers are averages. Your actual results will vary.
If you breed a false dwarf with a true dwarf (and it doesn't matter whether the doe or the buck is the false dwarf), you have the following results **on the average**: two of four (or 1/2) will be true dwarfs and two of four (or 1/2) will be false dwarfs. Notice there are no peanuts in these litters. The only way to produce peanuts is by breeding two true

dwarfs.
Let's see what happens when you breed two false dwarfs. You can easily predict that if both parents have only normal genes to pass to their offspring, all of the offspring will have only normal genes. And that is exactly what we get, a whole litter of normals or false dwarfs.
Now what does all of this mean for your breeding program? First, if you are breeding toward the standards and looking to successfully show your rabbits, at least one parent should be a true dwarf. But it is clearly obvious that you do not need to have both parents to be true dwarfs to produce a true dwarf.
In my barn, I sometimes breed true dwarfs together, even though I know 1/4 of the litter, on the average, will die. If the two rabbits complement each other and it is a good pairing otherwise, I breed the true dwarfs. The counterbalancing of strengths and weaknesses is the most important factor. Producing or not producing peanuts is secondary.
Most often, though, I breed a true dwarf buck to a false dwarf doe. I think that a false dwarf doe has an easier time kindling and caring for her young, especially if the kits are larger or there are many of them. False dwarfs seem to maintain their weight better and are prepared to kindle again sooner. I'd love to hear from other breeders about their experiences with false dwarf versus true dwarf does. Do you see a difference as well? In any case, with these pairings, no peanuts are produced.
Sometimes I breed a false dwarf buck with a true dwarf doe. I have heard cautions that the kits may be too big for the doe to kindle, but I have not had that experience. Remember, even if you breed two true dwarfs together, you will have some false dwarf kits. The resulting offspring have the same number of true dwarfs and false dwarfs as in a litter from a true dwarf buck and a false dwarf doe.
I have bred two false dwarfs together in hopes of producing brood does (brood bucks are part of the package, but not the goal in this case). I would choose this type of breeding very rarely. In one case, for example, I wanted to combine the genes from two lines of which I only had false dwarfs. I got three does to choose from and was very happy with the results - a whole litter of false dwarfs. But that is definitely a two-generation plan. The resulting brood does can now be bred to true dwarf bucks with the hopes of producing some show quality Holland Lops.
If you wonder whether your rabbit is a true or false dwarf, breed it to a known true dwarf. If there are peanuts in the resulting litter, your rabbit is definitely a true dwarf. If not, it is probably a false dwarf, though with a small number of offspring, the conclusion is not totally reliable. With repeated breedings to true dwarfs with no peanuts, you can safely conclude that your Holland Lop is a false dwarf. By the way, weight alone cannot determine a false dwarf. I have had a true dwarf buck who is over four pounds (pictured), but regularly throws peanuts with true dwarf does. And I have a false dwarf buck just under four pounds.
You may wonder why you have seen false dwarfs on the show table and whether they ever win. I do show my false dwarfs when they are young, hoping to get a thorough opinion of my Holland Lop. If I am going to use the rabbit in my breeding program, I'd like to hear about his or her strong points and other weak points (besides the extra

length) to help me make a better breeding decision. Sometimes, especially in the junior classes, a false dwarf will win the class. It is unlikely, however, that the false dwarf Holland Lop will have a long or very successful show career since false dwarfs generally weigh above four pounds in mature adulthood.

This point brings up another issue. If you want to register your false dwarf Holland Lop, you should do so as soon after the rabbit turns six months old as possible (the doe pictured was exactly 4 pounds when registered--at the very next show she was DQed for being over the weight limit). Once your rabbit exceeds four pounds, it is extremely difficult, if not impossible, to return him or her to four pounds and maintain the rabbit's health. Even though the false dwarf is unlikely to Grand, you may want the registration to show up on its offsprings' pedigrees, possibly earning that son, daughter or "grand-bunny" a red, red & white, or red, white & blue seal on its registration

As you cull your rabbits and decide which to keep, which to sell as show or breeding stock and which to sell as pets, remember that false dwarf bucks can be a valuable part of your own breeding plan. If, except for the extra length and size, a buck has numerous good qualities to pass on to his young, keep him or sell him as a brood buck. There is certainly no reason to automatically pet out a false dwarf buck. Also, buying a false dwarf buck may be a reasonably priced way to get a great set of genes into your breeding program.

To sum up, when you breed two true dwarfs, your litter will contain true dwarfs, false dwarfs, and peanuts. If you breed a true dwarf to a false dwarf, you should expect about half to be true dwarfs and about half to be false dwarfs. If you breed two false dwarfs, you will get only false dwarfs. Peanuts always die and can only result from the breeding of two true dwarfs.

Excerpts From: http://www.thenaturetrail.com/SolidsBrokensCharlies.htm