

TEST CROSS EXEMPLAR

A test cross is used to determine whether an individual with a dominant feature is pure-breeding (homozygous dominant) or not (heterozygous).

This is done by breeding (crossing) the dominant individual with one who has the recessive feature.

The offspring are used to determine if the parent was pure-bred or not.

Question:

In guinea pigs, long hair (L) is dominant to short hair (l). A guinea pig breeder suspects that one of her long-haired guinea pigs is not pure-bred. Outline how the breeder could determine whether the guinea pig in question is pure-bred or not. You should use a Punnett square to support your answer.

So what we know is the long hair guinea pig is either Homozygous Dominant (LL) or Heterozygous (Ll).

The breeder should do a test cross where they breed the long-hair with a short haired (Homozygous Recessive) guinea pig (ll), to see if the long-hair is pure-breeding (LL) or not (Ll).

Two Punnett squares show the possible results:

Homozygous Dominant (LL) x Homozygous recessive (ll)

		LL	
		L	L
ll	l	Ll	Ll
	l	Ll	Ll

100% long hair

Heterozygous (Ll) x Homozygous recessive (ll)

		Ll	
		L	l
ll	l	Ll	ll
	l	Ll	ll

50% long hair 50% Short hair

By doing a test cross, the breeder can use the offspring to determine if the Dominant individual (In this case Guinea Pig) is Heterozygous or Homozygous Dominant for the feature (In this case long-hair).

If any of the offspring from the cross have the recessive feature (in this case short-hair) we definitely know that the Long-haired parent is Heterozygous.

If after producing many, many offspring are produced, there are only long-haired guinea pigs, it is more likely that the dominant parent is Homozygous Dominant (pure-breeding). There is still a chance that the parent is heterozygous, as every time a heterozygous test cross reproduces it is a 50/50 chance to create dominant or recessive offspring.

The more the breeder ends up with only dominant individuals from a test cross, the more certain they can be that the parent was pure-breeding (Homozygous Dominant).