Here is some information regarding the **"Polled" gene in cattle** as unfortunately there are far too many who are confused regarding this topic. It is actually very simple and I hope you will find this information useful.

In cattle, the "polled" trait is determined by a single gene. Each variation of a gene is called an allele. These two copies of the gene contained in your chromosomes influence the way your cells work. The two alleles in a gene pair are inherited, one from each parent. Alleles interact with each other in different ways.

As we mentioned before there are 2 copies of the "polled" gene in every cow and bull and in reproduction one copy of that gene is given to the resulting offspring. Cattle can only be one of three different genotypes for the "polled" gene. They are:

PP – Homozygous Polled (2 copies of the dominant allele)

Pp – Heterozygous Polled (1 copy of the dominant allele and 1 copy of the recessive allele)

pp – Homozygous Recessive (2 copies of the recessive allele – Horned)

Polled is the **dominant** allele. What that means is if the calf has at least one copy of the polled gene, the calf will be polled. That is why we give the polled allele a capital 'P'. We give the horned allele a small 'p' because it is recessive and is only expressed when it is homozygous. **See Appendix 1 – Punnett Square**

Examples:

1) We breed a homozygous polled bull **(PP)** to a homozygous polled female **(PP)**
- Each parent will contribute a copy of the dominant allele (P) so 100% of the offspring will be PP or Homozygous Polled
2) We breed a homozygous recessive - horned **(pp)** bull to a homozygous recessive – horned female **(pp)**
- Each parent will contribute a copy of the recessive allele (p) so 100% of the offspring will be **pp** or Horned
3) We breed a homozygous polled bull **(PP)** to a horned **(pp)** female
- The bull will contribute a **'P'** and the cow will contribute a **'p'** so the resulting progeny will receive a copy of each allele and be 100% **Pp** – heterozygous polled
4) We breed a horned bull **(pp)** to a homozygous polled female **(PP)**
- The bull will contribute a **'p'** and the cow will contribute a **'P'** so the resulting progeny will receive a copy of each allele and be **pP** – heterozygous polled
5) We breed a homozygous polled bull **(PP)** to a heterozygous polled **(Pp)** female
- The bull will contribute a **'P'** making all the resulting progeny polled, but the female can contribute a **'P'** or a **'p'**. Therefore 50% of the progeny will be **PP** (homozygous polled) and 50% of the progeny will be **Pp** (heterozygous polled). The same result will occur if a heterozygous polled bull **'Pp'** is mated to a homozygous polled female **'PP'**
6) We breed a heterozygous polled bull **'Pp'** to a heterozygous polled female **'Pp'**
- The bull can either give a **'P'** or a **'p'** and the female can also give us a **'P'** or a **'p'**. This makes this combination the most complicated. I have listed the potential combinations below:
    - **PP**
    - **Pp**
    - **pP**
    - **pp**

- As you can see 75% of the time the resulting progeny will be Polled. But only 25% of the time the progeny will be Homozygous polled (**PP**). 50% of the time the resulting progeny will be Heterozygous polled because the progeny can get the P or the p from either parent (**Pp or pP**). 25% of the time the progeny will be horned (**pp**).

If you have a herd of mainly Angus cows – they are homozygous polled (**PP**) so you can use a horned bull (**pp**) and still get polled calves! However, if there is some Simmental, Hereford, Charolais, Gelbvieh in your herd, even though your cows are all 'polled' you are going to have a few heterozygous polled cows and you will get some horned calves by using a horned bull (50%) or even a heterozygous polled bull (25%). Terms such as "4 Generations Polled" are misleading and do not necessarily mean the bull you are purchasing is homozygous polled. **See Appendix 2.** The only way you know if you have a homozygous polled bull is to test for the trait. Scurs are not horns and are found on polled cattle on another gene. If there is interest, a breakdown of this trait can be provided in a subsequent report.

Appendix 1 – Punnett Square – The Punnett square is used to predict the genotypes of a particular cross. Named after Reginald Punnett who devised the approach on 1905, the square is still used today as a visual representation of Mendelian inheritance. Inserting the alleles into the square makes it easy to visualize all combinations and calculate probabilities. The example below is heterozygous polled (**Pp**) Sire mated to a heterozygous polled Dam (**Pp**).

	DAM	
SIRE	**P**	**p**
P	**PP**	**Pp**
p	**pP**	**pp**

Resulting progeny would have therefore have the following probability :

- 25% **PP** Homozygous Polled
- 50% **Pp**/**pP** Heterozygous Polled
- 25% **pp** Homozygous Recessive (Horned)

Appendix 2 – Example how the Homozygous Recessive (horned gene) gets passed on through generations –

- Generation #1 – Heterozygous polled Sire (**Pp**) bred to a Heterozygous Polled Dam (**Pp**) = Polled Heifer Calf (**Pp**) Probability = 50%
- Generation #2 – Same Heterozygous Polled Heifer (**Pp**) bred to a Homozygous Polled Sire (**PP**) = Polled Heifer Calf (**Pp**) Probability = 50%
- Generation #3 – The resulting heifer calf from generation #2 (**Pp**) bred to another Homozygous Polled Sire (**PP**)= Polled Bull Calf (**Pp**) Probability = 50%

As you can see in the above example, even though we have used Homozygous Polled (PP) sires in Generation 2 and 3, we still have not eliminated the recessive horned gene in this example. The 4th generation polled bull calf is still only heterozygous polled. This is no different than if we crossed a Horned Sire (pp) to a Homozygous Polled Dam (PP) and got a bull calf. Both Progeny are Pp.