PUNNETT SQUARES

When a green pea plant is mated with a yellow pea plant, each gamete will randomly contribute only one of its two alleles (genes) for that trait.
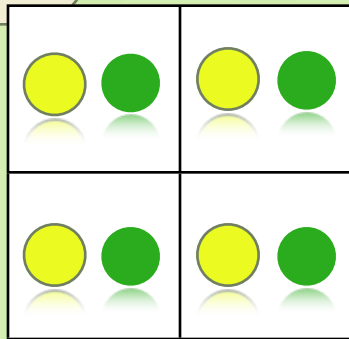
This assumes the green and yellow plants are both "true breeding" meaning that they are both **homozygous** (they have 2 green alleles or 2 yellow alleles; not one of each (which would be **heterozygous**).

The green plant contributes this allele

or this one

The yellow plant contributes this allele

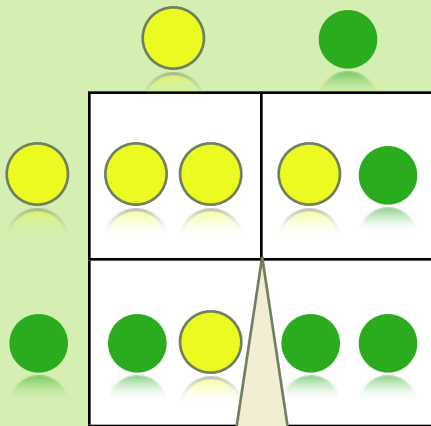**Y = yellow (dominant**
y = green (recessive)

or
this one

F1

In the F1 (first filial) generation all peas have the Yy genotype and since Y (yellow) is dominant, all the peas will be yellow (even though they have one allele for green color).

One of these heterozygous plants can than be "selfed" or mated to itself (plants can do this) to produce the F2 generation.

F2

In the F2 generation we can see 3 different genotypes: YY , Yy and yy .

Since Y is dominant, the YY and Yy genotypes will express the yellow **phenotype**, and appear yellow. The phenotype is what we can see while the **genotype** is the underlying genes that are present.

The yy genotype will appear green since it does not contain a dominant Y allele.

These 4 boxes represent the 4 genotypes of offspring that are possible. Each one has a 1 in 4 (25%) chance of happening.

If many peas are counted:
3 will be yellow (YY or Yy) for every 1 that is green (yy).

This gives a **3:1 phenotypic ratio** in the **F2** generation. The **genotypic ratio** however is 1:2:1 (YY, Yy, yy).

This applies for **diploid** organisms like plants, humans and other animals. Diploid means that every cell has two copies of every gene; one on each chromosome (one from your dad and one from your mom). The reproductive cells (**gametes**) that are formed are **haploid** meaning they only have one copy of each chromosome (and gene). Two gametes come together to produce a diploid **zygote**. The genotypes of the possible zygotes are depicted inside each Punnett square.

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