Key Area 2—Plant and Animal Breeding

Scientists and farmers have manipulated the DNA of crops and animals for years to **improve characteristics** to help support **sustainable** food production.

Plant field trials are carried out in arrange of environments to compare the performance of different cultivars (*cultivated variety*) or treatments to evaluate GM crops.

In designing field trials account has to be taken of;

- the selection of treatments— to make the investigation **valid** only one treatment must be trialled at a time eg. The effect of fertiliser on the growth of a crop.
- the number of replicates— several replicates must be used, at least 3, to improve the **reliability** of results and reduce experimental error.
- the randomisation of treatment— must be applied randomly to the test area to the test area to **prevent bias** of results.

Selection and Breeding

Over many years farmers and breeders have selected the plants and animals with the best characteristics to be the parents of the next generations. This allows them to bring together the desired alleles of two organisms thereby producing offspring superior to the parents.

<u>Inbreeding</u>

In inbreeding, selected related plants or animals are bred for several generations until the population **breeds true** to the **desired** type due to the **elimination of heterozygotes**.

A result of inbreeding can be an increase in frequency of individuals who are homozygous for recessive deleterious alleles. These individuals will **do less well at surviving to reproduce**.

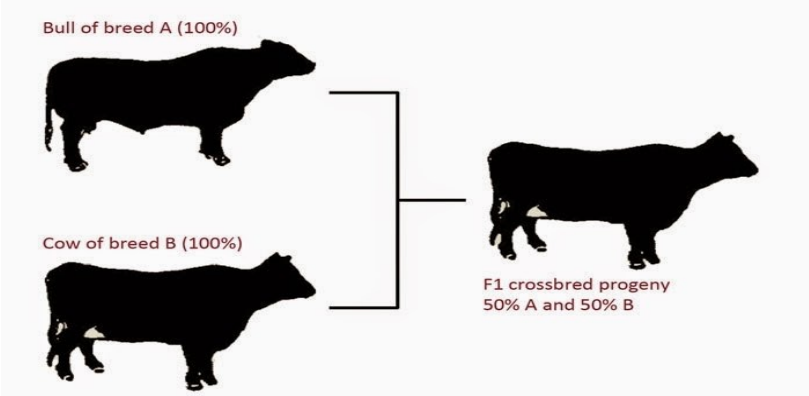
This results in inbreeding depression. This can be expressed as a **decline in vigour, size, fertility and yield** of the species involved.

Outbreeding

Outbreeding involves two **unrelated** members of the same species reproducing. Animals, and plants that cross-pollinate are natural outbreeders.

Cross breeding and F1 hybrids

In animals, individuals from different breeds may produce a new crossbreed population with **improved characteristics**. The two parent breeds can be maintained to produce more crossbred animals showing the improved characteristic.



Two breed cross occurs where breed A and breed B are two purebreeds and the F1 progeny (AB) contains equal parts of the two breeds.

In plants , **F1 hybrids**, produced by the crossing of 2 different inbred lines, create a relatively uniform **heterozygous crop**. F1 hybrids often have **increased vigour and yield**.

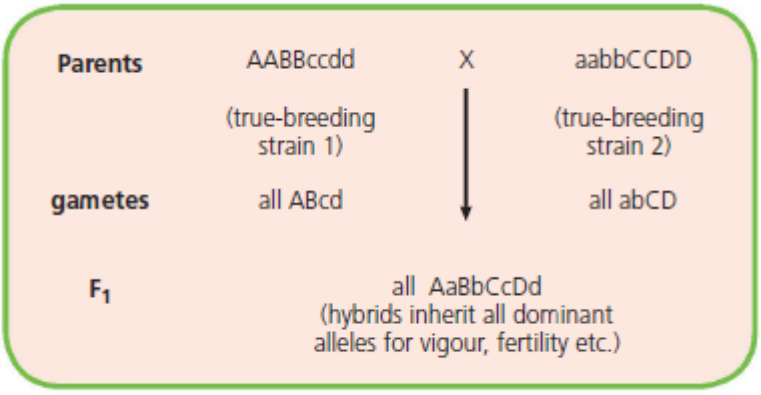


Figure 16.18 Hybridisation

In **inbreeding** animals and plants, F1 hybrids are not usually bred together as the **F2 produced shows too much variation.**

Genetic Technology

Breeding programmes can involve crop plants that have been genetically modified using recombinant DNA technology eg. Disease resistance, drought resistance, higher yields.