

Welcome
to
**Chandra Shekhar Azad University of Agriculture and Technology,
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Lecture Topic
Types of Hybrid

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Types of Hybrids

Single-cross Hybrids: A hybrid plant results from a cross of two genetically different plants. The two parents of a single-cross hybrid, which is also known as a F1 hybrid, are inbreds. Each seed produced from crossing two inbreds has a collection of alleles from each parent. Those two arrays will be different if the inbreds are genetically different, but each seed contains the same female array and the same male array. Thus, all plants of the same single-cross hybrid are genetically identical.

- At every locus where the two inbred parents possess different alleles, the single-cross hybrid is heterozygous. Plants of a single-cross hybrid are more vigorous than the parental inbred plants.
- In Figures 2a and 2b, the single-cross hybrid plant and ear are shown with the plants and ears of the parental inbreds. Clearly, the hybrid plant is taller and the hybrid ear is larger. The increase in vigor of a hybrid over its two parents is known as hybrid vigor

Diagrammatic representation of Single Cross performance over both inbred parents



Figure. 2a: Corn Plants: Inbred B73 (left), Inbred Mo17(middle), Single cross B73 x Mo17 (right) (UNL, 2004)



Figure. 2b: Corn Ears: Inbred B73 (left), Inbred Mo17(right), Single cross B73 x Mo17 (middle) (UNL, 2004)

❖ Breeders often measure the degree of hybrid vigor of a trait with the following formula:

$$\frac{100 (Hyb - MP)}{MP}$$

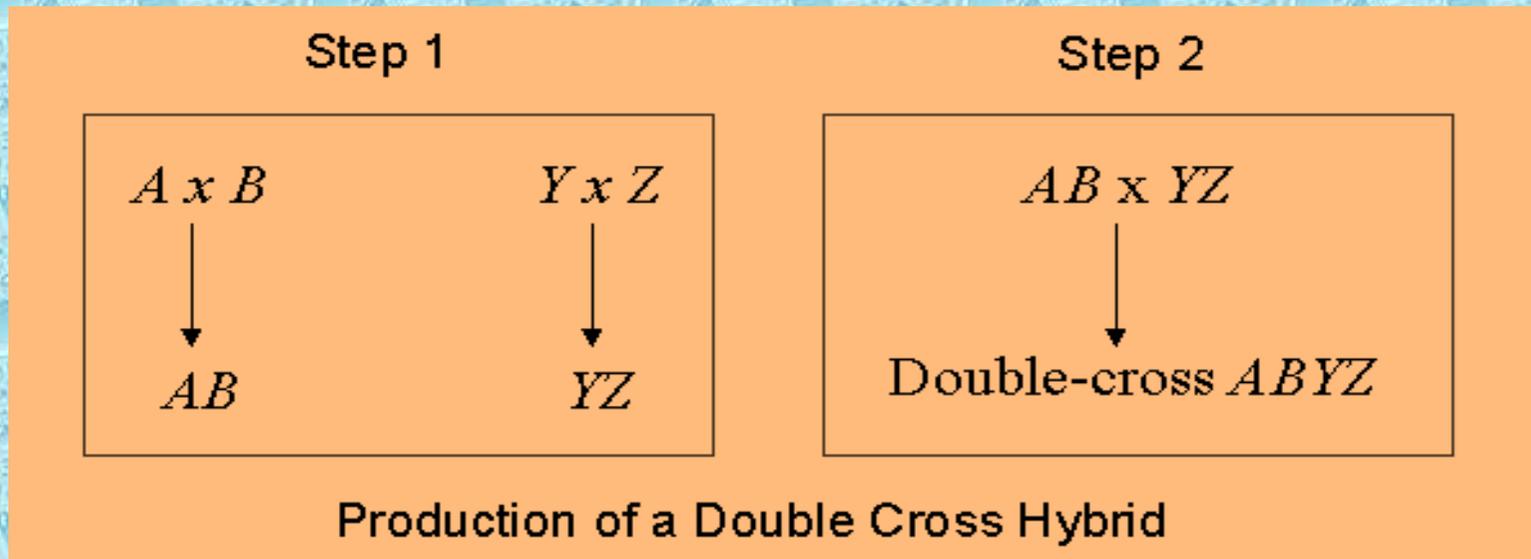
Where, Hyb = the value of the trait in the hybrid and

MP = the average (mid-parent) value of the trait in the two parents

For example, in Figure 2a the height of the single-cross hybrid is 3.0 m (this equals Hyb), the average height of the inbreds is 2.0 m (this equals MP), and the value of hybrid vigor is 50%. Hybrid vigor calculated in this way is called mid-parent hybrid vigor. Another type is high-parent hybrid vigor. This is the superiority, expressed as a percentage, of the hybrid over the parent with the better or higher value of the trait. Corn breeders will be successful in increasing hybrid performance if the hybrid vigor of a new hybrid compared to an older hybrid is increased and the two sets of parents have equal performance and/or if hybrid vigor is unchanged but the mid-parent value of the parents of the newer hybrid is superior to that of the parents of the older hybrid.

Double Cross Hybrid: As the name implies, producing a double-cross hybrid requires two stages of crossing involving two pairs of inbreds (see diagram below).

- ❖ In Step 1, two pairs of inbreds, *A* and *B* and *Y* and *Z*, are crossed to produce single-cross hybrids, *AB* and *YZ*.
- ❖ In Step 2, the two single-cross hybrids produced in Step 1 are crossed to produce the double-cross. Typically, *A* and *B* are closely related and *Y* and *Z* are also closely related, but neither *A* nor *B* is closely related to *Y* or *Z*. Unlike a single-cross hybrid, plants of a double-cross hybrid are not genetically uniform.



- Compared to single-cross hybrid production, production of double-cross requires an extra step. During the early history of the hybrid seed industry, this extra step was necessary because the inbreds available at that time produced so little grain that making commercial quantities of seed of single-cross hybrids was difficult.
- Even though the inbreds of each pair of a double-cross hybrid were related, the resulting single-cross hybrids exhibited sufficient vigor to allow those single crosses to be used successfully as parents in mass production of commercial seed.
- In most environments, the best single-cross hybrid will have superior performance to the best double-cross hybrid. As breeders gradually improved the performance of inbreds through selection, it became possible to commercially produce the more desirable single-cross hybrids.
- Double-cross hybrids may become important in the organic corn market. In production of organic hybrid seed corn, herbicides cannot be used. Therefore, seed producers desire parents that have good vigor and can compare successfully against weeds. The single-cross parents of double-cross hybrids have this desired vigor.

Types of Hybrids

Types of Hybrid

- Single cross hybrid (A x B)**
- Three way cross hybrid (A x B) x C**
- Double cross hybrid (A x B) x (C x D)**
- Top cross hybrid (Inbred x OP Variety)**

Single cross

Inbred line × Inbred line

A B

Modified single cross $\left(\begin{array}{cc} \text{Inbred line} \times \text{Inbred line} \\ A1 & A2 \end{array} \right) \times \text{Inbred line B}$

Three-way cross $\left(\begin{array}{cc} \text{Inbred line} \times \text{Inbred line} \\ A & B \end{array} \right) \times \text{Inbred line C}$

Double cross

$\left(\begin{array}{cc} \text{Inbred line} \times \text{Inbred line} \\ A & B \end{array} \right) \times \left(\begin{array}{cc} \text{Inbred line} \times \text{Inbred line} \\ C & D \end{array} \right)$

THANK YOU

