Maize Hybrids

Mini-Documentary: Seeds of the Future

The Journey of a Seed
Farming in Africa can often be traumatic. Crop failures are not uncommon. In “Seeds of the Future,” maize farmer Zeka Twoboy cites the challenges he faces, including pests and changes in climate, and recounts how Dupont Pioneer seeds enabled him to overcome the elements. While trying out different seeds, he had such a huge harvest on his small plot of land that people in his village accused him of using magic and witchcraft.

The maize seed he used, called Pioneer® maize brand hybrid 30G97, made a multi-year journey across several countries before it arrived at Twoboy’s small farm in Malawi.

Maize hybrids are created by crossing, or breeding, two different inbred parent lines with desired characteristics to combine into a hybrid. Farmers value hybrids because they are stronger and perform better across different environments than their inbred parent lines or open pollinated varieties (OPVs), which are the result of seeds pollinating in fields that are not controlled. With the impacts of climate change and rising populations, hybrids play an important role in combating world hunger.

Researchers use a range of tools – including genetic understanding, analytical technologies, and molecular biology – to selectively develop new seed products that meet customer needs.
While science may be universal, solutions are local; responses must match the specific needs of farmers. For example, Twoboy and his neighboring farmers need seeds that have a high tolerance to drought. Other diverse environmental factors that must be considered include differences in climate, rainfall distribution and quantity, soil, and pests.

"I believe the hybrid seeds will be the way to go if hunger is going to be eliminated."
Alick Nkhoma, Asst. Rep., Malawi, UN Food and Agriculture Org.

Understanding a Plant’s Genetics is Important

Although scientists have estimated that maize contains somewhere in the range of 60-80,000 genes, a single gene can have a significant impact on a seed’s performance. DuPont Pioneer has one of the world’s most genetically diverse collections of germplasm—a sort a library of maize genes used to develop hybrids.

To develop stellar seed performers, Pioneer’s researchers evaluate multiple generations of inbreds and use computer networks and other technologies to help them select the best-performing plants. Developing new inbreds involves crossing elite specimens, self-pollinating the progeny, and studying several generations of the plant. When an inbred exhibits genetic purity and consistently delivers high yield, it is identified as a potential parent.

From Mexico and Zimbabwe to Malawi

The journey of 30G97 began in a DuPont Pioneer maize research facility in Mexico where researchers developed a parent line that would create a plant that was hardier and could yield up to four times greater than maize seeds typically planted in Africa. The second parent line was created in Zimbabwe at the DuPont Pioneer Harare Research Station. In addition to excellent yield potential, the hybrid was bred to ensure that it would have key agronomic strengths, including tolerance to common plant diseases, very good grain quality, and strong standability ability to withstand unstable growing conditions.

Once developed, 30G97 was destined for Zambia, Ethiopia, Zimbabwe, Kenya, Tanzania and Malawi, where it would encounter mid-altitude dry, moist and wet environments. Although scientists have estimated that maize has in the range of 60,000-80,000 genes, a single gene can significantly impact performance. The seed was rigorously tested to see how it could be adapted to the respective climates of each area.

As 30G97 traveled closer to Twoboy’s farm, it was planted at the DuPont Pioneer off-season nursery in Zimbabwe to test and prepare it for the very similar growing conditions in Malawi.

Pioneer agronomists work closely with farmers to ensure that seeds are planted correctly and that there is continuous adherence to best management practices throughout the growing season. Twoboy received guidance directly from Patrick W. Khembo, managing director of Chemicals & Marketing Co. Ltd., in Blantyre, Malawi, a third-party distributor of Pioneer brand seed. Distributors like Patrick undergo many years of field training by Pioneer agronomists in preparation to provide the advice and support they routinely offer local growers.

Developing maize hybrids is a time-consuming, labor-intensive process. Tens of thousands of hybrid maize crosses are made every season. However, less than 1% of these hybrids will meet the requirements to be a commercial hybrid.
Plant Breeding Glossary

**Doubled Haploids** – Genetically pure plants that are developed through a special cross-breeding and chemical process. This process takes a fraction of the time of traditional inbreeding and provides improved parents for higher performing hybrids.

**Genomics** – The study of the genetic material in a chromosome set. The information gathered through genomic tools, when used in conjunction with other technologies, helps researchers better understand which genes determine important characteristics and how genes work together.

**Germplasm** – A collection of genetic resources for an organism. The Pioneer collection of maize genes used to develop hybrids, which is one of the most genetically diverse in the industry, is one example. These collections are critical resources for researchers who are committed to finding genes that improve specific characteristics.

**Grey Leaf Spot (GLS)** – A fungal disease that affects maize, or corn, and is often manifested as brown lesions on the leaves. This disease is most prevalent in hot and humid climates.

**Heterosis** – A term used in cross-breeding to define when an organism has qualities that are superior to those of either parent.

**Hybrids** – The offspring of a cross between two different parent plants.

**Inbreds** – The parents of hybrids, which exhibit desirable characteristics and genetic purity.

**Male Sterile Line** – Seed that has sterility factor in the cytoplasm of its cells and, thus, does not produce pollen. These lines are crossed with those that do produce fertile pollen, resulting in production of a hybrid seed that has attributes from both parents.

**Northern Leaf Blight** – A disease caused by the fungus exserohilum turcicum, which affects maize, or corn. The lesions are long and narrow.

**Open Pollinated Varieties (OPV)** – Types of plants (for corn, rice, etc...) that develop when the pollination of seeds in a field is not controlled. This process results in more genetic diversity and crops may not be uniform. However, the costs of OPV seeds are not as high as those of hybrids.

**Molecular Marker** – A piece of DNA that is closely associated with a gene (or genes) responsible for a certain characteristic, like height. By using molecular markers, researchers can better predict which plants will have beneficial characteristics. It also saves time because plant breeders can begin field trials with an improved pool of candidate hybrids that are more likely to succeed.

**Stress Tolerance** – Strains of seeds that can withstand stresses such as drought, high salinity, floods, cold, or soils that are deficient in nutrients.

**Transformation** – A process whereby the genetic characteristics of an organism is changed via the insertion of a new gene. The new gene generally comes from the DNA of a different organism. It gives scientists the ability to improve products in ways that may not be possible through conventional breeding, such as improving a plant’s resistance to insects.

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**Additional Resources**

*Corn Insect and Disease Guide*, Pioneer.

*Developing a Superior Maize Hybrid*, Pioneer Hi-Bred International, Inc.

*Fact Sheets*, Pioneer-Pannar Partnership in Africa.