Sweet Corn Genetics: Where We Are and Where We Are Going

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Genetic Ancestry

Corn has apparently been cultivated for thousands of year. Its exact origins may date back as far as 10,000 years, but corn's exact history becomes cloudy from the lack of accurate records. Myth and folklore also obscure its origins. It is possible, but not absolutely certain, that corn arose from teosinte. Corn is surely one of our most important cereal crops and is the most widely grown feed grain in the U.S.A. Completely dependent on mankind, it doesn't exist in nature without our nurture.

Breeding

For millennia corn was open pollinated (O.P.), bred by selecting the most desirable ears from the most desirable plants. Favorite strains or varieties became available. Around the late 1800's to the early 1900's breeders began crossing pure line varieties and the resulting crosses were our earliest hybrids.

Around the end of the great depression, roughly 1940, the use of hybridized varieties exploded and today, the vast majority of corn acres are covered with hybrids. Hybrids are characterized by stability, improved disease tolerance and "hybrid vigor." Hybrids also give breeding companies the incentive to pour resources into the development of new varieties.

Genetic Engineering, for traits such as insect tolerance and herbicide tolerance, arrived on the commercial scene in the mid to late 1990's in sweet corn. New varieties are being developed with improved insect and herbicide tolerances as well as draught tolerance.

Gene Types (Mutations)

Simply put, corn wouldn't exist without mutations and sweet corn wouldn't be "sweet corn" had it not mutated from hard corns.

Much of today's breeding has been built on a platform of 3 major modifier gene mutations: Sugary (su-1), sugary enhancer (se) and shrunken-2 (sh-2). These are random mutations that occurred in nature.

There are also several other major modifiers including brittle and brittle-2 genes. A few of today's synergistic varieties utilize the brittle-2 modifier. The brittle-2 mutation behaves similar to the sh-2 gene, so for most growers, it is not necessary to make the distinction. All of these major modifier mutations are naturally occurring and were recognized by breeders and utilized in conventional breeding practices.

More recently, breeding has focused on double and triple mutants. Remember, to be sweet corn, it needs a double recessive gene from at least one of the major modifiers listed above. However, there's no reason why it cannot have genes from more than one of those genetic mutations. Double and triple mutants include the synergistic and augmented supersweet classes. Among the progressive roadside and commercial growers, those two classes dominate today's market. With these advances, pericarps are tenderer, sugar levels have increased, and quality has improved. Conventional synergistic and augmented varieties are developed using traditional breeding practices.

Vigor – Seed and Plant

Stand establishment is essential for yield. Seed production companies learned that they needed to handle the harvest, milling and treatments of these varieties differently than the starchy varieties of the past. Many growers have also adapted better practices, realizing that the conditions on the initial planting day has a significant outcome on the final crop.

Variety vigor is talked about as if it is a single, solitary characteristic. Simple observation of your sweet corn emergence should have you thinking differently about vigor. "Seed" vigor is that vigor which begins the moment that the seed imbibes, and facilitates the growth of the embryo the first several weeks. Somewhere around the 2 to 5 leaf stage, the "plant" vigor begins to overshadow, but not correct for, seed vigor.

A low starch content in the endosperm of today's highly mutated, high quality sweet corn seed can often be related to low seed vigor. So generally, there becomes a negative correlation between modern high sugar varieties and vigor.

SuperSeedWare®

Through traditional breeding practices, Abbott and Cobb, developed a patented trait referred to as SuperSeedWare®. Although the seed that you plant in the field is well filled out (not of a shrunken appearance), they have managed to breed high quality hybrids that retain a long field or shelf life. These varieties hold the promise of improved cool season emergence, stronger root systems and even trimming a few days off of the maturity. A&C is in the process of rapidly converting their popular and promising hybrids to SuperSeedWare®. Abbott and Cobb already offer a number of varieties with SSW®.

sh2-i Gene

Crookham, and likely other breeding and production companies, are improving their seed quality using a conventionally bred trait called the sh2-i gene (a.k.a. shrunken-i gene). In the seed production fields, the endosperm is converted to starch, yielding vigorous, easy to plant seed with improved cold soil emergence over similar high quality varieties without the sh2-i gene. However in the hybrid sweet corn field, the grower's ears are sweet and tender. Several varieties are already commercially available.

Kernel Color
Look for improvement in kernel color, especially white kernels. Fresh, bright looking kernels are key to an attractive ears. Even in bicolor corns, attractive contrast is achieved by having a brilliant white kernel instead of a dark yellow kernel. Through traditional breeding practices A & C has developed their HiGlowMS® varieties with improved kernel color. Work is also taking place to release a "dominate" white kernel, instead of the recessive white kernel used in today's hybrids. A grower would no long need to worry about yellow kernels crossing into his white fields. It would also make other color combinations possible, such as bicolor corns with a higher percentage of white kernels and possibly even tricolor corns, if an eye appealing third color is developed.

Quality
Quality is still improving also. High quality varieties of just 10 or 15 years ago are now marginal, as many more varieties achieve super high quality status. This year I was fortunate enough to sample varieties with improved pericarp, texture, and flavor combined with 21% brix!

Disease Tolerance
Northern corn leaf blight is showing up earlier and more virulent than in the past. Varieties that had exhibited at least a moderate level of tolerance are sometimes showing full susceptibility. New strains of NCLB are probably appearing, and work is being done for a broader range of tolerance.

New strains of rust are also appearing. Illinois Foundation Seed has done an excellent job of breeding tolerance to these strains and often their new hybrid names are followed by the designation "XR" for the new rust resistance or "MXR" for maize dwarf mosaic virus tolerance and tolerance to the new races of rust. Conventional breeding was used for these resistances.

Summary
Today's choices of sweet corn varieties are probably more varied than at any time in history. From the plethora varieties in seed catalogs or on the internet, growers can choose from an abundance of heirloom (O.P.) varieties, conventional hybrids or genetic engineered varieties. Choices come in a range of colors, maturities and gene types. The future holds the promise of improved yield through better vigor and disease tolerances. Additionally, expect potentially more eye-appealing varieties with improved kernel color and longer retention of a fresh husk appearance. Tenderness, texture, sugars and flavor continue to improve.