Advances in Sunflower Breeding and Production

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Plant scientists have been employing science to improve crops for centuries. Evidence from early cave dwellers suggest they selected seeds from plants that had the best tall stalks and seeds. A great breakthrough occurred in 1866 when Agronomist/Monk Gregor Mendel crossed pea plants and became known as the "Father of Genetics". As knowledge improved, science improved. Plant scientists (agronomists by today's title) have advanced varieties and traits, one gene at a time.

Today, plant breeders work with a number of non-transgenic methods to transfer desirable traits from one plant to the next generation of plants. Sunflower is a crop that is not GMO or transgenic, which means that more traditional plant breeding techniques are employed. In an effort to use new technologies more efficiently with non-transgenic crops, plant breeders have discovered better and faster methods for transferring desirable plant traits to the next generation. DNA Marker-Assisted Selection (MAS) is one technology that is currently being employed. DNA markers have been found that allow a plant breeder to more efficiently select specific traits to advance to the next generation. While markers may or may not be the DNA that controls the desired trait, they act as a "flag" that point to the specific gene that plant breeders want transferred. This technology has been used since the early 2000s.

One particularly powerful form of DNA marker technology is Single Nucleotide Polymorphism or SNP (pronounced snip). This plant breeding technology allows less expensive and high-throughput DNA sequencing methods to identify and locate genes controlling important traits. SNPs located close to a particular gene act as a marker for that gene. Once the marker is identified, plant breeders know which genes to focus on and select for transfer.

Two other plant breeding methods that are currently garnering increased attention are Genomic Selection and High Throughput Phenotyping. Genomic Selection allows the breeder to use SNPs to increase the accuracy and efficiency of trait selection, with the key goal of shortening the breeding cycle time and quickly increase the rate of genetic gain. High throughput phenotyping uses remote sensing and other technologies to rapidly and inexpensively evaluate breeding germplasm for drought tolerance, heat tolerance, plant biomass, pest tolerance, and other important production characteristics.

Further, another new plant genetic transfer technique is called Clustered Regularly Interspaced Short Palindromic Repeats or CRISPR. The CRISPR breeding method involves proteins used to change the sequence and potentially "deactivate" certain undesirable genes. For instance, CRISPR technology could disable a plant's gene that allows disease or insect susceptibility, thus making the plant resistant to specific pests, without using transgenic methods. This technology could make plants more insect or disease resistant by turning off the bad genes and enabling the good genes to thrive, without inserting foreign genes into the plant. This could also eliminate or reduce future pesticide applications to control pests. Sunflower breeders are incorporating all these techniques to deliver the best traits possible.

As a result of improved crop production techniques, breeders are now able to reduce the time required to release a new and improved sunflower variety equipped with targeted pest tolerant traits from ten years to approximately three years, in some cases. Even without transgenic technology, sunflower enjoys herbicide resistance traits found in the wild and crossed into new hybrids, giving producers advanced tools. New advances are also finding sunflower genes that are insect resistant, which could eliminate or reduce future insecticide applications.

It is no accident that record crop yields are happening yearly. At a trial site near Prospect Valley, one new sunflower variety yielded 4998 pounds per acre. Clearly, 5000 pound per acre sunflower yields are reachable. While CSU does not breed new varieties, the on-farm testing team continues to explore new techniques to increase yields. To be sure, agricultural scientists are currently employing the best technology available and the return on investment is showing up with quicker variety release times, enhanced pest resistance, and higher yields using similar inputs.

Sources: Colorado Wheat Farmer, Glenda Mostek. Maine Organic Farmer & Gardener- Spring 2011, John Koster. Scott Haley, Colorado State University Wheat Breeder

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