Using innovative seed development to address changing weather challenges

Changing weather patterns are creating a new set of challenges for farmers, who need seed products that can take on these issues while continuing to improve productivity. While these challenges are substantial, so are the opportunities. Work by researchers and seed developers like Corteva Agriscience is already leading to new corn and soybean genetics that will be able to mitigate a range of issues. In this article, we'll take a look at some of the most common weather change challenges farmers are facing, and at the opportunities these challenges present to develop new and better hybrids and varieties.

Temperature shifts

Although daytime temperatures during the growing season may be remaining fairly consistent in the Midwest and Corn Belt, nighttime temperatures have been increasing. The alteration can reduce grain yield and quality for crops as it disrupts plants' circadian rhythms and the molecular processes involved in gene expression and plant reproduction, as documented in rice by researchers with North Carolina State University and other institutions.[1]

Winter temperatures have also been changing. The potential for severe cold spells continues throughout the Midwest - as the 2019 polar vortex demonstrated – but harsh winters are becoming less likely. This change has extended the growing season by two days per decade across the last century, according to researchers from Michigan State.[2] While a longer growing season may have its benefits, milder winters can also allow pests to survive, increasing pest pressures.

Moisture

Drought stress is an important consideration, but increased moisture can also pose its own challenges. Higher humidity can increase disease pressure, while severe rainfall events and flooding have the potential to damage crops and fields. Not only has rainfall increased in some parts of the Midwest and Corn Belt, but so has the intensity of precipitation, which can further erode soil and prompt flooding, especially when plants are young. As problematic as individual stressful conditions may be, the negative effects can be heighted when they occur simultaneously or in succession.

Research is already resulting in corn and soybean genetics that are better able to resist some weather-based stresses. The efforts of seed companies and developers from 1951 to 2017 improved heat and drought tolerance in corn and soybean strains, boosting yields by 33% and 20%, respectively.[3]

Of course, conditions aren't always this challenging, so seed needs to be adaptable. Researchers at the University of Illinois Department of Agricultural and Consumer Economics are finding that some corn and soybean varieties bred to maintain performance in stressful conditions may be underperforming in mild circumstances.[3] Some stress-tolerant lines show drops in yield when grown during neutral conditions. The shift indicates that seed development needs to account for not only crop resilience in the face of stress, but during more typical production periods.

To address these and other challenges to production, industry leaders, including Corteva, are exploring expanded public/private research partnerships and investing more in the development of new varieties.

Seed quality and protection

Maintaining and improving the quality of seeds for planting is another area of opportunity, according to researchers from the University of Reading.[4] Poor-quality seed intended for planting may not survive storage and may struggle to generate a robust, high-yielding crop. Seed quality can be damaged by occurrences during production, including high temperatures or drought during specific developmental stages. Parent lines intended to produce in stressful conditions also need the ability to survive and generate robust seeds while experiencing stress. Innovations in breeding programs and effective seed treatments will be important in mitigating these issues.

To address these and other challenges to production, industry leaders, including Corteva, are exploring expanded public/private research partnerships and investing more in the development of new varieties. New possibilities include genetics that can manage higher temperatures – during the day and at night – without reducing yield and seed that yields well under both stressful conditions and in more neutral growing seasons. New crop characteristics like longer root systems or shorter stalks, as well as new agronomic defenses, may hold some of the answers. Weather conditions will of course continue to vary by region as well, highlighting the ongoing need for specialized hybrids and varieties that meet local needs.

Work along these lines has already started in several areas. For example, a research team at Kansas State University is examining how to improve soybean tolerance to heat stress in the post-flowering stage.[5] Similarly, scientists at Penn State University and the University of Nebraska-Lincoln are working on genetic expression of specific traits in soybeans linked to surviving stresses like drought, cold, heat and high light levels using stress memories.[6]

At Corteva, our access to one of the world's largest germplasm libraries gives us a wealth of resources for developing new seed options to stand up to more stress and yield more with fewer inputs. Our commitment to sustainability extends to products that help protect seeds and crops while contributing to healthier air, soil and water which, in turn, can help optimize production and returns for farmers. As leaders in seed development, we see addressing these challenges as a way to continue improving the industry and ensuring farmers have the seed they need to be successful, whatever Mother Nature may bring their way.

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[6] Mulhollem, Jeff. "Scaring soybeans into defensive mode yields better plants a generation later." Penn State News. November 13, 2018. https://news.psu.edu/story/547586/2018/11/13/research/scaring-soybeans-defensive-mode-yields-better-plants-generation.