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Editorial

Genetic gain in crops: prerequisite for the sustainable food production and food security of the growing population

Since the public sector frequently helps the communities that need higher rates of genetic advances the most, plant breeders and managers in this sector have a huge responsibility to the world. For the farmers they assist, public breeding programs frequently provide the only source of improved germplasm. Enhancing crop breeding programs' pace of genetic gain may hasten the delivery of crop cultivars with greater nutrient density and climate resistance, which will be essential for both sustainable food production and the expanding population's food security. Genetic gain is described as from selection, or simply "genetic gain," is defined as the improvement/change in average genetic value in a population or the improvement in average phenotypic value due to selection within a population across cycles of breeding. When linearity is present, the average breeding value can be regressed on year or cycle to estimate this shift, which is frequently called a genetic trend. This estimate can be used to forecast future genetic gain, assuming that the breeding procedure stays the same and that the desired trait is quantitatively inherited in accordance with the infinitesimal model. To make the explanation understandable, we choose to use a high-level interpretation in this case. To achieve greater genetic gains in breeding programs, breeding or selection strategies that enable quick changes in the factors influencing genetic gain-that is, strategies that enable quick increases in selection intensity, genetic diversity in the breeding population, and/or trait heritability, as well as shorter breeding cycle durations—are required. Abiotic stress causes significant and frequently underestimated economic harm. Abiotic stress accounts for 66% of the yield loss for maize, one of the most important commodities in the world, while biotic stress-that is, the detrimental effects of pests and parasitesis thought to be responsible for only 10%. As a result, the crops are subjected to a variety of biotic and abiotic stressors, which taken together may have a negative impact on crop survival and performance. Insect pests, fungi, bacteria, viruses, and herbicide toxicity are examples of biotic stressors. Drought, high salinity, extremes of temperature, flooding, strong light, ozone, low nutrition availability, mineral deficiencies, heavy metals, pollution, wind, and mechanical damage are examples of abiotic stressors. It is widely accepted that each of these stresses poses a significant risk to the production of all crops in a sustainable manner. Pathogens, drought, excessive irrigation or submersion, nutrient deficiencies, toxicity from excessive fertilizer feeding, and high salinity stressors are some of these stressors that significantly affect global agriculture and lower average yields by more than 50%. Growing rates of genetic gain in public plant breeding initiatives can be very difficult, despite their tremendous importance. It is frequently seen to be extremely dangerous to alter the breeding process in an effort to increase rates of genetic gain. Breeders frequently believe that their present pipelines are nearly ideal and fear that the most vulnerable people on the planet would suffer greatly if modifications are not made and the breeding effort fails. This breeds conservatism, which can make change extremely challenging. Of course, though, improvement requires change. The risk of continuing to rely on visual selection in antiquated pedigree breeding schemes is greatly outweighed by the potential benefits of optimizing breeding pipelines to significantly reduce breeding cycle time and modestly increase selection differential and accuracy. In fact, rates of genetic gain and varietal replacement have been extremely low in much of the developing world since the end of the Green Revolution period. Therefore, more work is needed to comprehend the complexities of genetic gain and its significance in order to counteract yield losses.