



The thought process that led to the Durayield concept

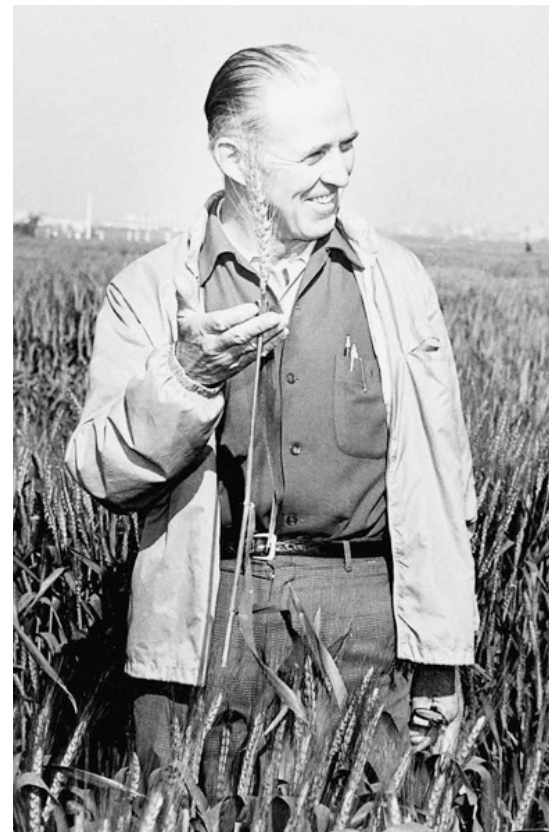
By: Ed Baumgartner

Living and working in Puerto Rico provides a different perspective not only in life but also in plant breeding. Everything you know is challenged. After first few years of working in Puerto Rico I realized that we could consistently create specific stresses on a crop. This was whether we intended to apply them or not. I began to think that this is a perfect place for a managed stress environment as long as insects and heat were part of the managed stresses that were desired. As a plant breeder you want to apply the various abiotic and biotic stresses during the development process to develop strong new inbreds and hybrids. Most of us are taught that you need to breed corn where it will be sold and grown. I agreed with this mindset early in my career but as time went on, I realized that this was not a correct thought process. Most of my colleagues in corn breeding will say that you need



to develop corn where it will be grown, however they are selecting hybrids to sell from their development programs based on how widely adapted they can be grown. The wider the adaptation for the hybrid, the better the corn hybrid in their world. What about the needing to breed corn hybrids where they will be sold concept?

Before starting our breeding program at 3rd Millennium Genetics in Puerto Rico, I began researching successful plant breeders and their methodologies. Prior to becoming my own boss, I was required to follow breeding strategies that my employer required. Most of these would not work in our new program because they were all based on the mindset that breeding needed to be done in the target environment and winter nursery was used only to advance a generation without selection or for hybrid seed make up to test the next summer. Being a University of Minnesota graduate, I started with the Father of the Green Revolution, Norman Borlaug. He has a very interesting story that went well beyond plant breeding. I recommend reading books written by Noel Vietmeyer about Dr Borlaug's life ([link](#)). Dr. Borlaug utilized Shuttle Breeding to develop his new wheat rapidly. This technique of using a target environment and then a stress environment to select in for varietal development really hit home for me. These new wheat varieties became widely adapted through this breeding method and were able to be deployed in various parts of the world where they were needed to stave off famine. If you read the books on Dr. Borlaug's life, you will see that he was not the most popular person in academia and other public institutions. He pushed the boundaries of what was accepted practice all the time. That's what we need to do now to get to the next level of production. We need to question all of the accepted standard practices of corn breeding.



The thought process that led to the Durayield concept

(continued from Page 3)

I find it interesting that the breeding methods of the first Nobel Peace Prize winner in Agriculture are not taught in US plant breeding classes. He must have really irritated his peers with his unconventional success.

I have had many opportunities to visit with successful corn breeders to try to understand what works for them. One of the common themes between all of them was selection under stress. Most accomplish this through selecting under higher populations to create drought and other stresses. Then I thought the real proof in a good plant breeder would be to research the research most widely used lines in the industry over time. The incredible part of this research is that some of the most widely sold hybrids had inbreds in them that were developed during difficult drought periods, were descendants of lines developed in drought periods, or were developed in areas prone to drought year after year. [\(Link\)](#) After this revelation, I began to think that we need to focus on creating real drought situations during the inbred development process rather than creating a possible drought like scenario with higher populations. I believe that higher population breeding to create drought stress has led us to reduced ear flex or fixed ear hybrids that are so popular today. No doubt they can yield at the proper population for the specific hybrid and with the right weather conditions. You get what you select for in a plant-breeding program. So why not select for more yield under actual or real life environmental stress conditions rather than a more plants per acre stress? It is logical that some of the genes captured under high plant population breeding add to drought and stress tolerance in the corn hybrid. It is even more logical to breed corn under drought and other stress conditions to capture the most possible gene combinations for broader tolerance to these abiotic conditions.



I began to ask the following questions: What are the relevant environments in a breeding program? Are all stresses in a given environment relevant? Do we need to select under more than one stress at a time? Do diverse stresses help develop the best inbred/hybrid? Where would we be yield-wise if we created drought stress differently during corn inbred development? If we develop highly stress tolerant corn will we lose top end yield? Would we need the plants per acre we use today if we did not use higher plant densities for drought selection? Would our corn plants only produce same amount of grain per stalk as they did 40 years ago? Would we have hybrid corn plants that produced two or three good-sized ears per stalk now rather than one? What would our seed field yields and seed quality be when inbreds are developed in difficult environments? Would our seed field yields be more predictable?

I welcome your feedback! I will respond to as much feedback as I can in subsequent issues of NeWold Times and continue the Durayield thought process.