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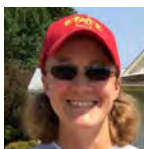
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Susan has really thrown herself into her work.



Tales from the Corn

by Susan Johnson

Corn is a weed.

You read that right.

Before the shovels and pitchforks come out, let me explain. I spent the summers of my youth walking beans for my Dad, going after any corn plant in sight. I then spent 15 years working in soybean breeding for Iowa State. Again, spending my summers keeping our research fields corn free. I've stood at the edge of a field before Spring planting and sighed at the number of ears laying on the ground, knowing we would see a nice crop of volunteer corn come up with our soybean plots.

Corn = weed.

Tales from the Corn

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As long as I'm being honest, I'll share this fun fact with you. More than once, in my younger days, I swore up and down I'd never work in corn. Have you watched corn breeders? They're always doing something. Taking stand counts. Thinning plots (in the days before precision planters). Shootbagging. Detasseling. Pollinating. The list goes on for days. Soybeans self themselves, there's not a tassel in sight, there's not a shoot to be found, no making up hybrids for testing, and so on and so on.

Go ahead. Call me lazy. I like to go golfing in the summer.

Yet here I am, working in corn. Surrounded by corn. Seriously, I am surrounded, there is a statue of corn here. It's everywhere.

And I like it.

How did I learn to love corn? How have I come to terms with spending my July self-pollinating in a nursery, after years of watching soybeans handle that by themselves?

Bear with me a little bit, as I'm still new at this, but I'll try and explain.

I like plant breeding. I enjoy being a plant breeder. It appeals to my slightly competitive nature. At its most basic level, plant breeding is trying to improve the performance of a crop. It is a continuous and constant process. You're always trying to improve, always trying to beat what is already out in the market. This holds true no matter the crop. This is how I looked at developing new soybean varieties, and now it is how we look at developing new corn inbreds and hybrids.

There's something I didn't have to worry about in my soybean world, working with both inbreds and hybrids, it complicates things. Soybeans are a "what you see is what you get" type crop. If a soybean line in a yield trial doesn't perform well or look good, it's done. Drop it and move on. Corn is more about potential and giving out second chances. First developing inbreds, then identifying ones with potential, and finally finding the right combination of parents that turn into a high-performing hybrid.



Olivia's, Minnesota famous corn statue

Maybe the biggest thing I'm trying to get my head wrapped around is heterotic groups. Working within a heterotic group to improve inbred lines. It's one of the things that appeals to me most about corn. In soybeans, I spent some time looking at the pedigrees and the history of some of our best material. I wanted to get an idea of what worked. When we set up crosses to develop new breeding material, we could combine the lines however we chose. There weren't any heterotic groups to consider. With corn, the knowledge of the pedigree is so important. The history is so important. Knowing

the heterotic group you're working within. Knowing which inbreds can be combined to develop new inbred material to work with. It's madness.

Working with inbreds to improve hybrid performance. There's another concept that didn't exist in my soybean world. I didn't have to think about how an inbred would affect not only the hybrid it could end up being a part of, but also how its agronomic traits affect its hybrid seed production. During the two harvests I've been here, I've

Tales from the Corn

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spent most of my time in the nursery making selections. Going through inbred after inbred looking for the best plants with the best ears. Throwing out material that wouldn't be desirable in any field. Using the different conditions provided by Mother Nature to our advantage to eliminate material that wouldn't hold up in any field year after year. This past season some windy nights and a wet fall gave us opportunities to get rid of some poor stalks and a lot of kernel mold.

Finally, you can develop the prettiest, toughest, meanest inbred there is, but none of it matters if it doesn't yield. This is where the potential and second chances part comes in. It doesn't matter whether it's corn or soybean. The first year of yield testing isn't going to end with you finding the next rockstar corn hybrid or soybean variety. Things would be a lot easier if it did. In soybeans, the first year of testing eliminates the worst and provides you with seed to test again the following year. That's it. With corn, the first year of testing helps to identify inbreds that show potential. The potential to combine with another inbred that will result in a winning hybrid. As soybean lines go through multiple years of testing in a breeding program, the ones that don't perform are done. There's no going back. In corn, inbred lines are combined with multiple testers, trying to identify the best possible hybrid combination. If one doesn't work, a different one is tried. Knowing what to try comes back to knowing the heterotic groups, knowing the pedigrees, and knowing which combinations work.

I've got some things to think about now.

I'm back to square one in some ways. I'm learning a new crop. I've been here almost two years. I know how much I've already learned about corn in that short amount of time. I am also aware of how much I don't know. Fortunately, I enjoy the challenge.



Did we say something you like? Did we strike a nerve? Do you have something to add to a discussion?

We would love to hear from you! Please send your letters, questions or comments to:

newsletters@3mgpr.com



Climate Change and Global Warming

by Erin Rodriguez



Climate change is a naturally occurring phenomenon that can be seen throughout the world's history. Ice ages, mini ice ages and/or periods of prolonged raised temperatures are observed in samples taken by geologists of the earth's crust. We know that the earth is in constant flux and change. Global warming is the theory that the recent climatic changes we are currently observing are a result of human contributions to pollution through the burning of fossil fuels, deforestation, and other forms of pollution. This a polarizing subject that has been quite prevalent in the American and Global debates lately. How do you discuss climate change without getting into politics? The first step is to acknowledge what we agree on: the earth's temperatures are rising. Then, we must explore the science surrounding this debate on both sides. Finally, we must offer a prescription based on the reality of rising temperatures independent of what the perceived causes may be.

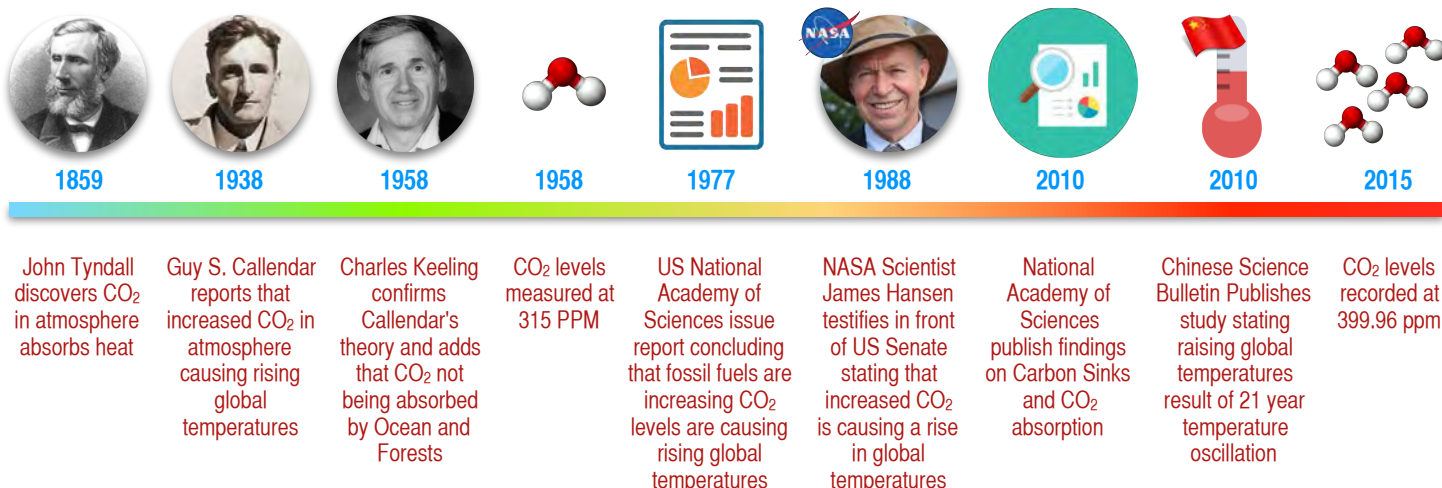
On the pro side proponents say that human beings and the industrialization of our planet, the increased burning of fossil fuels, deforestation and pollution are causing the earth to retain higher levels of carbon dioxide which in turn are creating rising global temperatures. Consequently, more extreme weather, drought, rising sea levels and species decimation are occurring at a rapid rate which puts the health of the planet and humanity in question for future generations.

Those on the con side argue that the increase in global temperatures and higher levels of carbon dioxide are a natural cyclical occurrence that is not related to the rise of industrialization, population increases, nor the burning of fossil fuels. They argue that if you look back on the global temperatures, the last century has not, in fact, been the hottest on record. Furthermore, they argue that the planet always goes through natural climatic fluctuations which can affect species extinction and temperature increases. They also claim the planet has the natural mechanisms to heal itself as is the case with so called carbon sinks (eco systems which naturally absorb CO₂ from the earth's atmosphere like forests and oceans).

We often think of global warming as a new argument and one that is politically driven rather than driven by science. This is not the case. The discovery of carbon dioxide's effect on the atmosphere goes back to 1859(1) when the scientist John Tyndall discovered that carbon dioxide in the atmosphere absorbs heat. Years later in 1938, Guy S. Callendar was the first scientist to theorize that carbon dioxide emissions were causing global warming.(2) Even in these early years this was a controversial idea that had vocal critics. Many of Callendar's contemporaries argued that these fluctuations in global temperatures were a result of natural atmospheric circulation changes rather than raised CO₂ levels. From that point on, the debate has been a consistent back and forth conversation. As you can see from the timeline below, this is a debate that is over 100 years old and has yet to gain consensus.

Climate Change and Global Warming

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It was in 1977 that the debate began to gain momentum when the US National Academy of Sciences issued a report concluding that burning fossil fuels increases CO₂ levels which in turn produces a rise in global temperatures. (3) However, in 2010, a study was published in the National Academy of Sciences found that carbon sinks such as the ocean and forest which naturally re-absorb CO₂ in the atmosphere have been working. They found that forests were growing faster because of the elevated levels of CO₂. (4) In 1988 NASA scientist James Hansen appeared before the US Senate and testified that CO₂ levels are causing global warming. However, even as late as 2010 the Chinese Science Bulletin published a study claiming that the recent rise in temperatures are merely the result of a natural 21-year temperature oscillation and that by the 2030's global temperatures will once again go through a cooling period. (5)

I would rather not focus on the dividing elements of this debate but rather focus on what we can agree on and how it affects us as a species, community, and industry. More importantly, I hope to start a conversation focused on finding solutions for sustainable living and agriculture. Moving forward with that goal in mind, let us begin with what we can agree on: the earth's average global temperature is rising and the environment is changing because of these rising temperatures. Whether these changes are a result of human contamination or natural climatic cycles, we need to work together to find ways to work in the environment as it is.

As farmers, we have the great responsibility of feeding the world's population. Regardless of the causes of climate change, our direct connection to the earth means we are immediately affected by these changes. We owe it to ourselves and each other to collaborate and converse so that we can develop new ways to work within the changing climate. We must continue to evaluate, study, and monitor the changes our planet is undergoing. We must find ways to work within the confines of a changing ecological paradigm. At 3MG, we do this in our breeding program as we breed corn to withstand drought, pest pressures, as well as heat and cold tolerances. We hope that the work we do will prove to be an important contribution to the farming community while working with Mother Nature. We know that many of you are also using science, breeding and conservation practices to find ways to continue farming for generations to come. We thank you, and we invite you share your experiences and ideas.

1a. National Aeronautics and Space Administration (NASA), "John Tyndall (1820–1893)," earthobservatory.nasa.gov (June 2, 2010)

2 G.S. Callendar, "The Artificial Production of Carbon Dioxide and Its Influence on Temperature," *Quarterly Journal of the Royal Meteorological Society*, Feb. 16, 1938

3. National Academies of Sciences, "Energy and Climate: Studies in Geophysics," www.nap.edu, 1977

4. Sean M. McMahon, Geoffrey G. Parker, and Dawn R. Miller, "Evidence for a Recent Increase in Forest Growth," *Proceedings of the National Academy of Sciences*, Feb. 23, 2010

5. Qian WeiHong and Lu Bo, "Periodic Oscillations in Millennial Global-Mean Temperature and Their Causes," *Chinese Science Bulletin*, Dec. 2010



The Genetic Market

by Ed Baumgartner

There are a lot of things to consider when you start a corn-breeding program, the least of which is how do you market the genetics once you develop them. I spent a lot of time thinking about breeding methodologies, germplasm, traits to focus selection on, testing methodologies and costs prior to starting our program. You have a blank sheet of paper in front of you to chart out your direction. That is very exciting to do while at the same time a very challenging endeavor. I can honestly say that I underestimated the marketing difficulty of the newly developed genetics. I did have a plan. It was a little bit "Build it and they will come" and a lot direct license the genetics to our interested service customers. My thoughts were that we develop good relationships with our customers and in turn we can be an alternative supplier of genetics to them. Great plan. What I underestimated is that the marketplace had changed completely during the 18 years that I have been in Puerto Rico. I did not understand how tightly tied genetic sales were to GMO trait packages, how \$7 corn changes farmer thought processes and that you need unit quantities of new products for people to try. The past few years have been quite a learning period for me. I can honestly say that developing the market for new products is more difficult than developing new products for the market.



The good news in all of this is that we are still here with good relationships with our service customers, still developing unique new genetics with strong native traits, we have made some genetic sales, we are figuring out how to have quantities of the right hybrid on hand, developed some good relationships with farmers and beginning to see some light at the end of the tunnel for marketing. For us, sub \$4 corn has changed the thinking of the farmer again and they are examining all aspects of their expenses, especially for seed. This is opening up sales avenues regarding our native insect and native drought tolerant traits. Most farmers are unaware that these traits exist in corn and actually work. We now know that one of our Durayield™ parents can confer an elevated level of both traits in the hybrid that is higher than currently available conventional products in the marketplace. When both parents are Durayield™ we can go toe to toe with the GMO products on insect efficacy and will be way ahead of them in abiotic stress conditions. This is exciting to be able compete with the best out there on a completely different platform that has no market restrictions.

Our hybrid testing program puts us on farms with very different cropping systems which allows us to understand the abilities of these products. We consistently out perform other products in no-till, strip till, corn on corn, heavily manured fields and corn following sugar beets. You may be thinking that this is not unique because other companies can recommend products for each of these conditions. What they are doing is taking the hybrids developed generally in high yield corn-soybean rotations and then determine which ones perform the best in the conditions outlined above when they are close to commercialization. We actually develop our hybrids in these conditions from the beginning. We learn a lot more about our products in a shorter time due to this type of development plan. We also have the high yield

The Genetic Market

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corn-soybean rotation plots in our testing program as we know that most corn planted is in this type of rotation. Our focus is to understand what pedigrees perform in specific conditions and then match that to the farmer needs. We know that our way into the marketplace is through niches that we identify and have the products to go after them.

The first products out of our program were somewhat yield capped in high yield conditions. They would really shine in difficult growing conditions but get lost in the high yield data sets. This makes them hard to sell because almost every retail plot is focused on high yield potential locations. Almost everyone purchases the high yield plot winners even though their farms really need

products with strong abiotic stress tolerances. No one wants to miss out on the chance to hit a home run. Our job has been trying to get customers to understand you can have solid performance in the tough conditions with our products, which helps overall farm profitability. As we continue to test the second breeding cycle of our products, we see increased yield across the range of testing conditions. I no longer believe we are yield capped in high yield conditions and have kept the strong performance in difficult conditions. The 2016 testing season was one of the highest yielding I have seen in my career. The good news is that our products competed very well in the corn-soybean high yield locations. The great news is that we dominated in the traditionally more difficult crop rotations and cultural practices. As we are able to get more products on to the farm, the combine yield monitors work in our favor. Some of those earlier yield capped products are picking up acres each year as farmers see what they do on their acres. This has made product positioning so important for us. They will do what we say they do. We know how they will perform because of the development program for both the inbred and hybrid development components we have implemented. We are ramping up seed stock and hybrid seed as we identify new hybrids that need to be in the market place.

These results follow what we have been saying from the day we started this breeding program. If you focus on stress plant breeding you will develop products that not only are defensive but also can deliver yield in a wide range of growing conditions. We hope to put an end to having workhorse hybrids and racehorse hybrids on the farm. We would rather focus on putting diverse genetics on the farm that have high performance levels in all conditions. As our weather continues to evolve, we want to have the genetics that can handle it. If you are interested in learning how we can help your retail brand or farm with Durayield™, please contact us.

Contributors

Ed Baumgartner
President

Erin Rodríguez
Editor, Assistant Marketing Manager

Raechel Baumgartner
Assistant Editor

Alexis González
Creative Design

We thank our staff at all our locations for providing us with support as well as many of the photographs used on our articles. Keep on contributing!

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3MG R&D

PO Box 818 • Santa Isabel, PR 00757

www.3mgpr.com

787-845-4600

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As we approach this most joyous holiday season, we want to take a moment to thank you for your support throughout the years. Thank you for giving us the opportunity to serve you. We hope that your hearts are as filled with joy, gratitude, and love as ours are.

God bless you all!



Founded in 2012, 3MG R&D has been involved in the creation of innovative products that we hope will be in the forefront of the seed market. Guided by our principle that we can develop food crops that combat environmental pressures naturally and economically, we continuously research new solutions using a mix of millennia-old breeding techniques with high-end modern genetic technologies.