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COVERING ENVIRONMENTS

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New Variety “G.E.M”s

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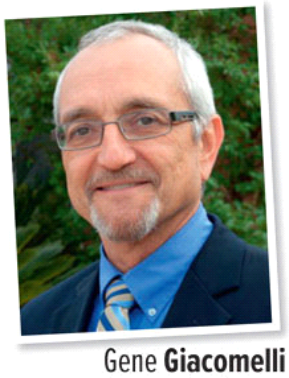
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Plant varieties are developed by the genetic manipulation of genes by breeding techniques to create desirable new traits—a yellow-flowering begonia, extended postharvest shelf life, an exceptionally tasty tomato or improved nutritional quality of spinach.

It’s the genetics of a plant that provides the potential to achieve its best performance, but it requires an environment at proper levels—in proper combinations and timing of temperature, light and nutrients—during growth by proper management procedures of an experienced grower for any plant to reach its genetic potential, and ultimately, its final market value.

That said, applying the proper Environment to exceptional plant Genetics within the carefully Managed greenhouse crop, anyone can realize a “G.E.M.” of results from their production facility. However, they’ll achieve biosystem sustainability only with carefully integrated design of component systems that complement one another within the facility. These include the structure, heating, cooling and lighting systems, and the nutrient delivery (fertigation system), along with efficient transport, handling and labor access for the multi-staged growth of the plant from seed to harvest.

Don’t underestimate the potential for plant production and quality improvements by breeding. A long time ago, a team of scientists and engineers at Rutgers University targeted improvements for greenhouse tomato crop production. In addition to mechanization to improve labor efficiency and supplemental lighting for predictable computer model-based timing of yields, the primary goal was to increase production capacity (kg/m2/year). That’s marketable fruit weight (kilograms) per area of production (square meters) per year. In 1980, U.S. yearly greenhouse production capacity was generally 25 and they demonstrated a 40% potential increase to 35 or more—a significant feat through improved environmental control and management!

Variety trials were completed to select the most productive of the large beefsteak or smaller-fruited varieties of that time. After 10 years of study much was learned about commercial lighting requirements for fruit set in the dark winter period and for fruit sizing after fruit set to increase harvest weight. But, also, mechanization provided mobile plants to increase space utilization and save labor. They could be serviced at workstations on transportable benches and not within the production bays.

But the breeders were busy, too, and they successfully established 50 kg/m2/year or more as the new standard for varieties within the traditional high-wire tomato production system. This diminished the

application of the Single Truss Tomato Production System. Furthermore, supplemental lighting, although potentially beneficial, was not required. Soon after the truss tomato variety was developed and improved harvest labor efficiency, as four to five fruits could be removed together with each truss, thus rapidly filling the boxes for sale.

How might CEA enhance plant breeding programs? Multiple seed corn crop cycles per year in the greenhouse has replaced the traditional procedure to obtain only two crop cycles per year. An R&D project at UA-CEAC in the 2010s utilized corn plants grown in pots on ebb-and-flood benches in the greenhouse at high density with supplemental lighting to obtain three to four crop cycles per year with 800 seeds per ear, even in fall and winter. The Bayer Marana Arizona greenhouse and research facility currently utilizes an automated transport, hydroponic system for seed corn production within their breeding program. This is a true G.E.M. at an investment of $120 million. If you're interested, visit the link above to see more.

How will CEA support crop variety development for living on the moon and Mars? The plant will be grown within a fully artificial environment, much like the high-density and very space-efficient vertical farms, never seeing the light of day. This new industry will continue to develop varieties to enhance attributes of yield, quality, taste, nutrition and resistance to the dangerous Galactic Cosmic Rays (OK, not GCR yet) for moon and Mars crops for when we must farm on other planets. Learning to grow very efficiently in extreme environments and with limited resources in space will benefit our production systems on Earth, while variety development for vertical farms will help establish space food varieties. You can find working examples of these concepts at these websites for the South Pole Growing Chamber and the Prototype Lunar Greenhouse.

Plant varieties are fundamental for the efficient production of the plant in controlled environments. Again, we can appreciate that it is all about the plant.

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