

Gearing up for future circumstances

abiotic stresses factors explained

For the western part of Europe, 2018 was a memorable year for meteorologists: an unusual long period of drought, hot weather and a record number of warm days over 20 degrees Celsius. One can argue about the cause, but most will agree that the world climate is changing. For growers, periods with extreme weather is yet another challenge to deal with.

To be able to feed a world inhabited by some 10 billion people in 2050, agricultural production needs to double, with a reduced input of fertilizer. At the same time, growing crops will be exposed to more extreme weather conditions, and those crops need to be grown in areas where fresh water might become increasingly scarce. Although, at first side, a bleak future, researchers and breeders are gearing up to provide the high yielding varieties that will still be able to thrive under these circumstances.

Abiotic stress factors

“Selecting vegetables for resistance to many different kinds of pathogens, so-called biotic stress, has been and will remain the major focus of much of the breeding activities,” explains Manager Research and Applications Gert-Jan de Boer. “But research and breeding activities will also encompass more attention towards creating new varieties that can withstand abiotic stress such as climate extremes.”

Abiotic stress or non-living factors that have an adverse effect to plant growth and development, include amongst others high and low temperatures, salinity, lack of essential minerals like phosphate starvation, drought and flooding. De Boer: “These factors might have overlapping effects on the vitality of the plant, but their effect can also be very (crop) specific. Increasing salinity of the soil or water, for example due to large-scale irrigation, has a greater impact on Curcubitae species than for example on tomato. In fact, some species related to tomato, such as *S. pennellii*, turn out to actually benefit from living on high saline soils. Although, these types of so called halophytic species have long held much promise to increase salt tolerance in crop plants, very little progress has been achieved.”

Salt tolerance

Plant salt tolerance has long been studied in model species such as *Arabidopsis* (thale cress), which is also a salt sensitive species. A number of genes from this plant play a crucial role in the uptake

of sodium from the soil. Reducing the activity of some of these genes, like *SOS1,2 &3* & *HKT1*, results in improved tolerance or hypersensitivity to salt. “In a collaborative study with researchers from the University of Amsterdam, we discovered that an increase in salt tolerance of lettuce could be achieved by introducing genes from a wild lettuce species, namely *L. serriola*, and that the *HKT1* gene from this species was amongst one of them.”

Collaborative research

Although tomato is able to withstand higher levels of salt than many other vegetable crops, it also has its Achilles heel with respect to abiotic stresses. This weak spot is exposure to prolonged periods of high temperatures. Elevating the temperature above 31 degrees Celsius during the day and 25 degrees at night is sufficient to significantly reduce the fruit set of most commercial tomato cultivars. “This is due to a reduction in the number of pollen formed and a decrease in viability of the pollen. An effort to identify tomato cultivars that are more tolerant

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Gert-Jan de Boer



to these higher temperatures, with the help and expertise of researchers from the Radboud University in Nijmegen, resulted in the identification of a number of interesting cultivars and strategies that tomato plants can apparently employ to set fruits and produce seeds under high temperatures. The research on this topic has now reached a phase where the laboratory can be exchanged for field experiments and where, similar to a relay race, the baton can now be picked up by molecular researchers at Enza Zaden to screen for heat tolerant genetics and breed new varieties using this information.”

ROS

One overlapping theme between many abiotic stresses, and even some biotic or pathogen induced stresses, is the accumulation of so-called reactive oxygen species (ROS). ROS causes damage to many plant cell components including the DNA. Some herbicides, such as Paraquat – also known as methylviologen –, function by inducing the formation of ROS species in plants. Since its effect is not restricted to plant cells, and they can also induce ROS in animal cells, the use of paraquat has been banned in the European Union.

When too much ROS is formed, plants can respond by the formation of antioxidants. Perhaps the best known antioxidants are anthocyanins. Anthocyanins are pigments that normally are

formed in flowers or red grapes. These antioxidants are therefore also present in red wine. “Again in an effort to translate research from Arabidopsis towards vegetable species, we participated in a European Union funded project together with researchers from the German University of Potsdam and the Bulgarian University of Plovdiv. For this project, researcher Lorena Romero Prada performed experiments at Enza Zaden as part of her PhD project to investigate the factors that influence the tolerance or susceptibility for ROS in tomato and lettuce. Some of her work can directly be incorporated in new varieties we develop. Varieties that ultimately can withstand extreme weather conditions or other abiotic stresses.”

Varieties of tomorrow

Our planet is changing rapidly and our varieties need to be able to be ready for this. In order to continue developing successful varieties, researchers team up with different universities and institutes to identify the genetics needed to grow the crops of tomorrow. “The success of future varieties will not only depend on characteristics of the variety such as yield, disease resistance and quality of the produce, but also on the flexibility of the plant to be able to grow and thrive under rapidly changing environmental conditions. Through various collaborative projects, researchers within Enza Zaden have been able to identify some of the genetic factors that we will need to breed for the varieties of tomorrow.” ■

Organic keeps growing

Year after year the consumption of organic produced food increases further. The prognosis towards 2024 is a nearly 15% yearly growth of the global organic market. When you visit your local supermarket, you will notice that more and more products are also available with the label organic. In Denmark, organic products made up for even 13% of the overall sales in 2017. It is clear that organic no longer is a niche market, but becomes more mainstream.

Also, we see that many countries have an organic regulation by law. In August this year, president Putin signed a new law on organics for Russia. As organic vegetables have to be produced from organic seeds, we see a rapid increase in sales at an at least similar speed. In 2017, the increase of the organic seed sales was, despite some seed production failures, almost 17%.

Organic seed production a challenge

Without the use of pesticides and chemical fertilizers, organic seed production faces more restrictions than conventional production. For many years, Vitalis Organic Seeds has built up a lot of experience in organic seed production all over the world. In 2019, we will celebrate our 25th anniversary. Ever since the beginning, we are continuously looking for and investing in new seed production locations. Apart from our marketing efforts, we are convinced that Vitalis has also a great competitor advantage being the most reliable organic seed supplier.

Understand what business you are in

Organic production is a completely certified production system regulated by law. At the same time it is a well-established and recognised consumer ‘brand’. So, it is of great importance to be involved in this market and stay ahead of the competition. Be aware of what the regulation in your region looks like. How it is controlled, by whom and how your growers deal with it. Be in contact with what we call the ‘organic world’ to, where needed, influence them or bring the latest information to your regional team.

We are in close connection with partners all over the world to share knowledge and talk about the latest developments in organics. Together with our experience in organic seed production and our knowledge of the organic world, we strongly believe that we can stay ahead of the existing and eventual new competition.

What the future will bring

You never know what the future will bring, but what I am sure of is that organic keeps growing. Also when I’m retired (as of 1 January 2019, red.) For me personally this will be the end of a great and wonderful period managing Vitalis Organic Seeds. But also before that, managing sales for Enza Zaden Benelux. I want to thank you all for your good, warm and even sometimes critical attitude towards organic and wish you all the best.

Believe me ‘Organic keeps growing’. ■

Since 1 January 2012, Henk Haitsma had been Director of Vitalis Organic Seeds in Voorst, the Netherlands. Henk retired on 1 January 2019. Henk is passionate about organic products and thoroughly convinced the organic world will keep growing. Close connection between conventional and organic produce companies is essential for that.