

Climate change, agriculture and the role of biotechnology

GMO-free regions,

Brussels, 17 November 2022

Hotter, drier, CRISPR: editing for climate change

26 February 2021

How CRISPR and other forms of genetic engineering are revolutionizing farming and addressing climate change



Designing crops for a changing climate

Crispr Can Help Solve Our Looming Food Crisis—Here's How

There's not enough land to feed everyone on Earth without ruining the climate, a new IPCC report shows. Gene-edited crops could help reduce agriculture's footprint.

- Agriculture -

How can CRISPR technology improve plant breeding?

COMBATING CLIMATE CHANGE WITH CRISPR?

CRISPR vs. climate change

Five ways CRISPR plants can combat climate change

Jenna Gallegos | Cornell Alliance for Science | January 7, 2020



Loss of crops to drought contributed to a food crisis in Ethiopia in 2008.

AGRICULTURE

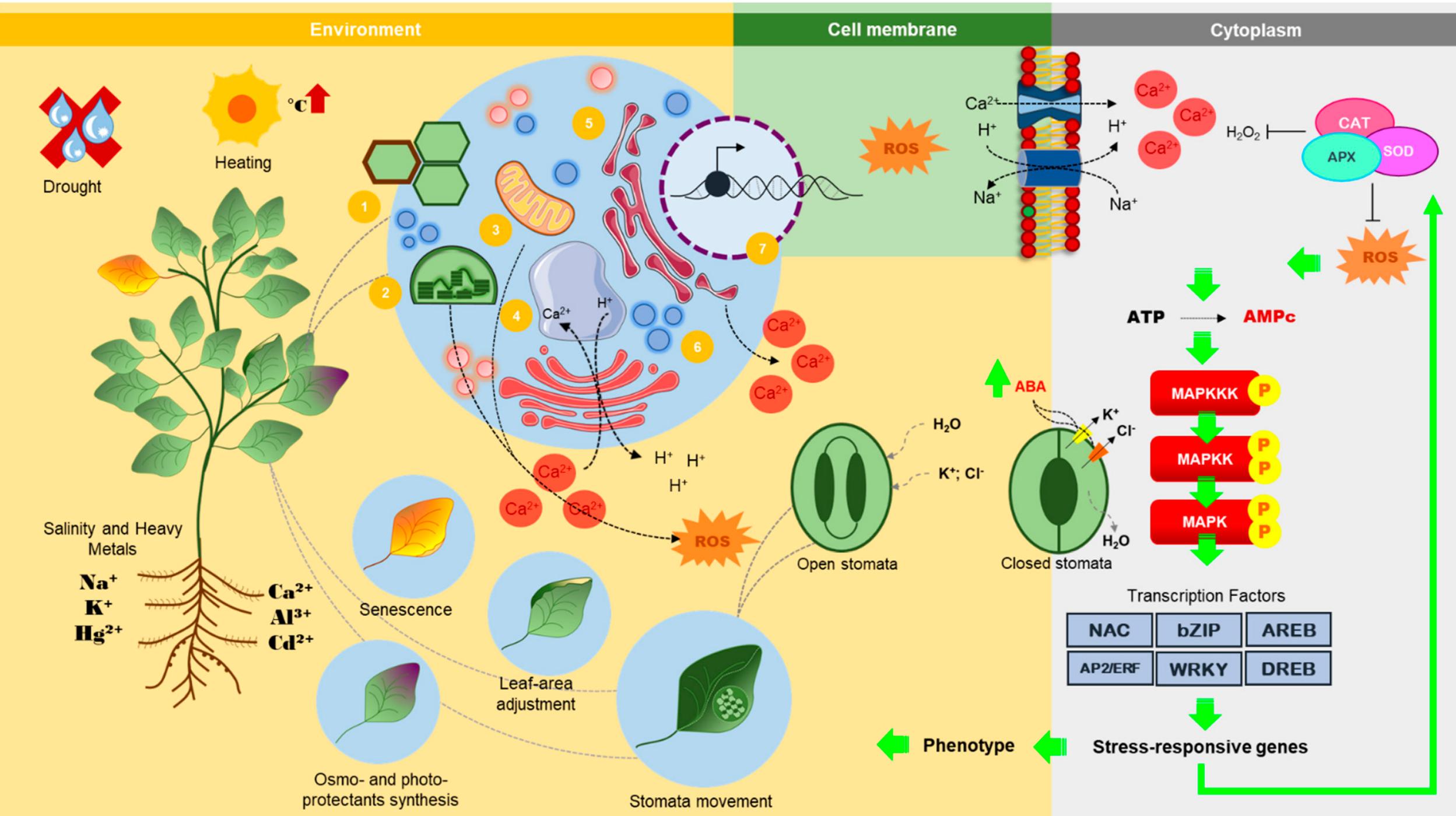
Cross-bred crops get fit faster

Genetic engineering lags behind conventional breeding in efforts to create drought-resistant maize.

Conventional breeding for drought tolerance is quite promising. Effective procedures for this, such as alternate selection under drought stress and optimal field conditions, have been known for a long time.

J.E. Quizenberry. Breeding for Drought Resistance and Plant Water Use Efficiency. In: M. N. Christiansen; Ch. F. Lewis 1982. Breeding Plants for Less Favourable Environments. New York, p. 207 f

However, they are hardly used because the focus remains on maximizing yield, processing quality parameters, disease resistance, and other traits associated with intensive agriculture.



Genome editing methods have so far been used mainly in **basic research** to study the complex interplay of different signalling pathways. For this purpose, mainly small changes are made to the genome, "stress genes" are switched on or off, in order to better understand what role they play in the plant's stress response.

This leads to **individual findings, but not to an understanding of the complexity as a whole.** Furthermore, an intended intervention in the complex interplay of different signalling pathways within the cell with genome editing techniques **can have an impact on many other traits.**

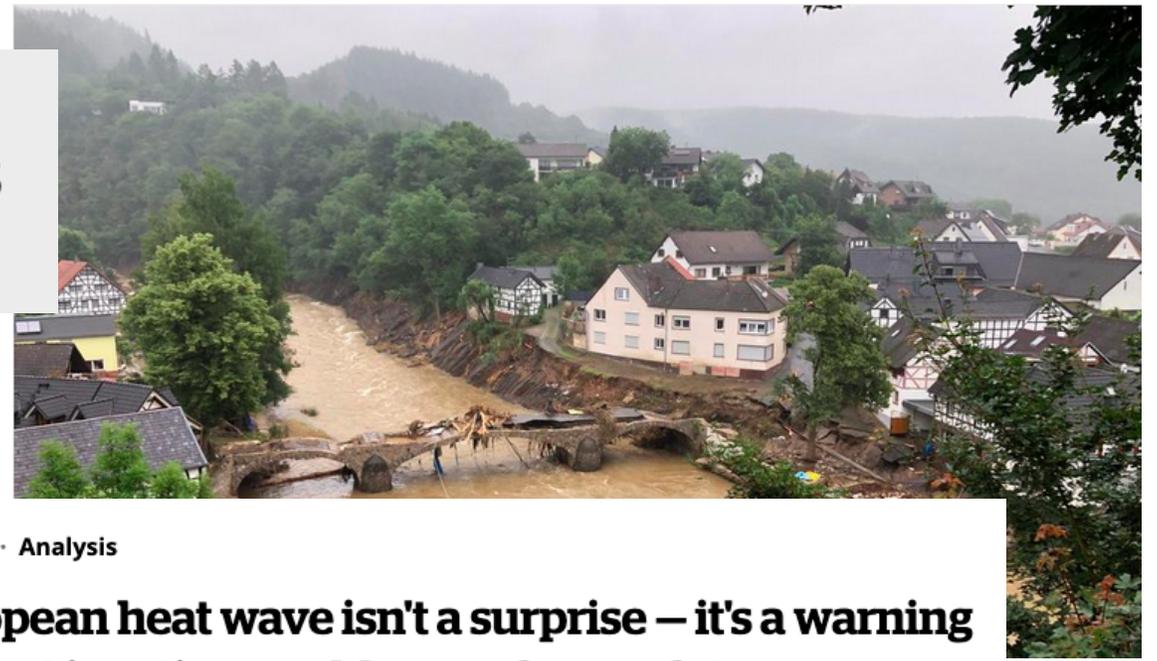




If we want to breed drought-tolerant plants, we must be prepared **to adapt to other types of plants and change our cultivation and food habits.**

It will not work to think that the type of high-yielding variety that dominates agriculture today can simply be equipped with additional drought tolerance.

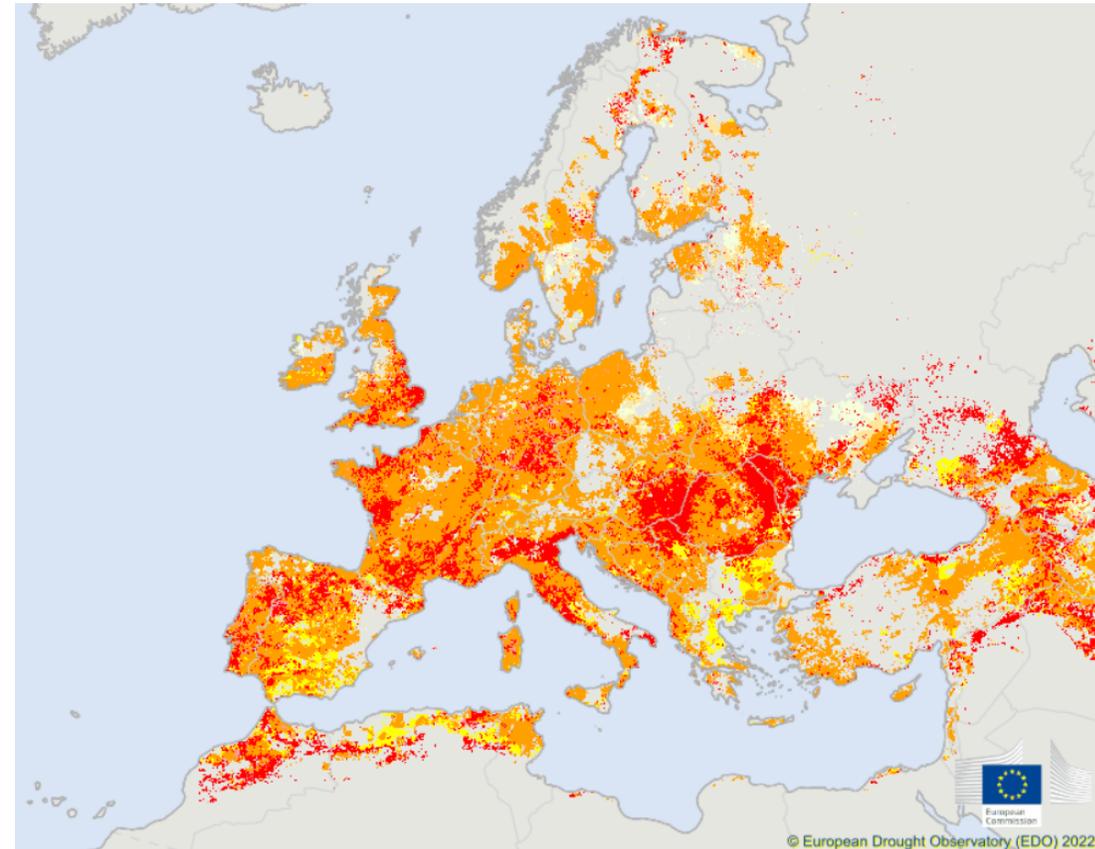
As floods hit western Europe, scientists say climate change hikes heavy rain



Science · Analysis

European heat wave isn't a surprise – it's a warning of what inaction could mean for our future

CBC News · Posted: Jul 19, 2022 4:00 AM ET | Last Updated: July 20



European Drought Monitor 2022

Adaptation of agriculture to global warming can be better achieved with different varieties, so-called **heterogeneous populations** or **intercrop mixtures**, in which different types are used depending on the weather conditions and the type of water shortage.



Summary:

In view of the effects of climate change that can already be observed and the developments that are emerging globally, **there is a great urgency to adapt agriculture in Europe to the rapidly changing conditions.**

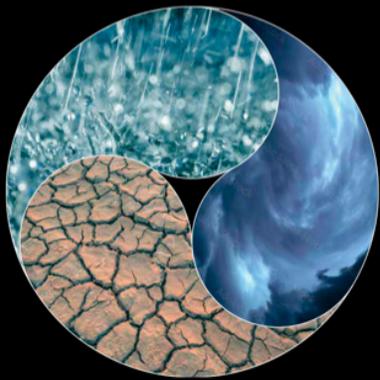
Due to the complexity of "climate-relevant" traits, **it cannot be assumed that the new genetic engineering approaches can contribute to the adaptation of agriculture to global warming.**

It is not to be expected that "climate-adapted" varieties developed using CRISPR/Cas will be available quickly - if at all!



Climate change, agriculture and the role of biotechnology

Report of the Federal
Ethics Committee on Non-Human
Biotechnology (ECNH)



“The clear majority of members are sceptical about the ability of new genetic engineering approaches to make a relevant contribution to the adaptation of agriculture in the required time frame. ... It is the ECNH’s unanimous view that ... **path dependency must be avoided** in both research and practice. **Other research and breeding approaches must be neither neglected nor impeded by investing in only one technological approach.** For precautionary reasons, **they must be organised** in such a way **that multiple paths remain open for agriculture** to fulfil its ethically indispensable tasks, namely ensuring adequate food as well as protecting biodiversity.”