Tran, V.H., A.A. Temme, L.A. Donovan. 2020. Wild and cultivated sunflower (*Helianthus annuus* L.) do not differ in salinity tolerance when taking vigor into account. Agronomy 10: 1013.
DOI:https://doi.org/10.3390/agronomy10071013

As the human population continues to expand rapidly, the food supply from agricultural production strains to keep up with demand. Increasing agricultural productivity in less-than-ideal areas, such as salinized land, could increase food supply. However, doing so would require more salinity tolerant crops. How can salinity tolerance in crops be increased? One potential approach receiving a lot of attention is to incorporate traits associated with stress tolerance from wild populations into cultivated genotypes, based on the long-standing expectation that crops are less stress tolerant than their wild progenitors and relatives. Writing in *Agronomy*, Tran *et al.* provide evidence in sunflower (*Helianthus annuus*) that challenges this expectation. Their findings highlight a trade-off between vigor (performance under optimal conditions) and proportional decline in performance under saline conditions for both cultivated and wild sunflowers. This trade-off needs to be explicitly considered going forward in order to identify wild traits with the greatest potential to enhance performance of cultivated sunflowers under saline conditions without sacrificing performance under optimal conditions.

Stress tolerance is often defined as the decline in performance under stressed conditions relative to non-stressed conditions. However, Tran *et al.* point out that this assessment alone fails to consider that plant vigor (assessed as plant size under non-stressed conditions) is generally greater for crop cultivars than their wild progenitors. Tran *et al.* compared the responses of ten cultivated and ten wild accessions of *H. annuus* to a 0 mM and a 150 mM sodium chloride (NaCl) solution. The authors included two different metrics to evaluate salinity tolerance: the first based on the traditional relativized reduction in performance due to salinity stress, and the second in which vigor is an additional explicit factor in the analyses. The different metrics of salt tolerance yielded different results. Using the more traditional metric of relative reduction in performance, salinity tolerance was found to be greater in wild accessions than in cultivated accessions. However, when variation in vigor was corrected for statistically, wild and cultivated accessions did not differ in tolerance, i.e. across accessions with variation in vigor, wild and cultivated sunflowers did not differ in their in response to saline conditions. In this framework, the most promising traits, or those associated with less of a decline in performance under stress, were INDEPENDENT of plant vigor. Additionally, Tran *et al*. showed that osmotic adjustment, a physiological mechanism expected to contribute to salinity tolerance, was only associated with salinity tolerance in wild accessions when accounting for vigor. This leads to the tantalizing suggestion that wild and cultivated sunflowers may use different mechanisms to combat salinity, and that the mechanistic basis of osmotic adjustment in wild sunflower deserves additional investigation as a trait with the potential to enhance salinity tolerance in cultivated sunflower.

Tran *et al.* does not refute prior support for the expectation that crops are less stress tolerant than their wild relatives when using the metric of proportional decline. Rather, the authors demonstrate that the traditional metric of stress tolerance may be insufficient when trying to mine wild relatives for traits to enhance cultivated stress tolerance. For systems like sunflower, where most wild cultivars are inherently smaller than cultivated sunflowers, and there is a trade-off between vigor (optimal growth) and a growth decline in response to salinity, vigor needs to be explicitly accounted for in order to identify traits that are associated with greater tolerance decoupled from vigor. The authors make a convincing argument that the potential for this tradeoff should be explored in other wild-cultivated comparisons and for other abiotic stresses relevant to agricultural productivity. While the characterization of stress tolerance in wild and cultivated plants has progressed, undoubtedly, the challenges of how to grow more stress tolerant crops will continue to be on the forefront of the quest to feed the world.