Bennett et al. [1] present the phylogenetic distribution of salt-tolerant species on a phylogeny of 2684 grasses in the context of plant breeding for salt-tolerance. Salt-tolerance, they conclude, is an evolutionary labile trait that has evolved a number of times across many lineages; this is at odds with the record of difficulty in breeding salt-tolerant crops.

One potential explanation for this disconnect is the association between soil salinity and alkalinity; many saline soils are also alkaline due to the presence of sodium (Na)-carbonates (see [2] for a review of salt-affected soils). Combined alkaline and salt-stresses are more deleterious to plant growth than salinity alone [3–5]. Thus, the failure of laboratory-bred NaCl-tolerant cultivars to give good yields under field conditions may reflect combined soil sodicity and alkalinity. Indeed, Yang et al. [4] have shown that for even for Chloris virgata, a natural alkali-resistant halophyte, the inhibitory effects of alkali stress (from NaHCO₃ and Na₂CO₃) on relative growth rate and stored energy were significantly larger than those of salt-stress (from NaCl and Na₂SO₄). Other Chloris species are tolerant of alkaline pH (e.g. Chloris gayana [6] and Chloris barbata [7]), and it would be interesting to see whether there is any evolutionary relationship between alkali- and salt-tolerance in Chloris and more widely in the Chloridoideae. Has there been coevolution of alkali- and salt-tolerance in grasses? If yes, this may provide new avenues for plant breeding for salt-tolerance.

Both alkali- and salt-stress impact photosynthetic productivity and metabolism, but they may involve different physiological and molecular processes (8–11 and references therein). However, plant breeding efforts continue to focus on NaCl-tolerance [12]. In Australia, where decades of research on plant breeding for salt-tolerance have been invested, 50% of soils are calcareous [13] and therefore contain significant concentrations of carbonate and bicarbonate ions (alkalinity). Sodic soils occupy about 27% of Australia [14], including large tracts of agricultural land; most have calcareous subsoils. This implies that a wider range of salts and their potential interactions need to be considered if we are to successfully breed salt-tolerant crops that are high-yielding under field conditions. It also suggests that new breakthroughs in food security are likely to arise at the intersection of disciplines (plant and soil sciences).
References

14. Northcote KH, Skene JKM. 1972 Australian soils with saline and sodic properties. Melbourne, Australia: CSIRO.