Letter to Editor by Dr. Park S. Nobel

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Near my 75th birthday Peter Felker persuaded me to pen a few “words of wisdom” relating cacti, particularly Opuntia ficus-indica, to global climate change and future drought, specifically referencing my books.

Already 9,000 years ago, opuntias were consumed by people in what is now Mexico; and O. ficus-indica made it from there to Europe on Columbus’s second voyage in 1494 (Nobel, 1988). Jumping to 1992, harvest data from Chile and Mexico showed that this cactus could produce 50 tons of dry matter per hectare per year (Nobel, 1994, 1998). This exceeds the annual productivity of over 99.9% of all plant species! Plant entrepreneurs in many countries pounced on the high possible productivity of O. ficus-indica for forage and fodder for cattle, sheep, and goats, especially in Chile, Peru, Brazil, and Tunisia; only in Mexico were the cladodes of this cactus used for human consumption on a large scale.

The potentially high productivity of O.ficus-indica is just part of the good news, as it also exhibits Crassulacean Acid Metabolism, or CAM. This photosynthetic pathway is utilized by only about 6% of plant species, nearly all of which are epiphytes and hemi-epiphytes with low productivity. The key feature of CAM plants is opening their stomates, pores in leaves and stems that are necessary for CO_2 uptake, at night when temperatures are lower than during the daytime. Such nocturnal stomatal opening results in 5- to 8-fold more CO_2 uptake per unit of water lost than for the 94% of plant species with daytime stomatal opening (Nobel, 2010, 2011). The water savings accompanying CAM are crucial in regions subject to drought, which are increasing as climate changes.

Sequestering CO_2 from the atmosphere helps lower the atmospheric CO_2 level, whose recent increases are mainly responsible for the temperature increases accompanying global climate change. Continued atmospheric temperature increases are predicted to wreak havoc on the environment as we know it. In this regard, the amount of land required for planting O. ficus-indica to substantially reduce the atmospheric CO_2 level are unrealistically large. And increasing atmospheric CO_2 levels actually benefit O. ficus-indica by leading to more CO_2 uptake (a 1% gain in CO_2 uptake per 10 ppm increase in atmospheric CO_2); increasing temperatures do not threaten it, as O. ficus-indica and many other cacti are extremely tolerant of high

temperatures (all references). Yet utilizing CAM can reduce water consumption and hence irrigation, crucial in regions where water is the most critical environmental resource.

Because of its prolific production of biomass, O. ficus-indica is already important for animal feed and increasingly as a healthy vegetable for people. Also it produces tasty fruits that are commercially produced in over 20 countries worldwide. But its most valuable attribute for its increasing economic impact is its high water-use efficiency. This will temper the ravages of drought and reduce the need for irrigation as its cultivation expands in the future. This is not only crucial in arid and semi-arid regions, both tropical and subtropical, but also is a great benefit in regions where over 70% of current water use is for agriculture.

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