Crop Diversity: Neolithic Foundations for Agriculture’s Future Adaptation to Climate Change

AGRICULTURAL ORIGINS

About 10 000 to 13 000 y ago, something fascinating, odd, and absolutely world-changing began to take place almost simultaneously, yet slowly, in Africa, Asia, the Near East, and Meso-America (1). After 200 000 y on Earth as hunters and gatherers, our Homo sapiens ancestors, 500 generations removed from us, began to make a slow, millennia-long transition to agriculture. Why?

Over the years there have been many explanations. Some have argued that population growth spurred the need to increase food supplies, which in turn pushed people to farm. But, if you are a hunter and gatherer and in need of food, it is not entirely logical that you plant seeds and wait for harvest time. That is a long time to be hungry. The population-food relationship may nevertheless have played a role. As numbers expanded in groups of hunters and gatherers, subgroups may have split off to migrate to new areas in search of food. On the margins of the natural ranges of the plants they knew and used, they may have found it useful to encourage the growth of such plants, to protect them, to harvest and even to take that last and all-important step of planting the seed they harvested in order to increase the stand.

Such care may have begun with plants whose value was particularly high, for medicinal or other purposes, for instance, as opposed to food. There may have been religious or ritualistic motivations.

Indeed, with the shift to agriculture beginning in so many corners of the world and involving so many plants, it seems possible, even likely, that multiple motivations and causal factors were involved in the shift.

Climate change may also have played a role. As the Ice Age came to an end 15 000 y ago, food became more abundant and human populations rose. The onset of a period of global cooling, the Younger Dryas, may have reduced food supplies precisely when populations were concentrated above carrying capacity, thus catalyzing agricultural efforts (2).

Thus, climate may have played a role in the domestication of crops and initiation of agriculture. As told thus far, this history focuses on the effect of external factors such as climate change and population growth on humans and their motivations. There is another way to look at the story, and that is from the plants’ perspective.

It is well understood and accepted that crops were domesticated in particular areas of the world, in what are now termed their centers of origin, (3) or centers of diversity. Potatoes were domesticated in the Andes; maize in modern day Mexico; rice along the marshy banks of the Yangtze River; sorghum in a Sahelian band across Africa; and wheat in the Near East.

It is in these regions that crops, once wild, now domesticated, have had their long history of interaction with environments, pests and diseases, and humans. In a very real sense, they coevolved with people. Here, one also finds—or found—the greatest amount of genetic diversity in the various crops, a reflection and result of the history. Cut open a potato in the Andes, and you may find the flesh to be white. But, it might also...