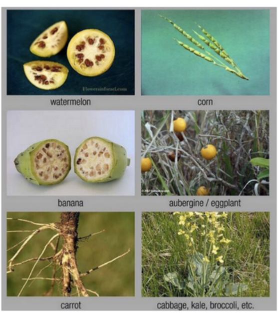
GENETIC ENGINEERING WITHOUT GMOS

Posted on November 29, 2015

The debate over GMO food safety still rages, with new transgenic plant and animal varieties being announced left and right. One of the greatest concerns from GMO protesters in scientific and non-scientific communities is consumers' increasing exposure to herbicides and pesticides, as GMO crops are usually bred for resistance to the weed- and pest-killing chemicals sprayed in increasing amounts on farmers' fields. But the transgenic techniques employed to create GMOs are not the only means we have of genetically engineering new food varieties.

In prehistoric times, most wild plants looked almost nothing like their modern, domesticated counterparts. When ancient humans stopped foraging for all of their produce and began farming it themselves, they selected plants with desirable traits, such as higher yields, and bred those plants with one another. Eventually, humans bred crops so thoroughly that they evolved into the domesticated versions we enjoy today. These plant breeding techniques were humanity's most basic form of genetic engineering.



Wild crops and their domestic counterparts.

ACCELERATING NATURAL SELECTION

As human knowledge advanced and the global population increased, twentieth-century scientists invented new ways to genetically engineer the world's crops. One lesser-known technique developed in the mid-twentieth century is mutagenesis. Seeking peaceful uses for atomic technology following World War II, scientists created laboratories all over the world in which they bombarded plants and seeds with radiation. Their hope was to produce plant mutations at a far faster rate than natural selection, thereby combatting plant diseases or pest infestations that harmed the global food supply.

The Institute of Radiation Breeding. Crops are arranged in a circle around a retractable rod of radioactive material, in order to produce useful mutations.

Most of the irradiated seeds and plants produce nothing useful, but every so often a new plant grows with larger fruit, greater disease resistance, tolerance for more extreme environments, or another preferred trait. These desirable strains are further developed and marketed as novel variants of already-known species, or to farmers whose crops are in danger of eradication by diseases or pests. Other varieties are designed for poor subsistence farmers to grow in harsh, marginal climates, enabling them to feed their families and sell their surplus crops, attaining a new standard of living.

Many foods we enjoy today have mutagenic origins, including varieties of grapefruit, wheat, barley, rice, cassava, tomatoes, bananas, sesame, peanuts, peas, cotton, sunflowers, sorghum, pears, pineapples, apples, and flax, among others. A good number of these plants can be grown organically, and are marketed as such. None of them are labelled "GMO," as GMO generally refers to plants containing genes from other non-related species, inserted by scientists with the help of viruses.

GENETIC ENGINEERING VS. GMO

Unlike GMO techniques, genetic engineering bears more similarity to ancient breeding techniques and modern mutagenesis; plants are modified through an accelerated form of natural selection, without inputs from unrelated plant or animal species. With genetic engineering, scientists turn to DNA sequencing to more rapidly identify desirable traits in a plant species, and then crossbreed those plants. This technique removes much of the trial and error of ancient breeding techniques, and enables DNA manipulation in finer detail than the mutagenic process of bombarding the entire seed or plant with radiation. It also shortens the development timeline of new plant breeds by at least a few years, at a lower price than traditional crossbreeding in the field.

To deal with climate change, groups such as The Land Institute are using genetic engineering to speed up the development of hardy perennial crops to feed the world and repair some of the environmental harms done by modern farming.

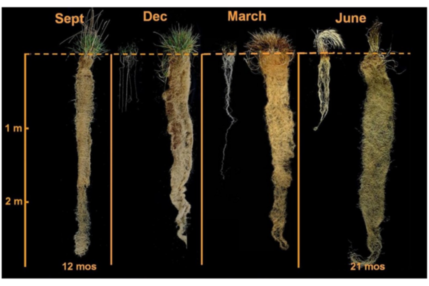
THE NEXT EVOLUTION OF WHEAT

A staple crop for 35% of the world's population, wheat cultivation is in danger from drought stress as global weather patterns shift. As an alternative, The Land Institute is developing an existing intermediate wheatgrass into a commercial crop called Kernza.

Kernza is a perennial grass that could one day outperform wheat, both environmentally and economically. Photographed by Scott Takushi of Pioneer Press, 2015.

This distant relative of wheat is perennial rather than annual, enabling farmers to harvest the same plant year after year without replanting. By avoiding annual replanting, farmers can save money on labor and equipment, and the soil won't need tilling, which preserves and enriches it for plants. Due to its wild origins, Kernza is also quite robust against pests and pathogens, which enables many test plots around the world to be grown organically.

Kernza plants are further enriched by the added time they're given to root deeply into the ground, where they can absorb more water and nutrients. This reduces their fertilizer requirements and improves their drought-tolerance, minimizing water usage in an increasingly water-stressed world. Kernza also absorbs CO_2 from the atmosphere, which helps to *slow* climate change rather than simply adapt to climate change's effects.



Four Season of Roots: Wheat vs. Kernza. The Kernza plant is perennial, giving it many seasons to send roots deeper underground for better water and nutrient absorption. Image created by Lee R. DeHaan.

After more than a decade of development, food retailers, bakers, and distillers are developing new recipes for Kernza, with positive customer feedback.

Newer, hardier, climate-change-adapted crops like Kernza still have years to go before reaching competitive levels of large-scale production. But with the help of genetic engineering, humanity can continue to develop innovative new food crops more naturally–and often faster–than GMOs.

Categories: Uncategorized

Tags: evolution, genetic engineering, GMO, mutagenesis

No Comments Share:

LEAVE A REPLY

Logged in as Fran Levy. Log out?

Comment

POST COMMENT

111 10th Ave. S., Suite 110 Nashville TN, 37203