VANDANA SHIVA ON SEED SOVEREIGNTY • ALGAE AGRICULTURE

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Growing, Breeding & Sharing Food Crop Varieties

by CAROL DEPPE

CAROL DEPPE / FERTILE VALLEY SEEDS

'Cascade Ruby-Gold' flint corn. Each color lends a different flavor to corn bread.

Humans have been growing food crops for more than 10,000 years. For nearly all those years, once we got our hands on a seed, it was fully ours. We could grow it and eat, share, trade or sell the crop. We could save seed from the crop and replant, share, trade, or sell it. Best of all, we could use the seed to breed new varieties of our own – varieties better adapted to our land, our climate and our tastes, needs and purposes. These rights comprised a commons of "seed sovereignty."

Today, farmers planting a genetically modified corn or soybean variety are denied all these rights but one. Their money buys them only the right to plant the crop for one year and for use as a food crop only. They cannot save seed for replanting. They cannot share, trade, or sell saved seed. Nor can they use the seed to breed anything new. And there is no research exclusion in the patent laws for such crops. Independent researchers cannot trial such crops, test their environmental impact, or even test their safety for human consumption without permission of the patent holder, a permission which is commonly denied.

Even gardeners today are increasingly faced with seeds we cannot fully own, seeds in which dependence upon the multinational mega-corporations who bred them has been built into the very biology of the varieties. Many of our garden vegetable varieties are hybrids, first generation crosses between disparate inbred parents. Hybrids do not breed true. Most hybrid vegetables are not better than the best equivalent non-hybrid varieties. They are more profitable for seed companies to carry, however, because they make the buyer absolutely dependent upon the company for new seed each year.

Food crop varieties are bred to fit certain agricultural patterns. The varieties and patterns go together and reinforce each other. Nearly all of the corn and soybean seed today is of ge-

OSSI-Pledged seeds

It all starts with the Open Source Seed Initiative and the Pledge. You will see the Pledge in the catalogs and on the websites of 23 seed companies this year. It reads: *You have the freedom to use these OSSI-Pledged seeds in any way you choose. In return, you pledge not to restrict others' use of these seeds or their derivatives by patents or other means, and to include this Pledge with any transfer of these seeds or their derivatives.*

The varieties designated as "OSSI" or carrying the OSSI logo in their catalog descriptions were pledged to the Open Source Seed Initiative by their breeders. These breeders indicated their intention that freedom to plant, save and exchange seed of those varieties and all their derivatives be bequeathed forever to all humankind.

netically modified varieties controlled by the multinational chemical companies that manufacture herbicides, for example. The main characteristic those companies breed into their varieties is resistance to their herbicides. Herbicide-resistant varieties facilitate and reinforce the agricnltnral pattern of factory farms growing huge monocultures managed by massive doses of often-toxic chemicals.

Food crop varieties are also bred to fit certain assumptions and patterns with respect to the overall food system. Corn bred by the mega-genegiant corporations, for example, are primarily dent corns bred for maximum yield for use as animal feed, or to feed the maws of factories that convert it into expensive processed food. The varieties don't taste especially good unless they are loaded with salt, sugar and/or fat. If you want corn that tastes great when simply ground and cooked using simple, healthful recipes, you usnally have to grow it yourself. To lose control over the food crop germplasm is to lose control over the entire food system.

When we buy crop varieties bred by others, we propagate their values along with their varieties. Embedded in many modern varieties are the values that farmers, gardeners and consumers should be completely dependent upon multinational chemical companies for the seed needed to grow food; that it is okay for a single company to control nearly all the seed for an important food crop, that mega-farms growing monocultures maintained by massive doses of herbicides are best; that crops should be converted into highly processed foods or animal feed rather than eaten more directly, and simply that flavor, nutritional value, pollution, biodiversity and sustainability don't matter. We are rapidly losing the ability to exercise any control whatsoever over the kinds of foods we have available and our options with respect to agricultural patterns because we are losing control of the breeding and ownership of our seed.

KAREN MORTON / WILD GARDEN SEED

Frank Morton's 'Stocky Red Roaster' pepper has fruit up to 7 inches long.

THE SEED SOVEREIGNTY COMMONS

Many gardeners and farmers have been fighting back and trying to retain our ancient rights to seed sovereignty. We promote and use only public domaiu varieties, that is, varieties that are non-hybrid, non-GM, nonpatented and non-PVP (plant variety protected). We participate in seed savers exchanges. We start and run dozens of small seed companies that exclusively sell the varieties that farmers and gardeners can still fully own. Some of us have become renegade freelance plant breeders – even those of us with Ph.D.s in plaut breeding or biology operating largely unsnpported and outside institutions – and we have been breeding and releasing new public domain varieties. I even wrote a book, *Breed Your Own Vegetable Varieties*, specifically to encourage and enable plant breeding by gardeners and farmers without formal training. There is now a whole movement of farmers and gardeners creating new public domain varieties. However, using the pnblic domain seed approach is fighting a defensive and rear-guard action. The multinational Gene Giants can plunder our varieties. Whatever we create they have full access to. Whatever they create they lock up in proprietary varieties. It is a losing battle.

The Open Source Seed Initiative was founded in 2012 by a small group of plant breeders, seed companies, farmers and sustainability advocates. Like the open source software concept upon which it is based, OSSI aims to create a protected commons, one that spreads virally and is open only to those who will share.

HOW IT WORKS

It starts with the OSSI variety contributors – the plant breeders – farmer-breeders, gardener-breeders, seed company breeders and nniversity and public sector breeders who believe in public control of food crop seed. They create the new varieties and pledge them to OSSI. Henceforth, they al-

ways transfer seed of the varieties accompanied by the Pledge. Those who accept the pledged seed agree to put no patents or other restrictions on it or its derivatives, and to in turn transfer the seed or its derivatives only accompanied by the Pledge. The Pledge thus spreads virally.

Any seed company that carries one or more OSSI-Pledged varieties can apply to be an OSSI Partner Seed Company. OSSI seed partners identify the OSSI-Pledged status of their varieties in their variety descriptions, acknowledge the breeders of the varieties, and inclnde the information abont OSSI and the Pledge in their catalogs and on their websites.

OSSI spreads the word on the importance of public ownership of food crop varieties, maintains a website with pages featuring OSSI variety contributors and seed partners, and provides a complete list of all OSSI-Pledged varieties with descriptions and photos. Each variety description inclndes links to every seed partner that carries the variety. OSSI is designed to attract traffic to its list of OSSI-Pledged varieties and channel that traffic directly to its cooperating seed company partners.

Does the OSSI Pledge have any formal legal standing? Possibly. Possibly not. Does OSSI create an ethical position and a platform for drawing attention to the issue of control of food crop seeds? Definitely! Does it serve as a rallying point for those who want to breed and buy food crop varieties bred for what farmers, gardeners and consumers actually need? Definitely! Does OSSI spread the word about varieties that enhance the independence and resilience of farmers and gardeners instead of destroying it? Yes! Does OSSI create an alternative to a seed system that is controlled almost eutirely by a few big corporations whose values differ profoundly from our own? Definitely yes!

GET INVOLVED

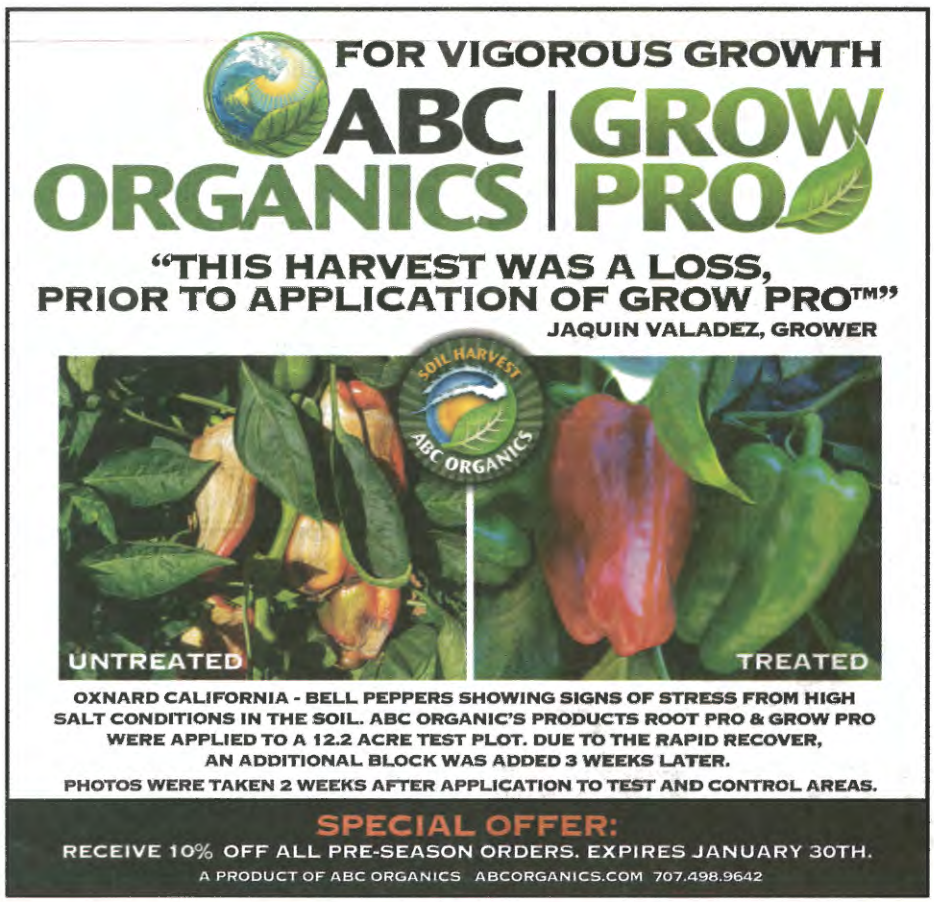
To get involved, first check out the OSSI website and sign up for the *Free the Seed* newsletter. Look at the descriptions and photos of OSSI-Pledged varieties, and follow the links to the seed companies that sell the varieties to buy and grow OSSI-Pledged varieties. Put the OSSI logo and variety name on prodnce of OSSI-Pledged varieties at yonr farmers' market stand. Feel free to share OSSI-Pledged seed with yonr friends and neighbors, and always pass the Pledge along with the seed. (A flier with information about OSSI and the pledge can be downloaded from the "Get Involved" page on the OSSI website to use to accompany transfers of OSSI-Pledged seed. Or you can make np your own flier with the Pledge.)

Have you bred any new varieties that yon would like to share? Go to the "Get Involved" page on the OSSI website to find the forms and instructions for pledging varieties. (Email a member of the Board of Directors if you have any qnestions.)

If you haven't bred any new varieties, why not get started? New varieties can contribute a whole different dimension to your repertoire as a farmer or gardener. They can also contribute to your bottom line – and breeding new varieties is ontrageons amounts of fun. The following are examples of how some OSSI-associated plant breeders created OSSI-Pledged varieties.

KAREN MORTON / WILD GARDEN SEED

'Red Ursa' kale was created by crossing varieties.



BREEDING NEW VARIETIES BY JUST NOTICING THINGS

'Fast Lady Northern Southern' pea

The most important and most basic plant breeding method is to just notice unnsual things that turn up, save the seeds separately from the rest and plant them out separately. I developed my corn and squash varieties on purpose, but most of my new bean varieties just sort of happened.

'Fast Lady Northern Southern Pea,' for example, came about from trying to grow a crop of 'Lady' peas. These are a Southern pea, a cowpea, *Phaseolus unguiculata.* Cowpeas normally require more heat than we have in maritime Oregon, so they mature too late to make a crop before the rainy season. 'Lady' pea is earlier than most cowpeas, but when I tried it, only one plant of a few hundred dried down before the rainy season. That plant was a good three weeks earlier as well as more determinate than the rest. I did the obvious. I saved the seed of the one plant and tilled under the rest. Then I just planted and increased the seed for a few years, always saving seed from the earlier plants for planting and eating the rest. In due course I released the new variety as 'Fast Lady Northern Southern' pea. It is Northern, short-season and cool-weather adapted. It retains its full Southern adaption too, however.

'Fast Lady Northern Southern' pea has a mild sweetish flavor and a fine-grained texture. Like other cowpeas, it is less affected by rain in the dry-down stage than common beans, is unpalatable to cucumber beetles and don't need soaking before cooking. And it tastes great with just a little salt, pepper and butter. Growing many different species of beans reduces isolation issues as well as enhances the resilience of my bean supply.

DEHYBRIDIZING A HYBRID

'Stocky Red Roaster' pepper

Acclaimed lettuce and greens breeder Frank Morton, of Wild Garden Seed, got his start in breeding peppers from a question asked by Jolene Jebbia of Gathering Together Farm. Jebbia had been growing a hybrid red Italian pepper for market, but suddenly the seed company stopped offering untreated seed. So she asked Morton: "Can you make an open-pollinated variety out of a hybrid?" Morton decided to try. He planted the remaining 30 untreated seeds, and saved their seed, that is, the F_2 seed.

Plants of the F_2 generation had peppers of all sizes and shapes. There were Italian types, short bells, long bells and heart-shapes. Some plants had peppers bigger and longer than the original hybrid. Most plants had red fruit; some had yellow or orange. Some had rough-skinned peppers and some smooth-skinned ones. The peppers had different thicknesses of flesh and different flavors. Morton saved seed separately from each pepper plant he particularly liked and planted it in a separate row the next year.

Sweet peppers (but not hot peppers) tend to be highly inbreeding, Morton says, so that facilitated the project. He didn't need to give his different pepper lines much isolation from each other as he bred them – just the modest amount provided by growing blocks of other crops in be-

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'Candystick Dessert Delicata' is bigger than other delicatas, has thicker flesh, is more productive and tastes like a Medjool date.

tween different pepper lines. When a given line became stable and uniform enough, he introduced it as a new variety. The result, to date, is nine new stable open-pollinated sweet pepper varieties of various colors, shapes, flavors and sizes, all now OSSI-Pledged varieties.

'Stocky Red Roaster,' in particular, is winning a devoted following. What Morton wanted from the line that became 'Stocky Red Roaster' was the ideal red roasting pepper. It needed to have a smooth skin and a rounded shape at the stem end so that the entire pepper would sear quickly and uniformly, and the charred skin would be easy to remove. (In addition, peppers that are concave around the stem tend to catch water and rot.) 'Stocky Red Roaster' has fruits up to 7 inches long and 2¼ inches wide at the crown. It has thick flesh and excellent flavor.

BREEDING NEW VARIETIES BY STARTING WITH A CROSS

'Red Ursa' kale

Morton bred 'Red Ursa' kale by starting with a cross. It was during his "salad days," the era in which he earned his living by growing and selling mixtnres of whole-cut baby leaves of many varieties and species to restaurants. He especially liked plants that produced lots of leaves that could be harvested at the 3- to 6-inch size. In addition, he preferred leaves with frills and loft. Flat leaves provide no bulk to a salad and don't hold dressing very well.

'Siberian' kale has whole green leaves with ruffled edges. 'Red Russian' has highly dissected flat leaves but a beautiful red color. Morton wanted a variety with the whole leaves with ruffles of the 'Siberian' but the red color of the 'Red Russian.' Whenever you want a combination of the characteristics of two different varieties you combine the varieties. That is, you do a cross. Morton planted the kales in adjacent patches. These *Brassica napus* kales are largely inbreeding. On organic land with its abundant pollinators, he never needed to hand-pollinate to get crosses. He just needed to be able to recognize the hybrid seedlings in the next generation.

When you breed from crosses it is important to hold off selecting until the second generation after the cross. The hybrid itself, the first generation, may or may not express any of the characteristics you want; it depends upon which genes are dominant. But all the genes you want are in there, even if they are hidden in the hybrid.

OSSI Partner Seed Companies:

- Adaptive Seeds (Sweet Home, OR)
- Backyard Beans & Grains Project (Everson, WA)
- Bountiful Gardens (Willits, CA)
- Brown Envelope Seeds (West Cork, United Kingdom)
- Cultivariable (Moclips, WA)
- Dwarf Tomato Project (Bemboka, New South Wales, Australia)
- Family Farmers Seed Cooperative (Williams, OR)
- Fertile Valley Seeds (Corvallis, OR)
- Fedco Seeds (Waterville, ME)
- Fruition Seeds (Canandaigua, NY)
- High Mowing Organic Seeds (Wolcott, VT)
- Joseph Lofthouse (Paradise, UT)
- Lupine Knoll Farm (Grants Pass, OR)
- Nichols Garden Nursery (Albany, OR)
- Oikos Tree Crops (Kalamazoo, MI)
- Restoration Seeds (Ashland, OR)
- Siskiyou Seeds (Williams, OR)
- Sand Hill Preservation Center (Calamus, IA)
- Southern Exposure Seed Exchange (Mineral, VA)
- The Guild of Oca Breeders (Cornwall, UK)
- The Sample Seed Shop (Tonawanda, NY)
- The Victory Seed Company (Molalla, OR)
- Uprising Seeds (Bellingham, WA)
- Wild Garden Seed (Philomath, OR)

So save seed from the hybrid, whatever it looks like. In the second generation after the cross you will start seeing different traits recombining to give you many different possibilities. That's when you start selecting your favorites.

Each year Morton planted seed from the plants that gave him the best yields of the best-flavored baby leaves of the colors and characteristics he wanted. That initial cross resulted in a number of different stable open-pollinated varieties, among them 'Red Ursa,' the kale he wanted when he made the cross. 'Red Ursa' has the beautiful red color of the 'Red Russian' parent and the whole leaves with frilly edges of the 'Siberian' parent. It excels both at producing many small leaves with superb flavor and as a general purpose kale.

'Cascade Ruby-Gold' and 'Cascade Creamcap' flint corns

I love true flint corns because they make spectacularly delicious polenta as well as great corn bread. My two flint corns, 'Cascade Ruby-Gold' and 'Cascade Creamcap' also started from a cross. I simply planted alternate rows of 'Roy's Calais' flint and 'Byron' flint. I was unable to grow 'Roy's Calais' very well because its poor husk coverage invited birds to ruin the ears and allowed entry to aphids that coated the kernels with aphids and aphid goo. I also didn't like the fact that the yellow ears were pale yellow and the interior color was also pale yellow, but I loved the flavor, ear size and productivity of 'Roy's Calais.' The fact that 'Roy's Calais' had a little white contaminatiou in it only opened additional possibilities. 'Byron' flint was not

CAROL DEPPE / FERTILE VALLEY SEEDS

'Fast Lady Northern Southern' pea has a mild, sweetish flavor and a fine-grained texture.

so productive and not quite so early, but it had great husk coverage and rich yellow-orange ears with deep orange interior kernel color. I interplanted the varieties and let the genes mix together at will. The result, after a few years of selecting in two directions, was two varieties – 'Cascade Ruby-Gold' and 'Cascade Creamcap.' Both are very early and very productive. (For recipes for these corns see *The Resilient Gardener.*)

'Candystick Dessert Delicata' winter squash

'Candystick' also started from a cross. I wanted a bigger delicata with thicker flesh. I tried several crosses among various delicata varieties and settled on going further with the cross between 'Sugar Loaf-Hessel' and 'Honeyboat.' I hand-pollinated to make the cross, saved seeds and grew the hybrids, raised the F2 plants and then selected the best fruits in the patch each year thereafter for seed. Within about 6 years I had 'Candystick,' which has fruits up to 3 pounds in size and flesh up to about an inch thick. The two factors together mean that the average 'Candystick' fruit has about 4 or more times as much food per fruit than the average fruit of other delicata lines, including either parent variety. Interestingly, 'Candystick' tastes more like a Medjool date than a squash. How that happened I have no idea.

CREATING MODERN LANDRACES

'Lofthouse Landrace Moschata' winter squash

Joseph Lofthouse farms in the Cache Valley, a high altitude site in the Utah mountains. The growing season is short; summers are hot and winds are arid. When Lofthouse first started farming he was unable to grow any winter squash to full maturity. He takes a landrace approach to most of his breeding projects. With the moschata project, for example, he obtained dozens of different varieties from different sources and planted them together. There were butternuts of all sizes and various colors as well as pumpkin and other shapes. He sometimes sends varieties to friends in longer-season areas to make crosses for him and send back the seed. He planted it all together and let everything cross-pollinate promiscuously. Initially, he saved seed of

RESOURCES

Deppe, Carol. **Breed Your Own Vegetable Varieties: The Gardener's and Farmer's Guide to Plant Breeding and Seed Saving** 2nd ed. Chelsea Green, 2000.

Deppe, Carol. **The Resilient Gardener: Food Production and Self-Reliance in Uncertain Times**, Chelsea Green, 2010. (Includes breeding, use and recipes for a number of corn, bean and squash varieties.)

Deppe, Carol. **The Tao of Vegetable Gardening: Cultivating Tomatoes, Greens, Peas, Beans, Squash, Joy, and Serenity**, Chelsea Green 2015. (Includes sections on breeding for organic systems, rejuvenating heirloom varieties, dehybridizing hybrids, and tomato genetics and breeding.)

Joseph Lofthouse's blog "Landrace Gardening:" *motherearthnews.com/search.aspx?tags=+Lofthouse*

Kloppenburg, Jack. **First the Seed: The Political Economy of Plant Biotechnology**, 1492-2000, 2nd ed., University of Wisconsin Press, 2005. (The classic on the history of control of seed in the U.S., by Jack Kloppenburg, Professor Emeritus of Rural Sociology, University of Wisconsin, Madison. Kloppenburg is one of the founders of OSSI.)

every fruit that managed to ripen seed at all. As years of selection went by, he was able to get fussier. He selected for orauge flesh rather than yellow, for good flavor and for mostly butternut shapes, though with about 10 percent other shapes. He deliberately retained all the different colors of young fruit. The idea is to create a highly heterogeneous population that is very vigorous and maximally resilient. He now has landrace moschatas that ripen reliably in his area.

Maritime Oregon summer conditions are not very similar to a desert mountain in Utah. However, we have so little summer heat, we can reliably ripen only the smaller earlier butternuts. Even 'Waltham' is not reliable for us. I wanted big butternuts, so I decided to give Lofthouse's landrace a try. I planted his "medium" line. It yielded squash ranging from about 5 to 30 pounds. They were earlier than even my *C. pepo* squash varieties, and they were amazingly productive. Even the plant that produced the 30-pound fruits – nine of them – ripened every one. The flesh of most is not as fine-grained or sweet as commercial types. However, that bothered me not at all. I ate them mostly in soups and stews, where the texture worked fine, and too much sweetness is actually a liability. The flavor was excellent. I ate about 200 pounds of them, using them as one of my main staples that year.

Lofthouse, who writes a blog on landrace gardening for *Mother Earth News*, has developed early, vigorous landrace lines of melons, cucumbers, *C. maxima* squash, sunroots and even okra, and has OSSI-Pledged them along with a number of tomato varieties. He sells his produce in his local farmers' market. People buy it happily. They don't mind that it is very variable, when it produces fresh local vegetables where nothing else can.

NEED MORE INFORMATION?
For more on the Open Source Seed Initiative, for a list of all OSSI-Pledged varieties with complete descriptions, photos and links to the OSSI partner seed companies that carry them and to sign up to receive the (free) OSSI newsletter *Free the Seed*, visit *osseeds.org*.

Oregon plant breeder and seed company owner Carol Deppe focuses on breeding open source crops for organic systems and human survival for the next 1,000 years. She is a member of the OSSI Board of Directors and is author of *Breed Your Own Vegetable Varieties: The Gardener's and Farmer's Guide to Plant Breeding and Seed Saving; The Resilient Gardener: Food Production and Self-Reliance in Uncertain Times;* and *The Tao of Vegetable Gardening: Cultivating Tomatoes, Greens, Peas, Beans, Squash, Joy, and Serenity*. For books, articles and seeds visit *caroldeppe.com*.

The knowledge shared at this year's conference was nothing short of astounding.