

**Potatoes, Plums, and Prickly Pears:
Luther Burbank and the Search for Game-Changing Plants**

Introductory Note

What follows is adapted from my book, The Garden of Invention: Luther Burbank and the Business of Breeding Plants (Penguin Press, 2009), and from a subsequent essay, “Luther Burbank’s Spineless Cactus: Boom Times in the California Desert” (*California History*, v. 87, n. 4, 2010). When I wrote The Garden of Invention, I wanted to interest general readers in a time in the fairly recent past when both growers and consumers welcomed new crops and recognized them as a vital part of national policy—a stark contrast to today’s common assumption of conflict between farmer and distributor, individual and government, and *natural* and *artificial*. Although I wrote about the late 19th and early 20th centuries, a period of intense globalization in the plant and seed trade, my primary focus was on the United States, where industrial, political, and geographic expansion fostered uniquely rapid changes in agriculture.

My challenge, as a writer, was to re-integrate the history of agriculture with more familiar histories of westward expansion, the rise of national markets, and the impact of Darwin and Mendel on scientific research--and do it for readers who know hardly anything about where items in their market basket come from or how they evolved. My solution was to write about Luther Burbank, a fascinating self-taught plant ‘evoluter’ (his own term) who lived from 1849-1926 and introduced over 800 new plant varieties—fruits, vegetables, flowers, nuts, grains, and even edible cacti, over the course of his career. Burbank was not at all a typical inventor, but neither were Thomas Edison or

Henry Ford, to cite two famous contemporaries and admirers who recognized Burbank as their equal in creating products and production techniques that transformed the world in which they lived.

Along with sections providing context for Burbank's career and a brief concluding section on his legal legacy, the pages below focus on three of Burbank's many plant introductions: potatoes, plums, and prickly pear cacti. I chose these three very different crops because both their origins and their marketing illustrate the increasingly complicated history of Burbank's creations, and because each was hailed, at least for a time, as the force behind a large new sector of agricultural production.

1. Into the Garden

A century ago, Luther Burbank was the most famous gardener on the planet: consulted by scientists, supported by millionaires, envied by rival commercial breeders, idolized by little children, lauded and parodied by journalists around the world. During his life, a steady stream of researchers, educators, spiritual seekers, writers, artists, tourists, and opportunists made pilgrimages to his home and garden in Santa Rosa, California, and his experimental grounds in nearby Sebastopol. After death, his name was honored in parks, schools, and nature preserves, his image preserved in everything from postcards and souvenir spoons to cathedral windows and portraits by both Frida Kahlo and Diego Rivera (neither of whom had known him in life). Burbank's posthumous reputation reached from commercial catalogs to school textbooks and on to

the United States Congress, where intellectual property protection was first granted to living organisms at least partly in his honor.

There are not that many agricultural celebrities. Today, people debate whether it is miraculous or tragic that breeders can use genetic engineering to alter crops, but nobody disputes the obvious fact that it can be done. When Luther Burbank was born in 1849, it wasn't obvious at all, either that it could be done or how to do it. When he began his career, the mechanics of plant reproduction were still much more mysterious than the breeding of animals. In the decades between the American Civil War and the Great Depression--after Darwin had drawn attention to the idea of change as a natural process in the organic world, during a time when the new field of genetics was just being discovered, and before contemporary advances in biology on the molecular level-- the creation of new plants was a wide-open frontier full of exciting possibilities. During those years, Luther Burbank was one of the people transforming the raw materials of modern farm and garden. Many others were involved in the same enterprise, of course, but few ever approached his level of fame. In the era when agriculture was becoming a science and science was becoming a business, Luther Burbank was the human face of the modern farm and garden.

2. Nature in an Age of Industry

When the United States was a very young country and the introduction of new seeds and plants was a central object of national policy, agricultural development was supervised by the Department of State, which was also responsible for patents. In 1827,

President John Quincy Adams formalized a long-standing policy when he instructed naval and consular officers to collect potentially useful foreign plants or seeds and send them to Washington. A decade later, the Patent Office, newly separated from the State Department and now in charge of agriculture, was preparing to move into a grandly neo-classical building just beginning to rise out of the capitol city's prevailing mud. Henry Leavitt Ellsworth, the first Commissioner of Patents, saw the expansion of his office as an opportunity to do something with all those seeds. As a Yale graduate and son of George Washington's chief justice, Ellsworth knew the Patent Office existed "to promote the Progress of Science and the Useful Arts." In a nation of farmers, what could be more progressive and more useful than promoting agriculture?

At a time when the entire country could still be considered an experiment, Ellsworth saw every farm and field as a potential laboratory of agricultural innovation. The Great Hall of the new Patent Office building (now the National Portrait Gallery) would display agricultural acquisitions. Members of Congress would distribute new plants and seeds, supplied by the Patent Office, to their constituents across the country. Reports on success and failures would come back to Washington, along with information on regional crop prices. In 1839, in the first appropriation it ever made for agriculture, Congress granted the Patent Office a thousand dollars to distribute seeds and gather information on agricultural markets. It was the beginning of a long association of new plants, national progress, and invention.

When Luther Burbank was born a decade later in Lancaster, Massachusetts, farming in New England was already in decline and working the soil did not seem a likely calling. In north central Massachusetts, where Lancaster had been settled in 1653,

sawmills, gristmills, and factories for nails, paper, and cotton dotted the riverbanks. The textile mills of Lowell and the machine shops of Worcester were near by, helping to establish Massachusetts as the most industrialized state in the nation.

Burbanks had been in Massachusetts since shortly after the arrival of the Mayflower, and the family had a long history as teachers, preachers, craftsmen, and manufacturers. Luther's father and uncle used the clay and timber on the family "farm" to make bricks used in many of the local houses, churches, schools, and factories. His mother (Samuel Burbank's third wife and mother of the last three of his fifteen children) was the daughter of a cabinetmaker and sister of a factory manager. Most of Luther's older half-siblings were teachers or tradesmen. The simple truth is that there was approximately nothing in Luther Burbank's background that would have predicted a desire to become an inventor of new plants.

There was, however, a great deal to suggest he would want to become an inventor of something, because that was what bright young men of his time and place were encouraged to do. Growing up, Luther Burbank absorbed the widespread national opinion that new inventions could and would increase comfort and prosperity in every sphere of human endeavor. He also had ample evidence that inventors were heroes who improved life for everybody, and that scientific knowledge should lead to immediate practical applications.

After Samuel Burbank's death cut short Luther's education, the young man worked for a time in his uncle's plow factory, tried his hand as a merchant seaman, and sold sewing machines door to door. And then he discovered his vocation-- at the public library.

Darwin's Variations of Animals and Plants Under Domestication, published in America in two fat volumes in 1869, was a detail-crammed response to those who had criticized On The Origin of Species by Means of Natural Selection as a hypothesis unsupported by sufficient proof. More a compendium than a treatise, Variations seemed to include every piece of evidence for biological change over time that Darwin had gathered during his entire career as a student of natural history. Its book was not a popular success like the 1859 Origin of Species or the 1871 Descent of Man; in England it sold fewer than five thousand copies.

Burbank hadn't read On the Origin of Species, published when he was only ten years old, though he had certainly heard of the controversial volume. It took him a year or two to notice Variations in Animals and Plants Under Domestication. When he did, however, it was a momentous encounter. "It opened a new world to me," he later said. "It told me, in plain simple sentences, as matter-of-fact as though its marvelous and startling truths were commonplace, that variations seemed to be susceptible, through selection, of permanent fixture in the individual.... I doubt if it is possible to make any one realize what this book meant to me."

Variations of Animals and Plants Under Domestication gave Luther Burbank several big ideas. The first was that each plant contained latent difference and that it was possible to force the emergence of those changes, even to the point of generating what seemed to be entirely new varieties. Still more exciting was Darwin's tentative suggestion that selecting, grafting, hybridizing, or simply moving a plant to a new environment might spur changes that would persist over succeeding generations. According to Darwin, these alterations were often inadvertent, but as Burbank

immediately realized, such happy accidents could also be made deliberate. That meant that the creation of new plant varieties, something far beyond the familiar efforts to breed the best of an existing stock, did not need to wait for the slow accumulation of natural advantages Darwin had described in the Origin of Species. Permanent evolutionary change could be greatly accelerated by human intervention.

With this new idea came another important revelation: if nature could be shocked into unanticipated changes, there was nothing wrong with trying to provide that shock. It is an error to speak of man ‘tampering with nature’ and causing variability,” Darwin wrote. “If organic beings had not possessed an inherent tendency to vary, man could have done nothing.” For Burbank, reading those words in the Lancaster public library, the fear of hell that had haunted his Baptist youth was quietly replaced by a much more optimistic creed. Instead of submitting to the mysteries of divine creation, it was right and proper to help those mysteries unfold.

At the end of Volume I, Burbank cannot have missed seeing a spark of another kind. Occupying the entire facing page, in type much larger and bolder than Darwin’s text, was an advertisement for another book, the best-selling Gardening for Profit by the popular 19th century authority Peter Henderson. On facing pages, the two key ideas of Burbank’s career came together. Plant life could be a subject for experimentation and improvement, and a commercial garden could provide a good living for an imaginative and enterprising man.

3. The Lucky Spud

Using his small share of the family inheritance, 22-year-old Burbank bought land in nearby Lunenburg, Massachusetts, and started a career as a market gardener, selling

his produce in the surrounding area. Less than a year later, he found his lucky spud, the plant that brought him his initial fame and remains one of his most enduring contributions to global agriculture.

Today, the Burbank potato, better known through its natural variant, the Russet Burbank, is one of the most widely grown potatoes in the world. In Idaho, where the Russet Burbank dominates state agriculture, a picture of the potato and the slogan “Famous Potatoes” have often appeared on its license plates. When the United Nations declared 2008 the “International Year of the Potato,” it featured the Russet Burbank as “the classic American potato.”

Large and oval, with white flesh and conveniently shallow eyes, the Burbank really is an excellent potato. Its high starch content and low moisture produce fluffy baked and mashed potatoes. The low moisture also means it can be fried without becoming limp or soggy, while its low sugar content prevents excess browning. These virtues, along with its large size, regular shape, and distinctive nutty flavor, make the Russet Burbank the preferred variety for many potato processors. McDonald’s, the largest purchaser of potatoes in the United States and a significant force in global potato markets, specifies Russet Burbanks. The Russet Burbank is also the guinea pig of the vegetable world, a favorite for laboratory experiments, perhaps because it is so widely available. When the Monsanto Corporation was looking for a plant with which to demonstrate the power of an introduced, bug-repelling gene, bT, it chose as its carrier the Russet Burbank potato.

All of this was far in the future, of course, when Burbank was tilling his field in Lunenburg Massachusetts in 1872. The Burbank potato was not Luther Burbank’s most

intricate exercise in plant breeding. Certainly it was not the invention that brought him the most money. He wasn't obsessed with finding a better potato. A break-through in beets would have suited him just as well. His cabbage seeds, his sorghum, and his honey had all brought cash prizes at the local agricultural fair. He was already experimenting with beans, which offer themselves up for cross-pollination in ways that are much more obvious than potatoes. But when the opportunity presented itself, Burbank was ready.

The story would be repeated for decades, an enduring part of the plant master's legend. Burbank was growing Early Rose potatoes on his farm in Lunenburg when he noticed a rarity, a seed ball forming on one of the plants. It was an inconspicuous little seed-carrying globe, like a tiny tomato dangling from the vine, and he claimed it was the only Early Rose seed ball he ever saw. Most farmers would have ignored the thing, since potatoes are not grown from seeds, but Burbank remembered Darwin's insistence a single plant could contain multiple variations. Vegetal reproduction hid those differences, but an enterprising experimenter could perhaps uncover them. It would be Burbank's first exercise in assisting evolution.

Burbank marked the plant with a strip of fabric torn from the hem of his shirt and waited for the seed ball to ripen. When he discovered that his precious seed ball had fallen from the stem, he spent three days crawling through the potato patch to track down the tiny thing, somehow recovered it, carefully saved the twenty-three seeds inside, and waited until spring to plant them.

The results were as varied as Darwin had predicted. Twenty-three seeds produced plants with potatoes of different sizes, colors, and shapes. Some had many tiny tubers and some had almost none. Two, however, produced impressively large white tubers with

smooth skins and relatively few, shallow eyes. This was already a case of extraordinary good fortune, but Burbank's luck went further. His new potatoes also tasted very good, and they stood up well over the winter's storage. The next summer, Burbank planted them both again. One variety produced many more potatoes than the other. It would take longer to discover that it also had superior resistance to the blight that had devastated Ireland's potato fields.

By the fall of 1874, Burbank was starting to show his new potatoes around. Like any other inventor, whether of better potatoes or better plows, Burbank now had to decide how to maximize profit from his discovery. He could have acquired a great deal more land and become a potato farmer, but he had neither the money nor the inclination to go into the business of wholesale potato production. Besides, that would not have solved two problems that were unique to breeders of new plants or animals: the lack of any kind of legal protection for their creations and the absence of any control over the product.

According to a long-standing legal principle called the "Product of Nature" doctrine, objects found in the natural world (animal, vegetable, or mineral) could not be patented. A gold mine was real property, and could be fenced; the design for a machine to extract gold was intellectual property, and could be patented; but gold itself was available to any lucky finder, and so were potatoes.

The second difficulty, one that only applied to animals or vegetables, was that living things tend to reproduce themselves. Unlike a mechanical invention, a plant is an organic factory for its own multiplication; any buyer could go into the potato-making business for himself, using the original purchase to grow a potentially limitless number of future generations. Even a large, well-established plant merchant could only count on

exclusivity for a season or two, after which other sellers would simply raise the new variety in their own fields, and Burbank was neither large nor well established. The thing to do was sell the rights to his potato to someone who had the means to propagate it on a scale big enough to make a profit before the plant's exclusivity faded and its value decreased.

During the years when Burbank was starting his career, seed sellers were the venture capitalists of the vegetable world, buying promising new prototypes, getting them into production, and grooming them for the market. Anyone trying to make a living by developing new plant introductions would hope to be bought out by a larger dealer, which was exactly what Burbank wanted. At the same time he was exhibiting at the Lunenburg Farmers Fair, he began writing to major seed sellers of the area, describing the wonderful virtues of his new potato.

On October 5th he received a reply from James J. H. Gregory, a seed merchant in the Atlantic seaport of Marblehead, Massachusetts, eighteen miles north of Boston.

“D[ear] S[ir],” Gregory scribbled. “I have a great number of seedlings sent me for trial and with these I shall be happy to compare yours another season. Should it prove to be a real acquisition I should so learn and would so inform you; the ownership of the potato would, of course remain in your hands to be disposed of as you might think best.”

James J. H. Gregory was not an obscure local retailer who struck it rich through another man's discovery. He was a leader in the growing ranks of seed sellers who were transforming the business of agriculture in the decades after the Civil War, and a man of considerable civic achievement. Twenty years older than Luther Burbank and a graduate of Amherst College, Gregory had been a teacher and school principal before taking over

the family seed business, and he was a prolific writer and lecturer on horticultural topics. Gregory was also a poet, a collector of Native American relics, a generous donor to the town of Marblehead, a selectman, a library trustee, a state senator, a benefactor of struggling families and adopted father to a number of orphans, and an ardent believer in educational opportunity who would later give over 30,000 books to African-American colleges.

Introducing new and improved seeds to the general market was a Gregory family specialty. In the early 1840s, when James J. H. Gregory was a young schoolmaster and Luther Burbank not yet born, James's father had popularized the Hubbard squash, a large, lumpy variety with a sea-green rind whose appearance does not inspire immediate affection. He named it after Elizabeth Hubbard, "a very worthy lady" who had directed his attention to this previously unrecognized variety of winter squash after she had tasted one grown by another Marblehead resident, Captain Knott Martin. Martin in turn had gotten his seeds from a different Marblehead woman, doubtless also worthy but unnamed. In this slow, casual, and very local way, the squash made the rounds of neighborhood gardens for a good twenty years before the senior Mr. Gregory took note of it, named it after the estimable Mrs. Hubbard, and put it on the market, where it remains popular today, prized for its rich, moist flavor and because it can be stored for months without rotting. There is no record of Mrs. Hubbard receiving a finder's fee.

After planting Burbank's sample in the summer of 1875, Gregory agreed it was a very fine potato. He also noted, however, that the market at the moment was glutted with new potatoes. He offered \$150 for exclusive rights to propagate and sell the variety,

which he generously decided to call the Burbank Seedling. He would list it in his catalog. It might catch on.

What was an ordinary transaction for James J. H. Gregory was a life-changing opportunity for Luther Burbank. His early success at teasing out a new variety of potato convinced him that he could make a career of his passion for garden experiments, and three years of battling the rocky soil and unforgiving winters of Massachusetts had persuaded him to join the on-going national exodus west. Burbank's older half- brothers, George and David, had been writing home about the splendors of northern California for twenty-five years, and by 1875 his younger brother Alfred was also living in Sonoma County, north of San Francisco. Lured by their letters and by widely circulated if somewhat exaggerated reports of cheap and fertile land in a perpetually balmy climate, Luther wanted to go to Northern California, too.

Burbank accepted Gregory's lower offer, which included the right to take ten seed potatoes with him to the western market. Selling his land in Lunenburg for barely enough to repay his mortgage, he packed his bag, bade goodbye to his mother and sister, and grabbed the hamper of sandwiches and cake they had prepared for the nine-day cross-country train ride. He was off to California to seek his fortune as an inventor of plants.

4.The Second Gold Rush

Before the discovery of gold in 1848, California agriculture was almost all in the future. Native American tribes depended more on hunting, fishing, and gathering wild fruits and nuts than on any sort of farming. Spanish missionaries and generals had come

north from Mexico to gain converts and consolidate their political control, not to cultivate the land, and they had never gone very far beyond mission gardens and grazing herds of cattle and sheep. Russians had sailed from Siberia to fish and trap for furs, and tales of fertile valleys full of wild oats had lured a few early pioneer farmers from the East, but neither they nor the Spanish ranchers were ready to meet the demands of the hoards of hungry gold-seekers who arrived at mid-century to make their fortunes and stayed to transform the state.

Food for the first rush of prospectors arrived by boat, shipped around Cape Horn from ports on the eastern seaboard or from Europe. A closer source was Hawaii, a mere 2400 miles away. Potatoes, easy to plant and ready to eat in a single season, were the first significant food crop cultivated in the gold country after 1849. The river town of Petaluma, just north of San Francisco, grew up as a depot for a local variety, the small Bodega Red potato. Cattle, timber, and wheat ranching followed, each requiring large plots of land but relatively few workers, and all suited for easy export. Twenty-five years after the gold rush, California was on the cusp of a second boom, this one based on agricultural rather than mineral wealth.

In 1875, the year Luther Burbank moved to California, the transformation had not quite begun. The luscious fruits, flowers, vegetables, and nuts for which the state is now so famous had not yet become big business, and in many instances they had not even been introduced. The small, sustainable network of farms and orchards that preservationists are now struggling to maintain did not exist; Burbank was one of the people who would help to create it. For the rest of his life, Burbank contributed in multiple ways to the rise of California agriculture, both by introducing new plants and,

equally important, by popularizing the idea that nature could and should be managed to provide an almost limitless variety of products. He was the perfect collaborator with the second generation of California boosters, eager to promote the state as a natural cornucopia where anyone could grow anything in the willing soil.

To be a plant breeder in 1875 required a course of self-education. Over a decade after the passage of the Morrill Act of 1862, the national network of land grant colleges was only slowly coming into being. The University of California, located in nearby Berkeley, on the east side of San Francisco Bay, had graduated its first class of twelve students in 1873; it would take another two years for the university to find a director for its College of Agriculture. The national program of Agricultural Experiment Stations, federally funded centers for research and plant improvement, would not begin until 1887. Other plant breeders, notably Vilmoran in France, had published their findings, but this information was not widely available.

Commercial sources of information were not very helpful, either. Then as now, garden books concentrated on advice for sowing and nurturing plants, with a great deal of attention to climate and pest control and little to plant variety. In the 1870s, the study of botany was about classification, not creation. The many farm journals of the day were full of information on improved methods of agriculture and horticulture, but not on how to improve the plants themselves, beyond the advertisements that usually covered front and back covers alike with their promises of sure-fire miracle crops. Seed sellers enhanced their catalogs with cultivation tips, but those were aimed at the vast market of inexperienced farmers and gardeners who had taken to the land with little actual

knowledge of what they were doing. And nobody had yet written much of anything about the plants of California.

In this vacuum, Burbank found inspiration once again by turning to Darwin, whose interest to agriculture and horticulture were almost entirely non-commercial. Darwin's Effects of Cross and Self Fertilisation in the Vegetable Kingdom appeared in England in 1876, the year after Burbank moved to California. It was presented as an extension of his earlier book on orchids, an interesting but not highly controversial field, and the new book's modest sales seem to have accorded with that assessment. When an American edition was published the following year, however, Burbank acquired a copy as soon as the book reached San Francisco. And once again, he drew a lesson in plant breeding that most other readers overlooked. To Burbank, the lessons of Effects of Cross and Self Fertilization in the Vegetable Kingdom (with its newly Americanized spelling) extended far beyond the realm of hothouse rarities, and also beyond the effort to coax out spontaneous variations that he had engaged in when working on his new potato.

“One sentence in the very introductory chapter of that volume opened to door of my mind and took possession of my fancy,” Burbank later recalled. “After discussing briefly the marvel of cross- and self-fertilization in plants Darwin said: ‘As plants are adapted by such diversified and effective means for cross-fertilisation, it might have been inferred from this fact alone that they derive some great advantage from the process; and it is the object of the present work to show the nature and importance of the benefits thus derived.’” In other words, cross-fertilizing plants might lead to offspring that were not only different from either parent (the novelty then usually sought in hybrids), but also better.

Burbank took Darwin's work within the orchids and expanded it to include just about anything he could think of, from variations on a single wildflower to multiple varieties of plums to improbable yokings of different species like the tomato and the potato. He began hybridizing and crossing plants as soon as he obtained some land, probably in the spring of 1878. Along with the already common practice of cross-pollinating two exemplars of the best of any particular variety, he crossed different species and experimented with plants that seemed to have little or no prospect for economic use, like the coastal dewberry whose sparse, soft fruit and limited growing range made it seem greatly inferior to hardier, sweeter, more prolific blackberries. He cross-pollinated nut trees, grapes, berries, roses, lilies, native wildflowers, and local cacti. It was a surge of intense creative activity, and Burbank's later catalogs almost always dated his experiments with hybridizing different varieties and crossing different species to exactly this period—before he had anything but curiosity, ambition, and access to the most ordinary tools and plants.

5. The Prune Boom and the Wizard of Plums

Nothing came easy. Burbank supported himself by gathering specimens for botanical collectors, by selling potted flowers and garden shrubs, then getting into the wholesale orchard business. In 1881, when sun-dried fruit was quickly becoming a major export from California, Burbank provided an instant orchard for a local speculator who wanted to get into the business by the end of the year. He did it by renting land, hiring a small army of temporary workers, and using innovative techniques to graft plum

buds onto faster-growing almond sprouts. This feat of mass production—performed decades before Henry Ford’s assembly line —boosted Burbank’s reputation as a supplier of commercial orchard stock and gave him the income to pursue his true interest, plant creation.

The delivery of almost twenty thousand plum trees in less than a year was a bravado feat of garden magic, but it was the creation of new varieties of fruit, especially plums, that gave Burbank the name of “the Wizard of Santa Rosa.” Once again, inspiration came from books. Shortly after he arrived in California, Burbank had stopped in the Mercantile Library in San Francisco and read a sailor’s tale of his travels in Japan. Amid the exotic adventures was an account of eating a delicious red-fleshed plum that grew only in the province of Satsuma, a description that lingered for years in Burbank’s memory.

After he opened his Santa Rosa Nursery, Burbank bought imported seeds and plants from a number of dealers in different countries. Isaac Bunting, an English bulb dealer based in Yokohama, agreed to send scions of the red-fleshed plum Burbank had read about, a process that took two years. Finally, in 1885, twelve healthy scions from several types of plum tree arrived by boat from Japan. Burbank grafted them to trees in his new experimental nursery in Sebastopol and waited to see what would emerge.

The Japanese plums that fruited the next year were very different from both the French petit d’Agen prune plums introduced to California in 1871 and the small, yellow-fleshed wild plums of the region. The Blood Plum of Satsuma, as Burbank named it, had a bright red interior. It also ripened weeks earlier than the more familiar varieties, and any plant that extended the commercial season, early or late, was always welcome. That

was hardly the end of Burbank's plans, however. As soon as the new plums had blossomed, he had started cross-pollinating the Japanese fruit with European and native varieties, grafting the new buds onto established trees to accelerate the growing process and make it easier to compare results.

In 1887, he harvested forty-three different hybrids, none of them intended for the casual buyer. Carefully wrapped in paper and cotton, packed two to a box, the new plums were sent to prominent fruit judges like to H. E. van Deman at the U. S. Department of Agriculture, who started praising the new plums and the extensive stock of the man who had now become "Mr. Luther Burbank, the well known nurseryman of Santa Rosa, California." Burbank exhibited his new plums at the fruit growers' convention in Santa Rosa in November, 1887, sent samples to the Pacific Rural Press and other California papers, and as far away as Florida.

In breeding his new plums, Burbank refined the method that came to mark almost all his plant experiments. First he grafted scions to established plants, so they would blossom and bear fruit as soon as possible, thus cutting several years off the maturing process. Next he cross-pollinated. Then he planted the seeds of the resulting fruit. Then, once more, he grafted the seedlings onto mature trees so they would fruit more quickly and he could evaluate the results in just a year or two, instead of four or five.

Over the coming years, Burbank would introduce at least 105 new plum varieties, many of them the 'good shippers' that enabled railroads to deliver fresh fruit to distant markets. By 1915, orchard catalogs in Japan were advertising Burbank plums, as his hybrids recrossed the Pacific. Burbank also crossed plums with apricots, a feat that was loudly criticized as impossible before external duplication confirmed his results; the 11

varieties of plumcot that Burbank developed are the ancestors of today's patent-protected pluots. Some Burbank introductions, like the Santa Rosa plum, remain popular supermarket varieties, widely grown not only in the United States but also southern Europe, North Africa, South Africa, New Zealand, and Australia. Others, like the Wickson plum, are still well represented in home gardens and orchards. A few curiosities like the 'stoneless plum,' a soft-centered fruit lacking the usual hard casing around its seed, generated a huge amount of publicity but are difficult if not impossible to find today—as are the vast majority of plant varieties offered by nurseries over a century ago. Novelty is always a big seller in the plant trade, but its commercial life is short; the stoneless plum's most lasting value came from the attention it brought to its creator.

In 1893, Luther Burbank published the work that catapulted him out of the local circles of California orchardists and into a new sphere of national and international celebrity. Not the multi-volume descriptions of his plant experiments or the biographies and autobiographies written by a legion of ghostwriters, and certainly not the book on child rearing he would later publish to much acclaim. All of those would appear in the coming century, and all would depend on the reputation he was about to achieve. What made the locally successful nurseryman of Santa Rosa into Luther Burbank, the world-famous plant inventor, was a fifty-two-page catalog called New Creations in Fruits and Flowers.

Unlike other nursery catalogs, Burbank's avoided the lush seductions of color lithography. He offered no premiums for early orders or pledges of reliable delivery. As with the Burbank potato, his market for his 'new creations' was not the retail customer, but commercial growers who would buy a prototype and propagate it for their own sale.

Naming rights were included in the purchase price (making it difficult to trace many of Burbank's creations), which ranged from a few hundred to several thousand dollars for as little as a single plant or bulb.

Many of the fruits and flowers offered in the New Creations catalog were significant improvements over existing varieties and are still widely cultivated, demonstrating very unusual lasting power in a business that depends on a promise of constant new introductions. Still, the best new creation was Burbank himself. The first New Creations catalog and all the annual editions and supplements that followed over the next twenty years provided a single, continuous vision of ceaseless progress, with the steady unveiling of new marvels fashioned from the raw material of nature but greatly improved by the hand of man. One man. Luther Burbank. The front pages were crowded with testimonials, not to the business or the individual products for sale, but to the creator. "Luther Burbank [is] the greatest horticultural experimenter in American, if not in the world," ran a typical endorsement.

Not everybody was convinced, of course. Some of the seed sellers and nurserymen who received Burbank's New Creations catalog were offended at the blasphemy of a mere plant breeder calling himself a creator of new life. Others doubted Burbank's plant inventions were as big, as new, or as unique as he claimed. Many dismissed Burbank's descriptions as the exaggerated fantasies of a competitor. More astute retailers, however, recognized that in branding himself as a creator of botanical wonders, Burbank was adding a great deal of extra value to anything of his they sold. When commercial houses bought a Burbank plant, they were buying his personality as well as his stock, grafting the master's fame onto their own catalogs. The eye-popping

prices he was asking would be repaid in all the publicity they garnered. The price *was* the publicity, at least in part, and if the plants were any good, they would be well worth the investment. Stark Bro's Nursery of Louisiana, Missouri, for example, bought the Golden plum from the original *New Creations* catalog, promptly renamed it the Gold plum, stressing its cost over its color, and promoted it as "a child of science, sprung from crossing our hardy fruitful American plums and the beautiful and exquisite plums of Japan...no marvel, then...that we were glad to pay full \$3,000 for a single tree."

Despite his lack of any formal education in biology, botany, horticulture, or agriculture, Burbank was also winning respect from scientists, based on the compelling lists of new products coming from his experimental grounds. The Department of Agriculture's 1898 publication, "Hybrids and their Utilization in Plant Breeding", borrowed Burbank's catalog photographs for its illustrations; agents from the newly formed Agricultural Experiment Stations made pilgrimages to Santa Rosa to meet the master and see nature-bending marvels like the stoneless plum, the white blackberry, or the extremely prolific, soft-shelled Royal walnut.

After the 'rediscovery' of Mendel in 1900, researchers considered Burbank's plant innovations as independently discovered demonstrations of the principles of inheritance they were still struggling to understand. Hugo de Vries, the Dutch geneticist who was a celebrated follower of Mendel and inventor of the word "mutation," accepted an invitation to lecture at the University of California because, he admitted, he wanted to meet Burbank; after visiting Santa Rosa, de Vries took photographs and samples of Burbank products back to Europe, demonstrations of the principles he and his colleagues were still struggling to understand, and used them in his lectures. In 1903, the California

Academy of Science celebrated its fiftieth anniversary by awarding a gold medal to Luther Burbank, “for meritorious work in developing new forms of plant life,” and declared him the most important scientist of the past half-century. David Starr Jordan, president of Stanford University and himself a noted biologist, gave Burbank an appointment as Special Lecturer on Evolution and published a series of articles that became The Scientific Aspects of Luther Burbank’s Work. And in 1905, as though bestowing a special seal of scientific approval, the Carnegie Institution of Washington D.C. granted Burbank the unprecedented sum of \$10,000 per year “for the purpose of furthering your experimental investigations in the evolution of plants.” As far as the general public was concerned, Luther Burbank’s status as a wonder worker of science was now official, as were both the possibility and the rewards of transforming nature.

6. The Empire of the Prickly Pear

Here’s a way to end world hunger and make the desert bloom. Take the common *Opuntia*, the prickly pear cactus that grows wild throughout the American Southwest, use hybridization and selection to ‘persuade’ it to relinquish its sharp spines, plant the improved version across the arid regions of the world, and open up the desert to grazing cattle. This was Burbank’s plan, and it promised more than a new product or even a new industry. It was a transformation of the landscape itself, or so it seemed to the many people captivated by the potential of Burbank’s spineless cactus, which was promoted both as cattle feed and as a newly convenient source of fruit for humans. From 1905 to 1916, Burbank’s spineless cactus was the center of an agricultural bubble held aloft by

combined winds of genuine need, popular science, the eternal pursuit of quick profits, and, most of all, the extraordinary fame of Luther Burbank himself.

Excited rumors about Burbank's newest transformation of nature had been growing for several years when he issued a special 28-page catalog, *The New Agricultural-Horticultural Opuntias: Plant Creations for Arid Regions*, in 1907. Again, the catalog was aimed at professional plant dealers who would buy the prototypes, multiply them on their own grounds, and sell the results to the retail trade. Again, this was reflected in the prices: complete possession of any of the eight new varieties ranged from one to ten thousand dollars each.

Today, breeding the thorns out of cactus so it will be better suited for grazing cattle seems like a very hard way to solve a not-too-pressing problem, but a hundred years ago, before the advent of hybrid corn, the possibility of cactus forage drew interest around the world. Government agents arrived from as far away as Russia and New Zealand to inspect Burbank's experimental gardens, and Brazil, Mexico, and Argentina all invited Burbank to advise them on cactus cultivation. Agents from the USDA provided *opuntia* specimens from around the world, and President Theodore Roosevelt designated a decommissioned fort in Texas as a spineless cactus experimental ground.

The high hopes for the spineless cactus grew out of genuine need, but they were propelled by the pervasive get-rich-quick mentality of California itself. At the start of the twentieth century, the dream machine in the Golden State was agriculture. From grapes to olives to rice to cotton, growers were busy introducing exotic crops to a landscape that still seemed like an agricultural blank slate, a place where success could bring fabulous profits and failures could always be erased. Still, the introduction of new crops often

required significant investments in draining, irrigating, terracing, tiling, or doing whatever else was needed to transform an untouched paradise into a working commercial garden. One of the charms of the spineless cactus was that it was a plant that seemed suited to existing conditions.

Interest in the spineless cactus was high at the University of California and at Stanford, as well as in Santa Rosa, San Francisco, and all the communities where Burbank bought or rented land to establish new cactus farms. Enthusiasm was higher still in Los Angeles, which was then a booming oil town struggling with water shortages and eager to establish its reputation as a gateway to agricultural development. Near the end of 1907, Burbank made the biggest single sale of his career. For twenty-seven thousand dollars, he granted rights to seven varieties of his cacti to the newly organized Thornless Cactus Farming Company in Los Angeles. That sale and another order for an additional ten varieties received a great deal of free publicity, adding to the widespread opinion that Burbank was a wonder worker whose creations would soon transform desert agriculture.

By the spring of 1908, Welch was boasting of 1,000 new plants produced each week at his cactus farm in the Coachella Valley, and of orders for 50,000 starter slabs of spineless cactus, received from customers around the world before a single plant had been shipped. The prospect of all these far-flung buyers, and the even more enticing vision of on-going trade in both cactus paddles as cattle feed and cactus fruit as a grocery item, caught the attention of the railroads. From potatoes to prunes, Burbank creations were a significant part of the tons of produce that filled cars heading east from California. Hoping to be both producer and shipper, the Southern Pacific Railroad worked from 1908 to 1912 to bring value to its barren acreage in southern California and the Great Basin by

growing Burbank's spineless cactus. During the same period, the Union Pacific Railroad sponsored promotions of Burbank's products around the country, with particular emphasis on spineless cactus.

Burbank supporters brushed aside warnings that the spineless cactus was not an easy or instant panacea for desert ranchers. On February 29, 1912, Representative Everis Anson Hayes, from Los Angeles, rose in Congress to defend of his state's favorite agricultural hero, "deploring that recently an employee of the Department of Agriculture had seen fit to assail Burbank and even ridicule his genius and the great work he has done and is still doing." Noting that 95% of the plums shipped from California were Burbank varieties, as well as almost all the state's potatoes, Hayes went on to declare the spineless cactus Burbank's greatest triumph and to insist that a photograph of Burbank's cactus field be inserted in the *Congressional Record*, reportedly the first such pictorial introduction. Many more spineless cactus photographs appeared in the *Pacific Dairy Review* the following July, which devoted its first four pages to the "immense possibilities" of fodder from the cactus before concluding, "it looks so simple that it may not even leave room for the agricultural or dairy editor to do anything but say 'plant Opuntias.'"

Like so many others, the editors were overly optimistic. A careful reader who could penetrate the thicket of adjectives in the *New Opuntias* catalog might have lingered on the conclusion of the following sentence: "Systematic work for their improvement has shown how pliable and readily molded is this unique, hardy denizen of rocky, drought-cursed, wind-swept, sun-blistered districts and how readily it adapts itself to more fertile soils and how rapidly it improves under cultivation and improved conditions."

As it happened, fertile soil, cultivation, and improved conditions were precisely what the desert lacked, along with water for irrigation and cheap labor to install fencing needed to protect the newly defenseless plants from hungry rabbits and other predators. If ranchers in the California desert could provide such ideal conditions, they would be growing alfalfa, which was in fact a better feed. But if the cactus wasn't flourishing as hoped, the enthusiasm of people who wanted to sell it remained as fresh and green as the grass the *Opuntias* were supposed to replace. And since this was California, no one should be surprised to learn that the spineless cactus boom inspired a side bubble in real estate.

By the second decade of the twentieth century, the small family farm in California had already been replaced, as an economic force, by corporate agriculture. The vision of moving to California and living off the products of the land of sunshine continued to lure many migrants from other regions, however, and they were the target of numerous real estate vendors who embraced the spineless cactus as a way to market barren land. In 1912, for example, a former cattle ranch in the San Joaquin Valley was divided into twenty-acre lots and renamed "Ora Loma, the Spineless Cactus Land," where buyers would turn virgin desert into profitable farms by planting spineless cactus, paddles of which would be provided with every purchase. In the fall of 1913, the Magazine of Wall Street printed a comic response to another spineless cactus brochure, which the author claimed has inspired him to form his own company.

TAILLESS JACKRABBIT (LTD.).

Today I have a letter in my mail enclosing a prospectus. This well-printed document sets forth that the next great killing in the financial world will be made by the Spineless Cactus, the one invented by Luther Burbank. The salesman who

sends me this letter asks me to take an acre or two and interest a few of my personal friends at so much commission per friend. I shall not buy Spineless Cactus Incorporated, today; but when I get my Tailless Jackrabbit (Ltd.), listed on the Stock Exchange, I shall expect all my friends to bite. ... Kind reader, may I not put you down for a few shares in Tailless Jackrabbit (Ltd.)? If the door is locked when you call, throw your money over the transom at the sign of the Rabbit's Foot.

Eager to discourage pirates and profiteers and to escape from the details of sales, Burbank tried again to have an official dealer for his spineless cactus. Not far from the Ora Loma Company offices in San Francisco, in the Exposition Building at the corner of Pine and Battery Streets, a much larger entity called the Luther Burbank Company appeared in 1913 to make yet another attempt to handle the sale of spineless cactus for the harried inventor. The founders, who had no experience in the plant trade, paid Burbank \$30,000 for exclusive rights to market his creations and sold shares in the company worth well over \$300,000. Another sales office opened in Los Angeles, and salesmen were instructed to accept all orders.

In 1913, a group of Canadian investors bought one hundred thousand plants from the Luther Burbank Company that they intended to propagate on newly acquired acreage south of Riverside, California, part of a larger plan to enter the hog and cattle business. Another big order came from Texas. In October, 1914, a buyer in Mexico City ordered enough spineless cactus cuttings to plant a thousand acres, which the Los Angeles Times noted "would take more than the entire Burbank plantation could supply at one time."

The Times reporter had spotted a problem that the Luther Burbank Company managers had somehow missed: limited inventory. The result was a cautionary tale of

the perils of moving too fast on a product still under development. In 1915, having accepted too many orders, the directors compounded their problems through a fraud that would have been comical if it had not been so ruinous. They bought ordinary cacti, singed off the spines with blowtorches or rubbed them off with pads, and sent out the doctored slabs for planting. Of course the buyers discovered they had been deceived as soon as the newly planted cactus slabs started growing. Trust, that most important element in plant sales, had been destroyed.

By the time the Luther Burbank Company finally collapsed into bankruptcy, Burbank himself was suing the owners for non-payment of almost ten thousand dollars due on his original contract. Although he was not responsible for the company's errors, they had operated under his name, and his reputation as a wholesale supplier never fully recovered. Burbank remained a popular hero, featured in newspapers, visited by celebrities, cited in textbooks as a scientist whose work explained genetics, but in the future, Burbank would license his creations only to well-known garden retailers or sell them himself through catalogs of seeds, bulbs, and garden plants. Today, the FAO and other organizations promote Burbank's spineless cactus for use in arid regions like Mexico and North Africa, but on a much smaller scale.

8. The Garden as Intellectual Property

In 1837, the newly independent Patent Office received roughly 650 patent applications for the entire year, of which 435 were approved. In 1874, the year Burbank put his first potato on the market, patent applications had risen to almost 13,000. In 1893,

the year of the first New Creations catalog, 38,473 patent applications were received by the Patent office. By 1926, the year Luther Burbank died, the number of was 110,030, a rate of increase that far exceeded the rate of population growth. Not one of the patents granted from those applications was for a plant.

Burbank had always wished he could patent his creations. During his lifetime, he was regarded as a great inventor, a master of the intricacies of evolution, a communicant with the mysteries of nature, a selfless creator of plants that benefited all humanity, a sexless god of fertility, and a jolly champion of little children. It also makes a great deal of sense, however, to see his career as a series of attempts to earn a living from the business of plant breeding in a time when objects of nature, no matter how improved and altered, could not be treated as intellectual property.

Over the years, Burbank's strategies for dealing with the absence of plant patents had been nearly as inventive as his plant creations themselves. He tried retail sales, both at the farmers' market and out of his garden. He accepted commissions to breed new products, payable on delivery. He assumed the risk of development and put out catalogs offering his inventions at high prices to wholesale producers who could then profit from being the first to offer a new creation: what economists call "first mover advantage." He contracted with large plant-selling companies like Jackson & Perkins to market his inventions for him, collecting payments that varied depending on whether they sold wholesale, retail, or from prototypes they propagated in their own gardens. He accepted the support of the Carnegie Institution of Washington, D.C., a generous but somewhat demanding patron. He flirted with academic appointments and made occasional forays onto the lecture circuit, where he could command the modern equivalent of ten thousand

dollars for an evening's talk. He turned himself into a marketable commodity, capitalizing on his reputation to sell books, and even opened a souvenir stand outside his home. What he could not do was profit from the monopoly on production a patent provides.

For anyone working with the products made from of natural matter, the barriers to obtaining a patent came from two directions. Long tradition, embodied in many court rulings and even more deeply ingrained in human instinct, held that access to any creation of the natural world—air, water, diamonds, string beans—should not be owned exclusively by a private party. The second barrier was the requirement that an inventor had to submit clear instructions on how to duplicate the process being patented. This requirement, known as “enabling disclosure,” exists so that others can benefit after the set period of patent protection has elapsed. The name “patent” is the same as the word that means “open” and “obvious,” because the privilege of patent protection carries the demand for disclosure of how your invention is made. In the barely understood processes of hybridization, however, and in the highly variable process of plant selection, enabling disclosure was virtually impossible.

In 1926, when Burbank died, the tantalizing vision of patented plant inventions still remained out of reach. Not very far out, however, because Burbank's widow sold his experimental plants—the inventory of his outdoor laboratory—to Stark Bro's Nursery, which had bought and renamed the ‘golden plum’ over 30 years earlier, and Paul Stark was chairman of the National Committee for Plant Patents, a Washington lobbying group.

In November 1929, the members of Stark's committee began an aggressive campaign to promote their cause, speaking at public hearings and in private meetings with members of Congress. They also drafted the bill they hoped would be introduced.

Six weeks after the stock market crash, the plight of plant inventors yearning for intellectual property protection was nowhere near the top of the country's list of agricultural problems. As the global financial crisis deepened, farmers were among the first to be hurt. Farmers are always debtors, borrowing against the prospects of a future harvest in order to pay for seeds, fertilizer, and machinery. When commodity prices plunged in 1929 and the credit sources farmers depended on collapsed, they had no way to pay their debts. The start of a lingering drought that would turn much of the Great Plains into the famous "Dust Bowl" was also taking a toll.

Amid the growing cries to do something for the farmers, the first legislative response had nothing to do with helping those who were suffering most. In May 1930, Congress opened debate on legislation proposing a radical change in the legal and commercial status of both plants and those who breed them. Luther Burbank's name and his legend loomed over the entire debate. He was cited repeatedly as a brilliant inventor had suffered from not being able to profit from his ideas. Congressmen vied with each other to praise him in ever more elevated terms. Glowing descriptions of Burbank's contributions to humanity were interlaced with reminders of the financial sufferings he had endured because he could not patent his creations. He was remembered as a selfless champion of both nature and the national economy, a hero who had been denied the rewards that his labors so richly deserved. Members of Congress heard dire warnings

about the future of plant breeding if other horticultural inventors did not receive better encouragement in the form of patent protection.

Eighty-three year old Thomas Edison, holder of a world record of 1,093 separate patents, sent a telegram in support of the legislative change. “Nothing that Congress could do to help farming would be of greater value and permanence,” Edison declared, “than to give the plant breeder the same status as the mechanical and chemical inventors now have through patent law.” Edison did not mention that he himself had recently moved into botanical research, trying to find a new source for latex. Elizabeth Burbank also wrote in support of the bill, describing it as “one of Luther Burbank’s most cherished hopes.” Again, her connection to the chief lobbyist was not part of the record.

A few voices rose in opposition. In the House of Representatives, Fiorello LaGuardia, “the Little Flower” who would soon be elected to three terms as mayor of New York City, tried to get his colleagues to look more carefully at possible consequences of the proposed legislation. LaGuardia’s comments were a survey of issues that continue to make plant patents controversial. Fearing the effects of such patents on small producers, he asked how they would be able to compete with patented varieties developed by large growers with greater resources for investment. He worried, too, about farmers who inadvertently cultivated seeds of what turns out to be a patented plant, and he asked if they would be liable for accidental infringements on patent rights. More pointedly, he wondered why Congress wasn’t working on more extensive farm relief instead of focusing on the rather small population of developers of new plant varieties.

These were all good questions, but they were silenced by the enduring power of a dead man’s reputation. Asked if he would agree “there is no man who is a greater

benefactor to the human race than the man who produces a new vegetable or a new fruit,” the representative from East Harlem (arguably the least gardened district in America) answered without hesitation or qualification. “I will go further and state that I consider Luther Burbank the outstanding American of his time,” LaGuardia declared, leaving a field of other heroes that stretched from Abraham Lincoln to Charles Lindbergh to fight it out for second place. He added, however, that Burbank had managed to make a living without patent protection, and he imagined that other plant breeders could do the same.

LaGuardia’s objections notwithstanding, the bill passed both House and Senate, becoming the Plant Patent Act of 1930. Almost five years after his death, the powerful public image of Luther Burbank, the benevolent inventor in the garden, was still sufficient to overcome fears of a new natural order in which the living substance of creation could be privately owned and controlled.

The Plant Patent Act of 1930 allowed patents only on plants produced through asexual reproduction, with the ironic exclusion of potatoes. Most early patents went to graft-propagated roses and fruit trees sold by Stark Bro’s and their fellow nursery owners. Since then, patent protection for living things has been greatly expanded, but the beginning of the current privatization of nature was planted the grounds of Luther Burbank’s garden. Whether that is a good thing or not is something we can all debate.