

LUTHER BURBANK AND PLANT BREEDING.*

BY ENOS BROWN.

To Luther Burbank has been granted the knowledge, supreme beyond other men, of the susceptibility of plants to vary under the influence of new environments, delicate manipulation, and intelligent direction. Variations in plants, in color, size, fragrance, or form, have been observed by biologists from the first, but the phenomenon of change was regarded as a simple order of nature and an additional instance of nature's lavish endowments. That plants could be made to respond to a dominant will, and that the character, appearance, or habits of a plant might be controlled or altered, and that new ones might be created out of a combination of others, was never dreamed of or imagined, but all these strange things have been demonstrated as facts in the later years of the present generation.

The theory of plant evolution has, in a brief period, been even more conclusively established than the most enthusiastic disciple of Darwin ever conceived to be possible. That the scene of these superlatively impressive manifestations of the power of the mind over the natural impulses of plant life should have been developed in the farthest West is something to astonish the most credulous.

It is only ten years since Mr. Burbank began those experiments which have lately culminated. For thirty years a resident of Santa Rosa, Sonoma County, he was perfectly acquainted with all the conditions of climate and soil which distinguished this portion of California. In ages past a lake spread its broad area over this valley, depositing in time a rich alluvial soil of great depth. Frosts are of rare occurrence, and plant growth, no matter how delicate, is never arrested from this cause. In no region is there a combination of circumstances more favorable for fullest development or successful experimentation.

The marvelous results attained are due to nothing but rational methods, insight, close observation and a highly developed knowledge of plant instinct, altogether directed by scientific attainments of the highest order and with a definite object always in view.

It has been established that wild flowers are stubborn in maintaining their original form. In a bed of one thousand, or even ten thousand blossoms, for that matter, there may be but one exhibiting variation. The change may be upward or downward, an improvement or otherwise. It makes no difference to the plant breeder. One plant susceptible to change has been found, and is selected for further experiment. All the remaining plants, the unchangeables, are uprooted and destroyed. Upon the one the

efforts of the breeder are centered. The faculty to discern a slight variation in a single plant is an essential, the foundation upon which after-results are obtained. Let the lover of plants endeavor to exercise this faculty and pick out of a bed of a thousand flowers the one that differs from all others in color, form or fragrance, and then will be understood the fine quality of that gift which enables Mr. Burbank to glance over a bed of flowers and instantly discern the one variation for

and crossing with the ordinary white calla of the United States a deep yellow flower has been evolved as hardy as the native variety. The first crossing resulted in light and dark yellow flowers. Subsequent crossings yielded flowers as deep in color as the original. It has taken years to develop these qualities in its new environments, but there is no reason why the yellow should not be cultivated in temperatures where the common white now flourishes. To the residents of New

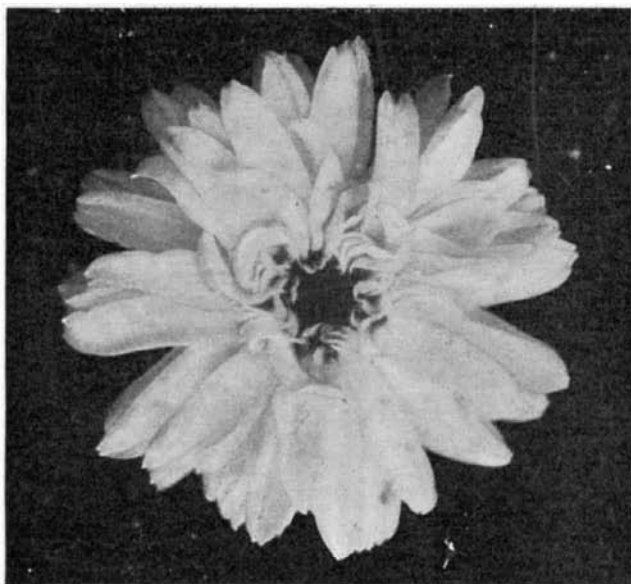
and Old Mexico, Arizona, Texas, and Central America the qualities, amiable and otherwise, which pre-eminently distinguish the prickly pear need not be enlarged upon. In the hot-houses of the North small specimens of the plant are cherished as conclusive exhibitions of the eccentricities of nature. In its home this cactus grows to the dimensions of trees and is used as fences to protect the domicile against the intrusion of any animal, wild or domestic. Its sharp

thorns are impregnable to assault. Divested of its spines the prickly pear as a food plant has a value equaling one-half that of alfalfa. It propagates itself with little moisture. Cattle eat it with avidity, but the spines, introduced into the intestines, cause death. A more conclusive test of the practical value of the theories of Mr. Burbank, then, in an endeavor to divest the prickly pear of its thorns, could not be imagined. This he undertook to do, and succeeded.

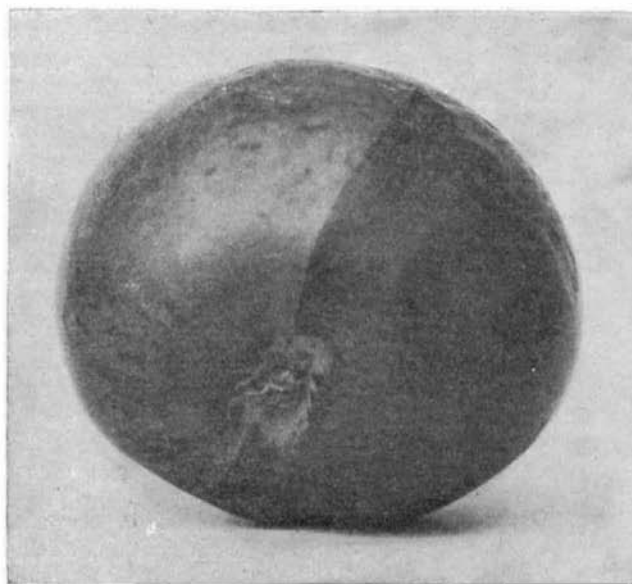
In certain parts of Central America there grows a species of prickly pear which has no spines or spikes, the only thorns with which the plant is endowed being the spicules found within the leaves. A plant of this variety was set out in the experimental grounds and crossed or hybridized with five Northern species, producing a type in which the spines were almost eliminated. Continued crossings produced in the fifth or sixth generation a plant completely thornless. Succeeding efforts resulted in a cactus in which every evidence of even a spicule had vanished. The new plant is

hardy and of vigorous growth. One plant in the grounds is three years old and stands eight feet high, covering a space perhaps five feet square. Upon it there are one hundred and seventy leaves, and the whole plant weighs nine hundred pounds. The fruit is of delicious flavor, somewhat like the pineapple, only more delicate. The deserts of the South may be clothed in the spineless cactus at no late day. Its value would be incalculable.

The magnificent crimson poppy, which bears a flower fully eighteen inches in circumference, is a product of hybridizing the opium with the Oriental. The first generation produced a flower having a narrow crimson streak. In this all the pistils excepting those which were crimson were cut off or amputated. These seeds were, in due



Daisy Shasta, One-Third Natural Size.



Hybrid Baldwin Apple, One-Half Yellow, One-Half Red.

which he is seeking. Minute attention to details is one secret of the success attained. Sterilization extends not only to the soil in which seeds are planted, but to the fertilizer with which the soil is enriched. Hostile germs are destroyed by boiling the soil. The boxes are sterilized by a solution of sulphate of copper. Mr. Burbank has correspondents in every part of the world where the science of botany is understood or a botanist penetrates. Scientific associations everywhere are his coadjutors. Persons in every zone forward to him new types. For him to look at a seed is to identify it. The environments and conditions of growth are understood as soon as the home latitude of the plant is ascertained. Identical environments of a plant may be imitated, and later, by graft or hybridizing, new vigor, which means greater power of resistance to lower temperatures, may be imparted. A conspicuous instance of this fact is the yellow calla, which is naturally confined to a limited area in the sub-tropical regions of South Africa. At home it is an extremely fragile plant. By hybridizing



Bed of Cactus Seedlings, Thornless, Showing a Few Reversions.

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* From American Homes and Gardens, August, 1905.

time, planted, and a flower nearly solid crimson bloomed from the stem. Successive efforts eliminated every other color but the one desired. It is the glory of the field; a whole garden in itself. It took three or four years and many generations to create, but the great crimson poppy is now a permanent addition to the ornaments of the garden. As showing the results of continued crossings, in a bed containing hundreds of thousands of leaves there could be seen no two which were alike.

The California poppy, *Eschscholtzia*, naturally rich, deep yellow in color, by following up a rare specimen in which only a vein of crimson appeared, has developed a new type which is all crimson.

The fragrant verbena is a product of selection and crossing. A plant was discovered in which a trait of ancestry revived and exhibited itself in one specimen, which was discovered by the plant breeder and its fragrance restored.

The amaryllis has been bred into a new plant, colossal in size and gorgeous in color. Its size has been increased to four times greater than the original, and measures from eight to ten inches across.

A wild white blackberry crossed with the Lawton produces a much clearer white, and is infinitely more productive than the Lawton and of finer flavor.

The common daisy of the North has, by hybridizing and selection, developed into a flower four and five times as large as the original and many times more beautiful. The variations of the new plant are endless.

The latest wonder to be established at the experimental farm are two new types of the black walnut tree, and named the Paradox and Royal. The first is a crossing of the common English walnut with the California, the latter between the Eastern and the California. In front of the Burbank home there are trees of the Paradox, not yet fourteen years of age, which measure two feet and over in diameter at a height of three feet above the ground. It is claimed that these trees are by twenty-five to fifty per cent. more rapid growers than any others known. The quality of the wood for finishing is said to be very superior, and it takes on a beautiful finish.

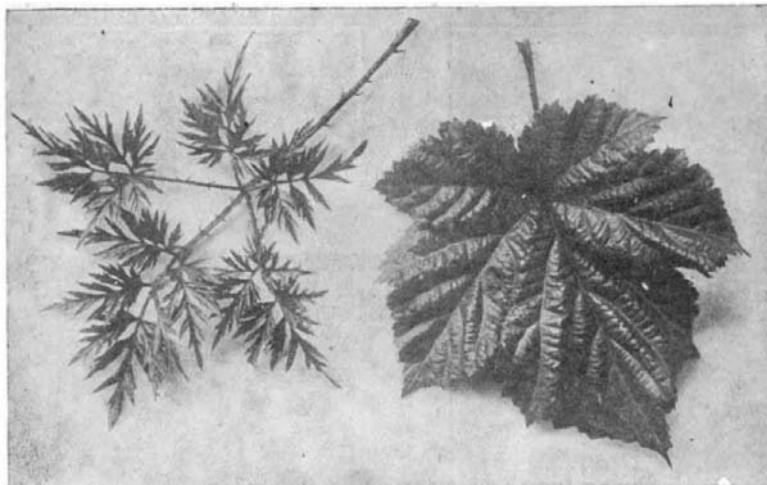
No one expects a plant to flourish without proper nourishment. The plant responds quickly to genial culture. In color combination a new type is found or else the greater peculiarities of one of the parents. Color is certain waves of light. Soils known as alkali produce colors in which the red is predominant. In soils with acid combination blue is most conspicuous.

Permanence of the new types is assured. A gain in color, form, vigor, size, fragrance or quality, in the direction of variation, once secured, is as liable to endure as new varieties of fruits, berries, and flowers which have been established for generations.

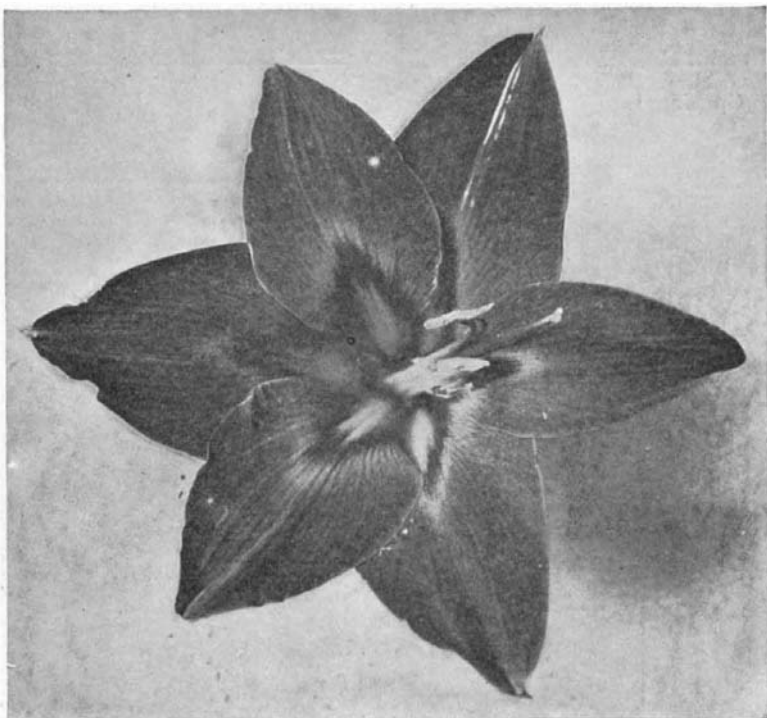
To enumerate all the variations upon estab-



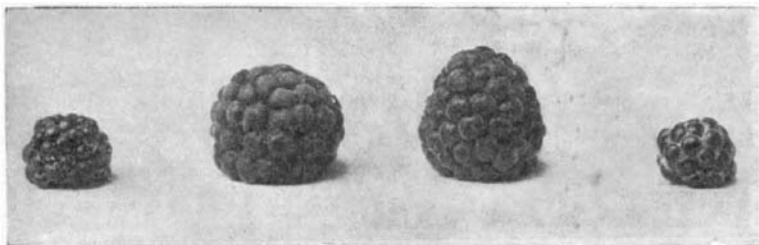
A Thornless Cactus Not Yet Deprived of Its Spicules.



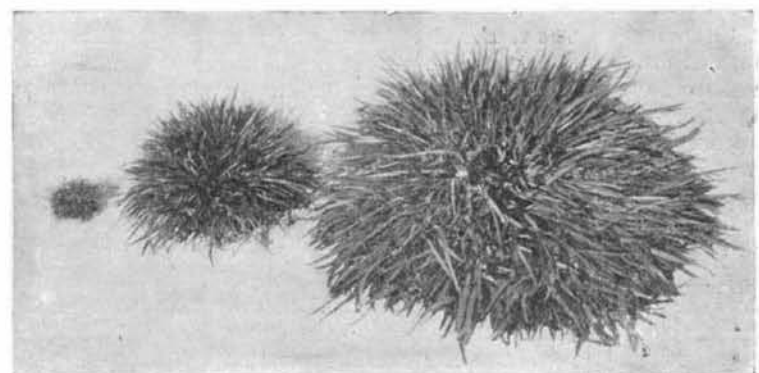
Extreme Form of Blackberry Leaves Produced by Hybridization of Two Distinct Species.



An Amaryllis One-Quarter Natural Size.



The Two Central Raspberries were Produced from the Two Varieties at the Ends by Crossing and Selection.



Sweet Vernal Grass, Showing Great Variation in Size of Plants Grown from the Seed of One Plant.



Cactus Ready for the Hybridizer.

lished types built up under Mr. Burbank's methods would be impossible. There is no end of them. Upon no species of plant life, be it flower, berry, or fruit, has crossing and hybridizing failed to produce the most wonderful changes. When a change is noted the avenue is opened for variations in every direction. Time is the greatest element in all plant modifications. It may take years to develop to the full realization of the hopes of the plant breeder. Any property, color, shape, size, or fragrance may remain dormant, to be brought out under the influence of improved cultivation or the stimulation of some influence imparted by the hybridizing process. The best or the worst qualities of a plant may be confined in a single one. The expert plant breeder will combine many traits in order to produce the type he is searching for.

The element of precision enters into all of Mr. Burbank's operations. The depth to which seeds should be planted, nature of soil required, the proper temperature, exposure, shady or otherwise, moist or dry—all of these particulars are observed and recorded with infinite care. When the plants appear a careful selection is made of the most promising. These selected plants are never lost sight of. Then preferences (for their mute language is understood) are humored. If color is the object sought, every other tendency is lost sight of but that; so for size, form, or fragrance. Later a combination of all these qualities may be merged into the one. Cultivation will not produce new type, but crossing and hybridizing almost always will.

Pollination is effective only at the moment selected by the plant itself. To some plants the time is when the bees appear. The evening primrose selects the time when the night moths are abroad. Pollen is sometimes applied with the finger; a camel's-hair brush is used in the case of certain plants. Pollen is gathered early in the morning. Sometimes buds are picked and the pollen taken as they ripen and open. The plants thus treated are tagged and watched and their character and habits recorded. It may be years before the results of all this care and detail are known to a certainty.

Mr. Burbank expresses himself as follows regarding the vast possibilities of plant breeding. They can hardly be estimated.

"It would not be difficult for one man to breed a new rye, wheat, barley, oats, or rice which would produce one grain more to each head, or a corn to produce an extra kernel to each ear, another potato to each plant, or an apple, plum, orange, or nut to each tree.

"What would be the result? Nature would produce annually without extra cost or effort, 5,200,000 extra bushels of corn, 15,000,000 extra bushels of wheat, 20,000,000 extra bushels of oats, 1,500,000 bushels more of barley, and 21,000,000 extra bushels of potatoes. Not for one year only, but as a permanent legacy for all future generations."

Truly a wonderful outlook!