

"THE ART & SCIENCE OF BREEDING PLANTS & ANIMALS"

A paper delivered at the September 6, 1984 meeting of the Atheneum Society by Martin Standard.

8:30

Many of our members have chosen to give papers on the life of some great man or woman, and in every case the audience has seemed to enjoy them. That was because the membership is composed of the type men who were born with a fire and determination to succeed and they enjoyed hearing how others have done it. Whether you have already succeeded or are young and still striving, there is much to be gained by studying the lives of the great. I would even suggest that you encourage your children or grandchildren to make such studies. After all, you do have a moral obligation to attempt to guide those youngsters.

Studying the approach to life of great men or women gives us a guideline by which to compare our own approach, and their achievements give us reason to believe that we too can fulfill our dreams.

Tonight I am giving you a paper on one of these great men, <sup>one</sup> who has done much for mankind and is known worldwide as the most outstanding pioneer in the field of "Plant Improvement". He is LUTHER BURBANK, the father of the "Burbank Irish Potato", now known commercially as the "IDAHO POTATO" and found ~~found~~ for sale in almost every grocery store. I bought some in Krogers last week.

Burbank was born in Massachusetts in 1849 and died in California in 1926. He did his work long before the modern scientific methods of plant breeding were known, so he truly was a pioneer, beating his own path every step of the way.

Obviously I cannot give you a 3-semester course in plant-breeding in the time allotted. However, I can give you a brief description of the marvels which have been accomplished and point out to you the tremendous possibilities which lie ahead. I think this is important for two reasons. First, you are an important persons in this fabulous agricultural community known as Christian County, and for this reason should be fully aware of everything that affects it. Secondly, you may have a child or grandchild looking for a profession, one that offers excitement, travel, prestige and remuneration comparable with the best. The field is so great that any boy or girl can advance to the full capacity of their abilities, be it great or small.

To help you visualize the work done by Mr. Burbank and to save time in needless description by myself, I am passing out Xerox copies of a series of photographs pertaining to items I will discuss in this paper. I will direct your attention to the proper photograph as I commence my discussion on it.

Mr. Burbank's greatness stems from his exceptional power of observation, and his ability to analyze the cause and effect of the slightest improvement in a plant. These traits were essential because he was searching among thousands of new plant seedlings for the slightest improvement upon which he could advance toward his goal. His determination was beyond belief, sometimes keeping him on the same problem for years but it always paid off.

You in this audience who have succeeded had many of Mr. Burbank's inborn qualities, otherwise you could not have succeeded. And it was thought that the rest of you had those qualities or you would not have been voted into the Society. Therefore, I challenge each of you to go forward with vim and vigor, never doubting that you will reach your goal.

Mr. Burbank was my Father's hero on the farm where he at the turn of the century was constantly trying to up-grade the quality of our crops, grains and vegetables, as well as the quality of our stock. (And here, I might tell you that the methods of improving animals are almost identical with those for improving plants).

It followed as the night the day, that later Mr. Burbank should become one of my idols, because at the tender age of six my Father enrolled me in the "B. B. Institute of Knowledge". This was a sort of tutorial type of school, wherein my Father was the Head Master and I was the "Student Body" --- I might explain that the "B.B." stands for 'Behind the Barn', and that

is where all little boys were taken for learning the facts of life when I was a child.

Another time I will tell you young guys some other things I learned in that Private "B.B." School!!!!

Mr. Burbank performed more than 100,000 experiments during the forty years he devoted to plant improvement. Yet, it is considered by history that his greatest contribution to society was to divorce the then scientific community from the attitude that "It cannot be done" to an attitude of "It might be done if we try hard enough". He encouraged thousands of bright minds throughout the world to devote their lives to plant breeding --- he opened their eyes to the great possibilities of improving every plant and of creating some new ones which the world had never seen. He once said "give me the specifications of the plant you want and I will develop it".

A hundred years ago he pointed out that developing new or improved plants was the only way the ~~the~~ ever-increasing population of the world could be fed. He has certainly been proven correct as virtually every fruit, nut and vegetable found in the groceries today is different and vastly improved over what existed when we were boys.

The quantity produced per acre, the flavor, the nutritional value, the appearance, the keeping and shipping qualities and many other characteristics have all been improved to the benefit of mankind.

Many very brilliant and capable minds sit idle for lack of a spark to set them off and someone to show them the general direction in which to head. Burbank provided this spark and direction to many and now 50 years after his death, many are being motivated by the lessons he taught. I myself have used some of them to good advantage in my flower breeding.

It is said that "Money talks". Well, it spoke very loudly to Mr. Burbank because his experiments were terribly expensive, requiring perhaps 50 to 100 men to care for the thousands of plants involved in a single experiment. He apparently struck it rich in his first experiment, the development of the 'Burbank Potato' and was then able to expand his experiments into other things on a larger and larger scale.

A discussion of his development of the BURBANK (or IDAHO) potato will illustrate the monetary value of his plant improvement work.

When 17 years old he found a pod of seeds on a potato plant in his Mother's garden. It was a rare thing as potatoes seldom make seed pods, so with the permission of his Mother he planted the seeds. There were 23 seeds in the pod, each seed representing an entirely new variety, just as each of your 23 children would be different if you had that many, although each had the same parents. He cared for the new plants until digging time and then laid ~~laid~~ all of the potatoes out for comparison. The results are shown in Photo "A".

**A** PHOTO "A":

You will note that most of the potatoes were worthless. However, 2 or 3 were slight improvements over most potatoes.

or at least as good. He took the 2 or 3 good ones and bred them together, thereby concentrating the good qualities and among the results there were some showing distinct improvement. By this method of cross-pollinating the best of each generation, he produced in just a few generations a potato which far surpassed any potato the world had ever seen. This was a stroke of pure luck because it usually takes much longer to achieve such an improvement.

This was in 1871 when he was only 22 years old, and that first success inspired him for the rest of his life. He named this marvelous potato the "Burbank Potato" (now called the Idaho Potato), and now 114 years later it is still the principal potato grown by the commercial growers.

Not only was this potato superior in size, taste, smoothness and appearance, it was so prolific that it produced four times as many pounds per acre as the potatoes then in general use and this of course vastly increased the profit of the growers. It was estimated that the growing of this potato added \$17 million dollars per year to the income of potato growers in America. Naturally its use quickly spread throughout the world and BURBANK'S name became famous.

**B** PHOTO "B":

Photo "B" shows the "BURBANK" potato. Notice how smooth and perfect it is compared to its ancestors shown in Photo "A".

With his early success Mr. Burbank, like an Independent Oil Operator who became wealthy on his first oil producer, apparently had enough money to go into plant breeding in a big way. He worked on many kinds of vegetables, fruits, nuts and

flowers, often spending years culling out over a hundred thousand seedlings before finding any real improvement. He attempted anything which he thought would be of value to mankind.

To me one of his most interesting accomplishments was the successful removal of the spines (or thorns) from the desert cactus, which grew on millions of acres in our driest deserts where nothing else would grow and which sometimes did not receive a drop of rain for 2 or 3 years, or perhaps even for 10 years.

Here, let me tell you of a <sup>one</sup> boy from of those desert regions who was in my son's outfit in the Army. He told my son that he had never seen it rain in his life until he got in the army. He said that it had rained a few times but it was always at night when he was asleep.

Why did Mr. Burbank want to remove the spines from the cactus? I will quote from his own recorded thoughts:

"He knew that here was a plant which has shown its ability to outdo Alfalfa five to one and which has promise to support the cattle of the world on what have been nothing but waste places.

"He knew that cactus, although there may not be a drop of rain for a year, or two years or even ten, still contrived to get enough moisture out of the deep soil and out of the air to build up a structure which by weight is ninety-two per cent water -- plants which contrive to absorbe from the scorching desert where temperatures sometimes soar to 130°, and to protect from the withering sun, enough moisture to make them nearly as juicy as a watermelon.

"Here are plants he said, which are vertiable wells of water growing in a land where there are no springs or brooks --- nor clouds to encourage the hope of a cooling rain; here are plants which are rich in nutriment for man and for beast, here in the desert where the demand for food is the most acute and the supply of it most sparse.

"And here they are ruined for useful purpose by the spiny armor which places their store of nutriment and moisture beyond reach of man or beast."

He, as you and I, knew that the desert soils were tremendously rich in minerals and all that they needed to make them one of the most productive soils in the world was to give them water or give them a plant that would grow without water.

As he searched for the answer, he realized that there would be no way to increase the rainfall or to bring water to the desert. At this point he must have recalled the reputed saying of Mohammed "If the Mountain will not come to Mohammed, then Mohammed will go to the Mountain", because he decided that he would accept the desert as it was and change the cactus that grew in it from a worthless plant into an edible plant. And this he did by breeding a cactus without spines but with all of the desirable qualities, and thereby producing a plant which was a virtual storehouse of nutrition and moisture for cattle, antelope or other grazing animals.

As an indication of its toughness and ability to do without water for long periods, in one of his experiments he left a cactus plant hanging in a closet for 6 years and 8 months.



Then he planted it in desert soil and immediately it began to grow vigorously. Another interesting characteristic of the cactus is that when and if it does rain, once a year or once in 10 years, at the first drop of rain the pores of the cactus fly open and absorbe every bit of the moisture and stores it, and then preserves the storage by quickly closing its pores to keep it from evaporating.

C PHOTO "C":

Photo "C" shows a patch of his "Spineless Cactus". Notice the density of these four year old plants after having harvested a million pounds from this one acre. The vigor of growth is illustrated by the fact a single scorching hot day in June will add one ton of weight to this acre of cactus.

Now lets look at some other copies of Mr. Burbank's photos.

D PHOTO "D":

Photo "D" will show you why the tropical islands of the South Pacific are all ringed with coconut palms. When the coconut falls into the salt water, the top eye sends up a large leaf which acts as a sail for the floating coconut. The wind drives it across the ocean to an island and as soon as the waves toss it upon the shore, the bottom two eyes quickly put out roots and another palm tree grows.

E PHOTO "E":

Photo "E" will show you the modern beautiful snowball blossom which he produced from the wild one.

Another of his flower marvels was the creation of "Nicotia" by crossing our common tobacco plant with the petunia. I have seen it in pink and white and it is beautiful.

F PHOTO "F":

Photo "F" will show you how he more than doubled the edible meat of the orange by decreasing the thickness of the rind. Think of the additional profit made by reducing the cost of shipping worthless peeling weight.

G PHOTO "G":

Burbank spent years on the improvement of the Cherry. He planted thousands of seeds from planned crosses. From the seedlings he selected 500 which showed promise of improvement. He then grafted the 500 on to one single tree, which is shown in Photo "G". This means that virtually every limb on this tree is a separate variety of cherry. He put them on one tree to make the comparison between the varieties more valid, as the growing conditions would be exactly the same for each variety under this system, and there would be no extraneous cause for one to be larger, sweeter or more prolific than another, such as varying soils or moisture conditions if grown on separate trees. It also enabled him to compare side by side the many varieties and to find the smallest sign of improvement, and saved him miles of walking in making his cross-pollinations.

H PHOTO "H":

Photo "H" will give you a good idea of how much plants can be improved. Pictured is the modern Amaryllis which sells for about \$10.00 per bulb. In the same vase with it are its tiny parents.

This is a spectacular example of the "HYBRID VIGOR" factor coming out in the children of widely diverse parents. (This 'hybrid vigor' is a major factor in the improvement of

animals and poultry where two pounds of meat is more profitable than one pound).

Burbank did similar work in the development of the modern TUBEROUS BEGONIA, which has a gorgeous bloom 3 or 4 inches across in many bright colors. I saw its native parents growing wild in the Andes Mountains and their blooms were about the size of your thumbnail and no prettier than a common weed.

I PHOTO "I":

Photo "I" will show you the work he did with the walnut, greatly increasing its size, thinning its shell and improving its taste.

J PHOTO "J":

Photo "J" shows how he improved the asperagus. The long asparagus cost no more <sup>to produce</sup> than the short one but brings double the price in the market.

K PHOTO "K":

Photo "K" shows the actual size of a Burbank plum and its wild ancestor. To the grower there is an immense profit advantage in the Burbank plum and its eye-appeal to the customer is much greater.

L PHOTO "L":

Photo "L": shows you our modern corn and the tiny wild parent from which it originated. While Mr. Burbank did some improvement on the corn, the giant steps in its improvement had been made long ago by the Indians, which should bring us to this observation:- All of the great brains of the world have not come out of some American University with a scientific

Photo tag stuck on them.

I am reminded of the comments of my taxi driver the day the Russians put up their first Sputnick. I asked the driver what he thought about the Russians putting up the Sputnick and he replied, "Cap, don't you believe that --- them guys can't even speak English."

L Photo "L" is perfect for studying the techniques of Mr. Burbank. The average person will look at this ear of corn and every grain looks just alike, just as they say say that 'every Chinaman looks alike'. There are approximately 1,000 grains of corn on this ear and everyone is different, yes, just as different as each of your 10 children if you have that many. Mr. Burbank, more than most people perceived this difference in the grains, and out of the 1,000 grains, he would select perhaps 10 that showed the most improvement over other grains. He would then plant these 10 grains as new parents and cross-pollinate them, and again select the best grains for several generations. Just as you cannot make a silk purse from a sow's ear, Burbank knew that he could not produce good corn from culls, so he discarded 990 of the 1,000 grains on the ear, thereby reducing his work tremendously.

This same principle of selectivity applies in the improvement of all plants and animals, even unto people. Therefore, you might be justified in trying to tell your son to do a little evaluation before marrying.

Mr. Burbank once told the Vegetable Canning Association "Give me your specifications for the vegetable you want and I will develop it." This he did time and time again. He sweetened the vegetables, he increased their vitamin content, he increased their keeping qualities and eye appeal for sale, but, of most importance to the Canning Industry he increased their profit by

reducing the cost of picking and handling.

To illustrate how he did this, let's consider the tomato: In our home gardens we want one plant of tomatoes to spread out its production from about July 4th until frost. This means picking the ripe ones every few days. In the Canning Industry, they cannot afford to go picking every few days. They want all of the tomatoes in the field to ripen at the same time so that the entire crop can be harvested by a machine instead of by hand, and by having them all ripen at the same time the entire crop can be harvested by one trip of the machine through the field. This affords a great saving in labor cost.

Also, instead of having one tomato three times as large as another, as we find among our garden tomatoes, the Canning Industry wanted uniformity of size and appearance, and without blemishes which would have to be cut out by hand. Burbank gave them all of these things. However, I might mention one thing: the canners did not put the requirement of 'good taste' in their specifications to Mr. Burbank and that is why we end up with winter tomatoes coming from California with no taste but tough enough to be picked and canned without damage or to be used as red baseballs by children playing in the snow. <sup>TP</sup> Mr. Burbank was successful in making crosses between many plants which had previously been considered impossible to cross. He was successful because he was perhaps the first plant breeder to realize that BOTH the male (pollen) and female (stigma) parts of the flower had to be "READY" for the act of pollination. If you will examine carefully you will find that each indicates its readiness when they are. The male part is nearly always "READY"

before the female part, usually by several hours but sometimes by a day or more.

If some of you 'horny' husbands would take a lesson from the flower and realize that your "object of love" needs a little time to get 'ready' for pollination, you would not hear so many complaints of 'I have a headache'!!!!!!

Once I was giving a talk to a women's flower club on hybridizing and when I got to the point of explaining the "readiness" factor, one lady held up her hand and said "I didn't know flowers were so much like people."

At another meeting on hybridizing, a lady held up her hand and said, "I just love what you are saying about making crosses but I don't quite understand how you do it --- do you plant mama and papa in the same hole?"

One brief paragraph on animals and I will say Goodnight. I mentioned above that not only plants but animals are constantly being improved. The hens are now laying almost twice as many eggs as they used to on the same amount of feed. Broilers and fryers are grown to saleable size in almost half the time on the same amount of food. Milk cows are giving richer and more milk, and beef cattle are growing larger and faster on the same amount of food than they did when I was on the farm. These are mostly genetically controlled factors. Indicative of the changes which have been made, I went to the Kentucky State Fair in Louisville shortly after I retired, and as I strolled through the animal exhibits I did not see a single breed of cow, hog or poultry which was rated among the best when I was a boy.

While Mr. Burbank did much to improve the keeping qualities of individual foods, it was Napoleon Bonapart who made the "canning process" possible. He needed a broader diet which could be transported with his armies, so he offered a prize of

twelve thousand francs to anyone who would devise a practicable method of preserving perishable foods. Just one more example of how "Money talks."

It is estimated that there are a half million species of plants in the world, yet only a few hundred are used to any important extent for food. Which means that the field is wide open for improvement and development of many others. Among new foods developed within the last 75 to 100 years is the tomato, known as the "love apple" which was thought to be poisonous. The lima bean came to us from South America; the potato, discussed in detail above, was unheard of in the civilized world until the white man went to Peru.

Representatives of all leading nations are scouring the remote places of the earth for crops which promise to increase the food supply, so if your kids are looking for travel and excitement, the road is open. The Mission Fathers of the South-west brought in the olive and the date from the Mediterranean region, while a woman missionary traveling in Brazil sent us cuttings from which our great orange-growing industry has developed.

The future is very bright in this field of work and it is certainly an exciting one, so let me encourage you to take your copies of the Burbank photos home and discuss them with your children.

Goodnight.

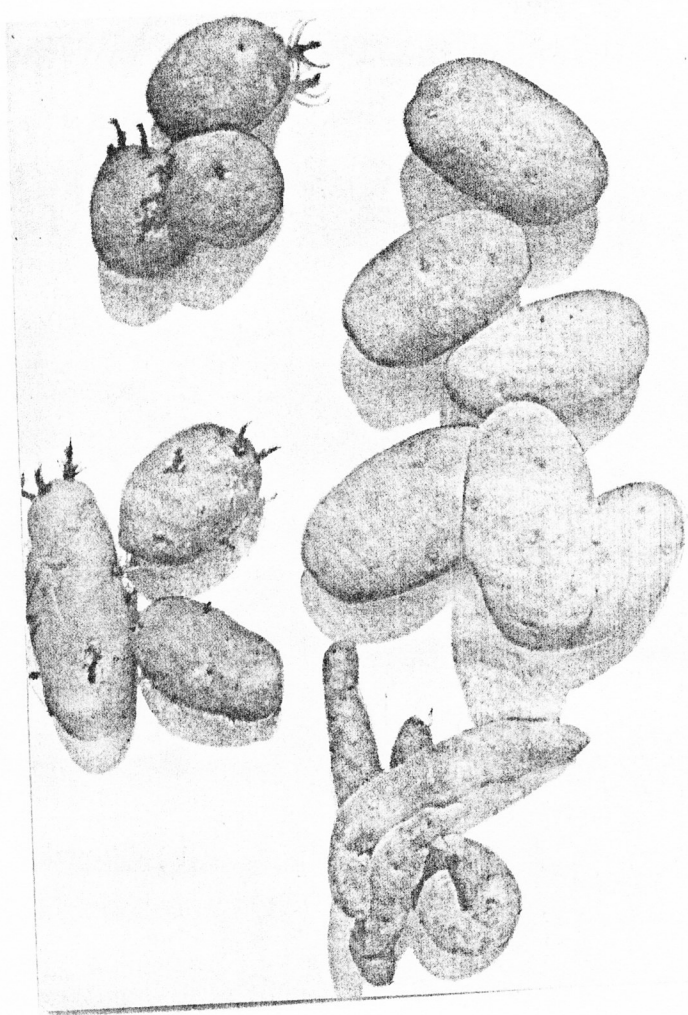
Martin Standard

12 EXHIBITS  
PERTAINING TO PAPER DELIVERED  
BEFORE THE ATHENEAEUM SOCIETY

By: Martin Standard

9-6-84





*Some Potato Seedlings*

*A direct color photograph print of different kinds of potatoes produced from a single potato seed ball. It will be seen that while all of these potatoes are small, some are more shapely than others and at the bottom of the picture will be seen a common variation of tubers known as "snake potatoes." These forms represent different stages in the history of the potato and almost any potato seed ball will give variations as wide or wider than these.*

PHOTO  
A



### *The Burbank Potato*

*An improvement in one of the most important crops which, as has been stated by a member of the United States Department of Agriculture, is adding seventeen million dollars a year to the farm incomes of America alone, to say nothing of foreign countries. This potato was produced by Mr. Burbank when in his teens, and was the result of finding a seed ball on his mother's potato patch. The perfection of this potato involved no form of crossing or hybridization, but was brought about solely through utilizing the forces of environment and heredity—and by careful selection.*

PHOTO

**B**

## LUTHER BURBANK

bulbs are nearer the surface than those of the plants which grow where the sun gets at them.

On the other side of the same canyons the bulbs grow deep in the soil, and the leaves and the blossoms transform themselves to protect their moisture from the sun.

Which is all that the cactus did when the sea was turned into a desert.

\* \* \* \* \*

Along the Pacific coast from Oregon well down into California, there grows a common wild flower of the pipewort family.

Inland a little way, say ten or fifteen miles, the stalk of this plant is smooth and with hardly the suspicion of a hair. But along the shore, where the northwest winds pick up all of the finer particles from the beach and form a sand blast, the plant has developed a stalk so covered with hairs that it is as woolly, almost, as a sheep—perfectly protected against the sand-enemy.

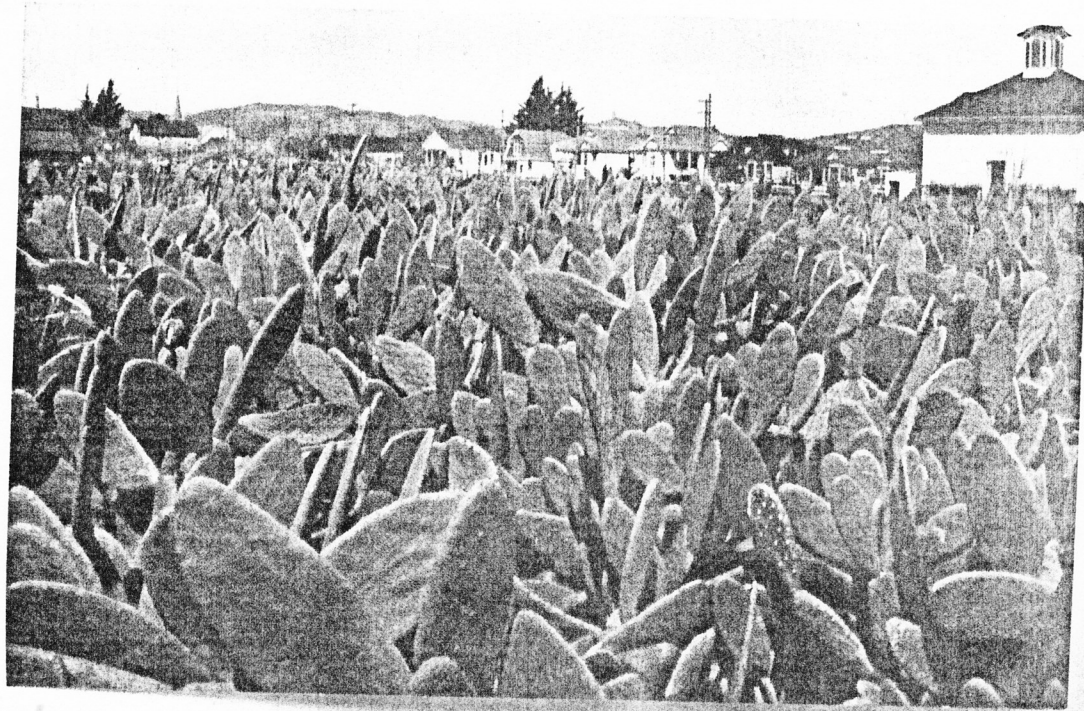
Which is all that the cactus did when the antelopes came to destroy it.

\* \* \* \* \*

Let the cactus, battle-scarred and inured to hardship, teach us our first great lesson in plant improvement:

That our plants are what they are because of environment; that simply by observing their

[32]

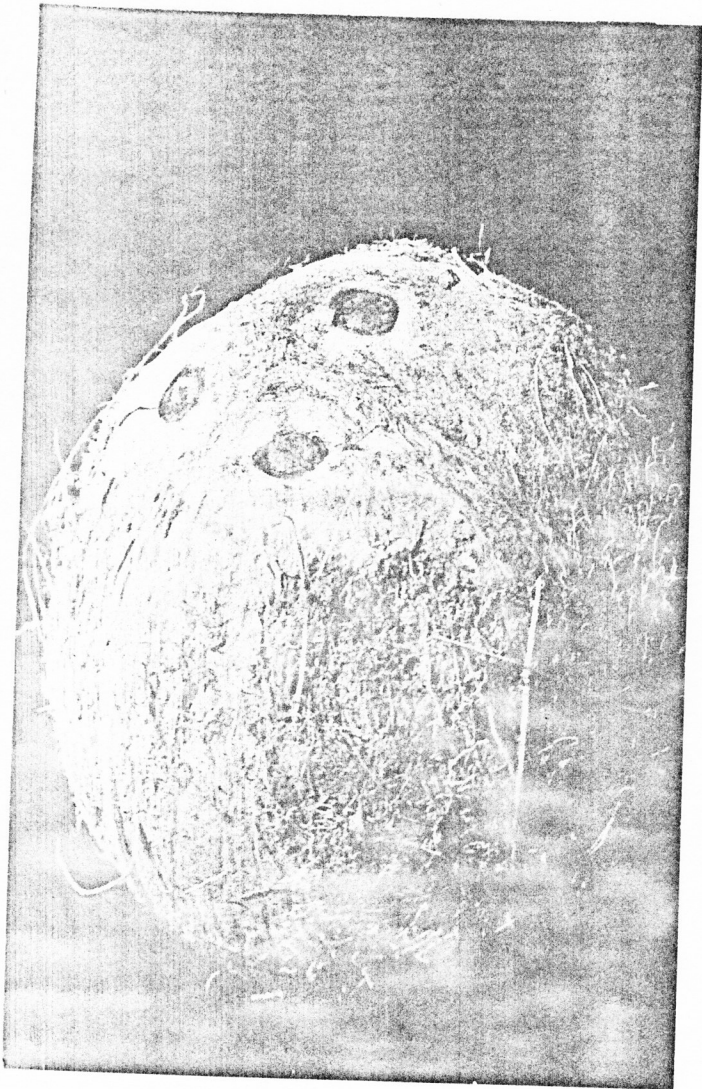


## Spineless Cactus in the Patch

This direct color photograph print will give a good idea of the density which a field of Mr. Burbank's cactus attains. All of the cactus shown here is under four years old, some of it less than three. Each plant was started simply by planting a single slab in the hard adobe soil—a soil on which few useful plants will grow. On the acre on which this picture was taken there is still a growth of cactus, in spite of all that has been cut off, weighing more than one million pounds. The rapidity of cactus growth is illustrated by the fact that a single hot day in June will add a ton in weight to this acre cactus patch.

PHOTO

C

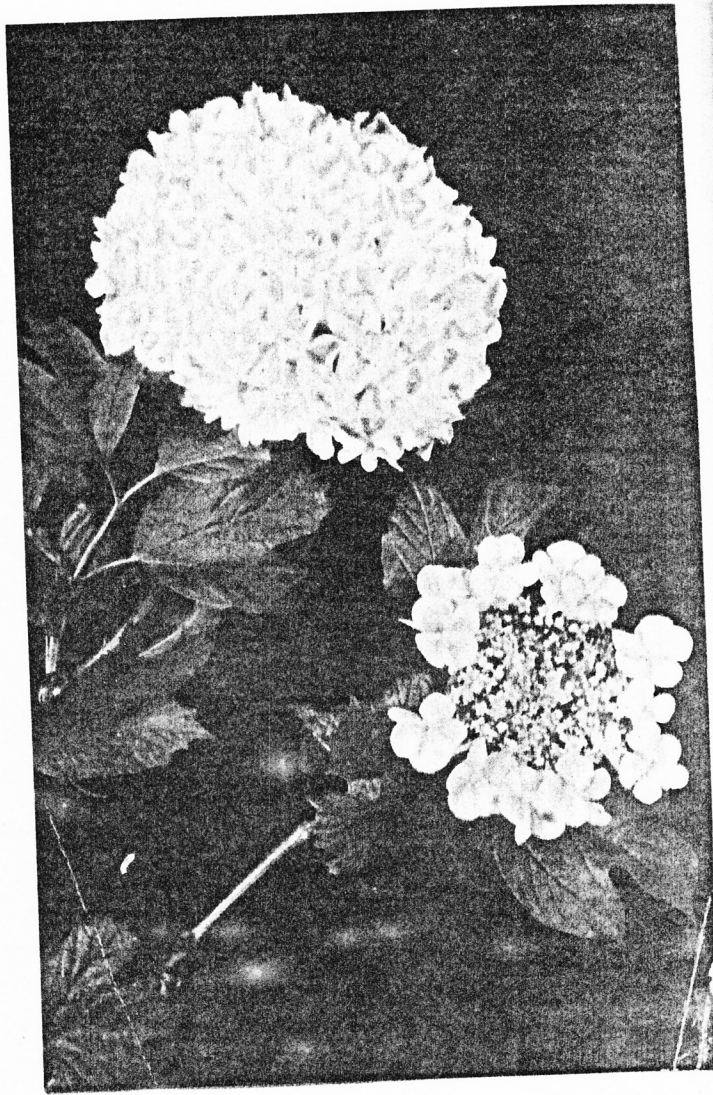


### *The Coconut's Three Eyes*

*As this coconut falls in the water, one of the eyes shown at the top throws up a sail-like leaf while the other two begin to throw out a mass of roots within the excelsior-like covering, but inside of the waterproof cover of the nut, which for the purpose of illustration, has been removed. When the sail has carried the nut to a new environment, the roots burst forth and the sail grows into a taller stalk, which finally becomes the trunk of the new palm.*

PHOTO

**D**



### *The Snowball, Tame and Wild*

*The upper snowball is the one which grew in Mr. Burbank's yard, or such as commonly grows under cultivation. The snowball below is a wild one such as grows in the woods. The wild snowball, it will be seen, uses the flowers to attract messengers of pollination to the reproductive mechanism which the flowers encircle. The upper snowball, however, has lost its power of reproduction by seed and advertises to us, instead, to perpetuate its race.*

PHOTO

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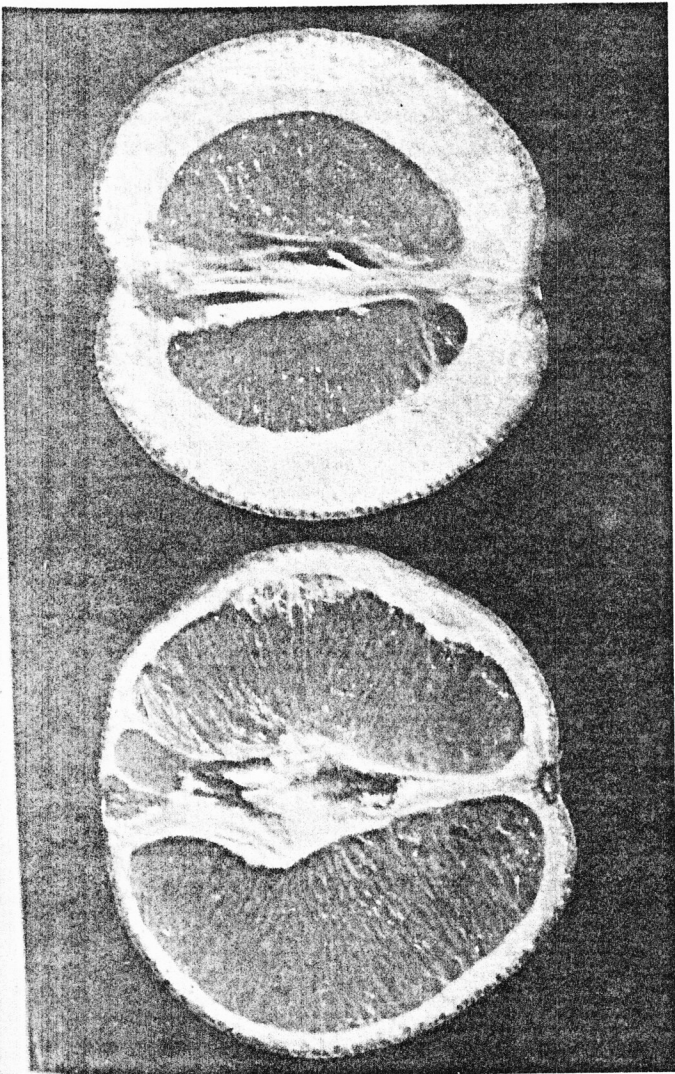
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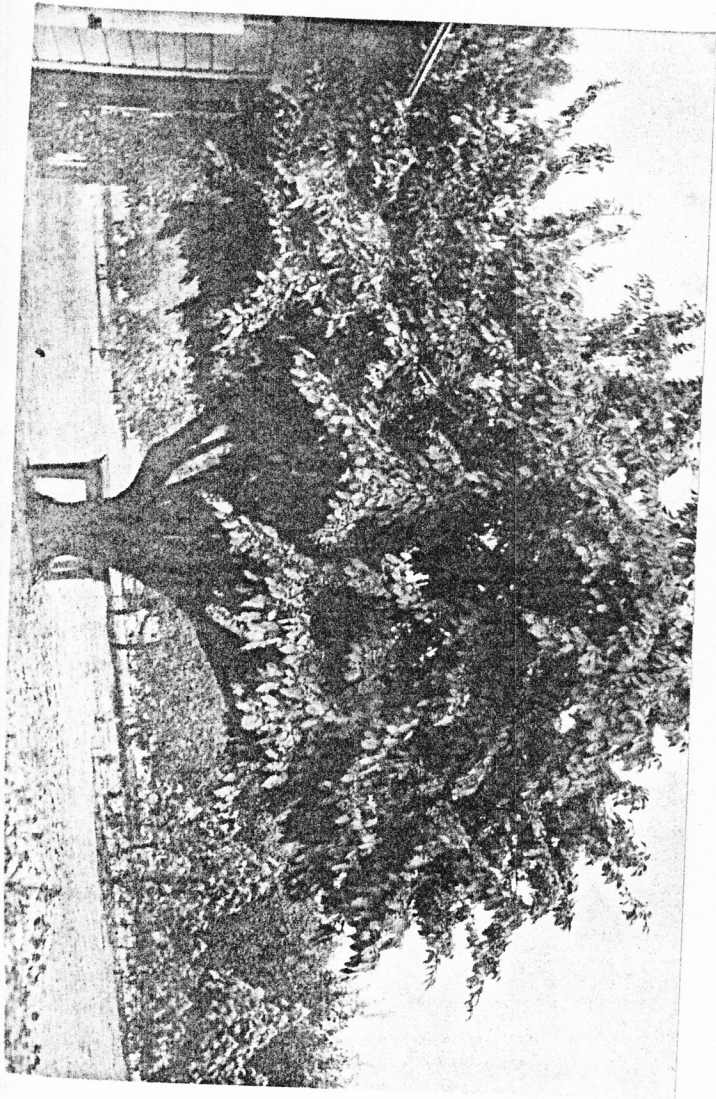


### *Less Rind, More Meat*

*This color photograph print shows a good comparison of the orange as it formerly grew and as it grows today, since the orange has been transformed to meet our ideals. Simply by selecting the kinds which have been propagated this improvement has been worked.*

PHOTO

**F**

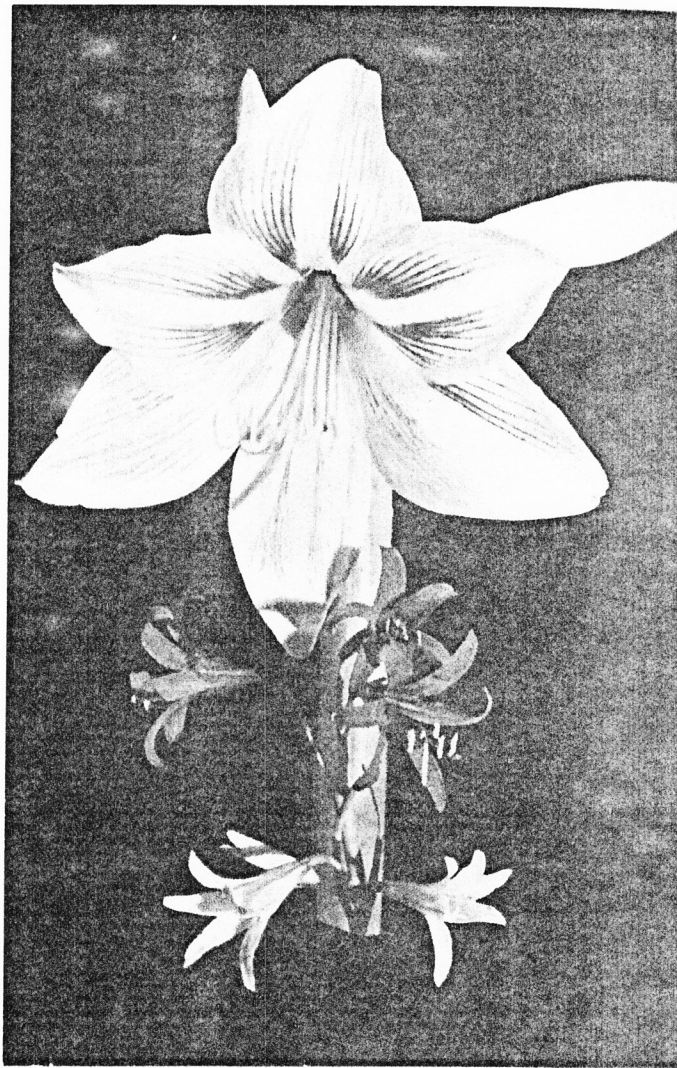


*Five Hundred  
Kinds on One Tree*

*This direct color  
photograph print shows  
Mr. Burbank's famous  
cherry tree on which he  
has produced as high as  
five hundred kinds of  
cherries at the same time—  
this for the purpose of  
easy comparison  
and intelligent  
selection.*

PHOTO

9



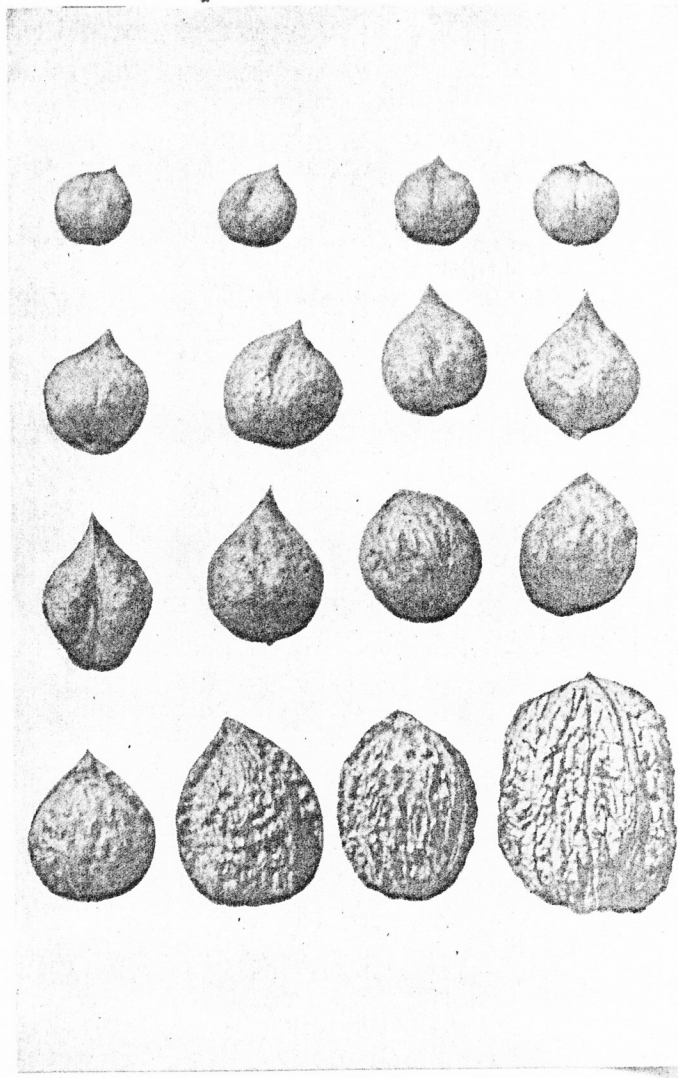
*The Amaryllis and Its Parents*

*Having effected a combination between species, Mr. Burbank, in the amaryllis, made a combination between genera. In this direct color photograph print the improved amaryllis and its tiny parents are shown in truthful proportion.*

PHOTO

H





*Variations in Walnuts*

*All of the variations pictured above were secured by crossing. Mr. Burbank, in his walnut work, has grown nuts by the wagon load for the purpose of finding one or two which came near his ideal.*

PHOTO

**I**

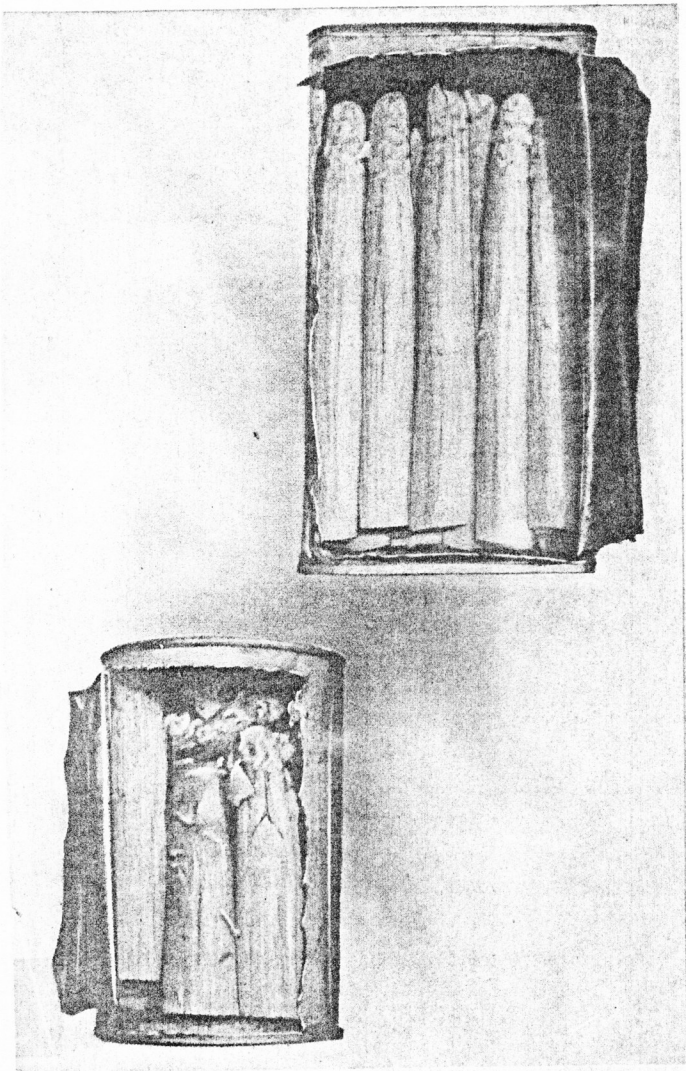
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### *Both Good Asparagus*

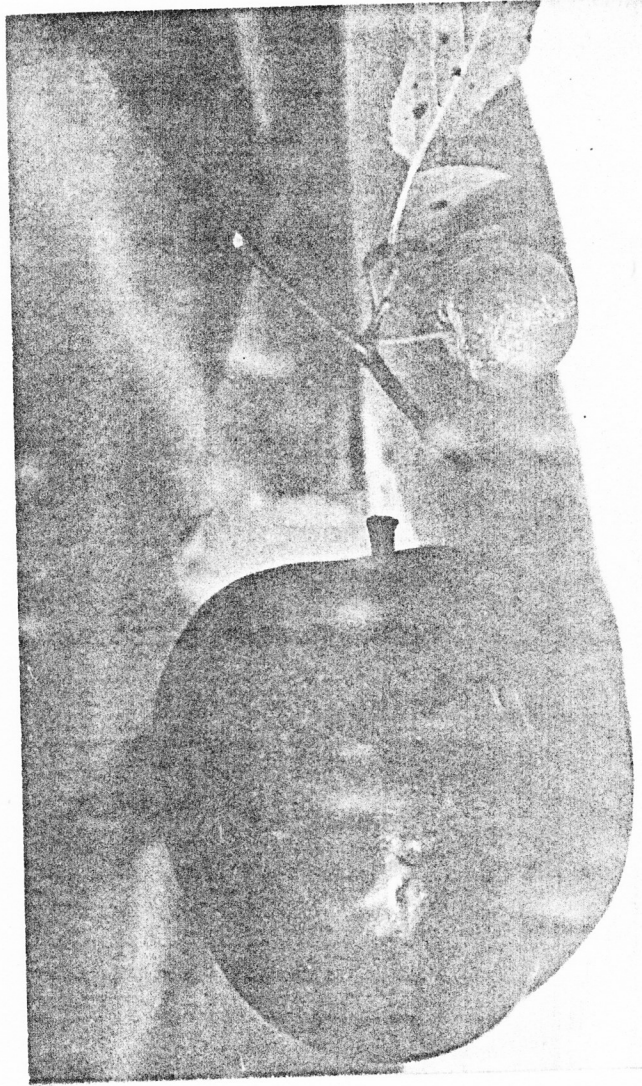
*This direct color photograph print shows the advantage of selecting asparagus for durability as well as for size and flavor. One tin shows stalks which are whole and tempting—the other stalks which, during the process of cooking and canning, have broken and become messy. The unbroken asparagus costs no more to raise but commands twice as great a market price.*

PHOTO

J

*A Burbank Plum  
and Its Wild  
Ancestor*

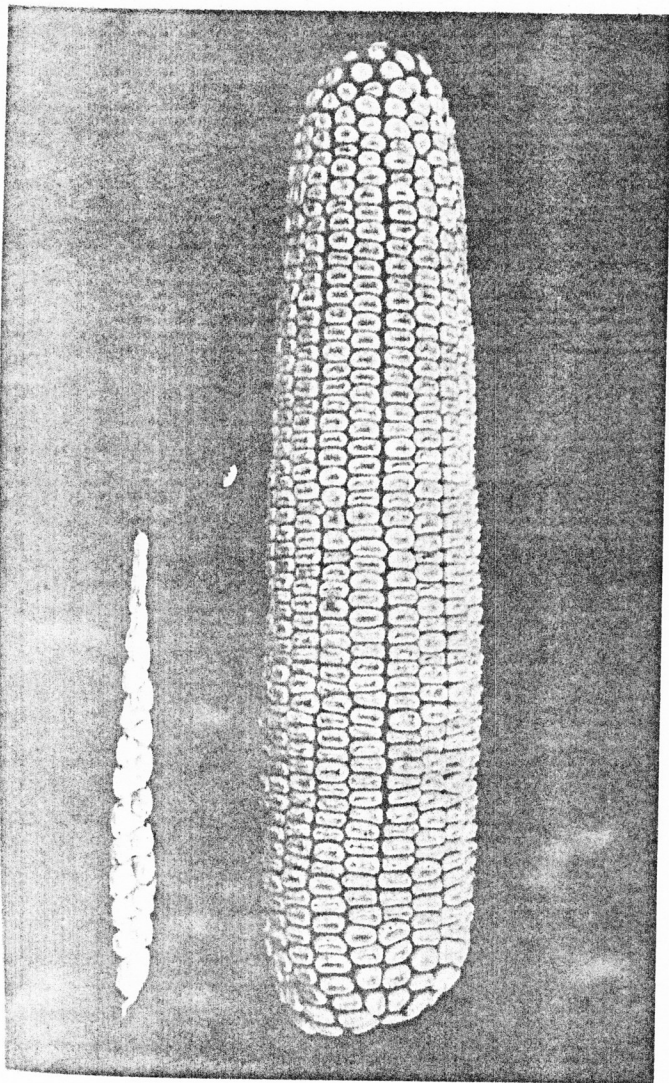
*When plants grow wild there is little need for large quantities of luscious meat; but as they come under cultivation the stone grows less and the meat not only more but better. This direct color photograph print is of one of Mr. Burbank's latest plums and of a wild plum such as grows in the woods near Santa Rosa; both are actual size.*



PHOTO

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### *Our Corn and Its Tiny Parent*

*In the direct color photograph print shown here a typical ear of "dent" corn is placed for comparison beside the tiny teosinte ear which the American Indians discovered and improved.*

PHOTO

L