AMERICA'S
CROP HERITAGE

Howard Dorsett and David Fairchild (seated) worked together for twenty years, trying to increase the number and improve through introductions the quality of the fruits and vegetables of the United States. (From *The World Was My Garden* by David Fairchild, Chas. Scribner's Sons.)

AMERICA'S
CROP HERITAGE

The History of Foreign Plant Introduction by the Federal Government

By NELSON KLOSE
Associate Professor of Social Sciences
Central State College

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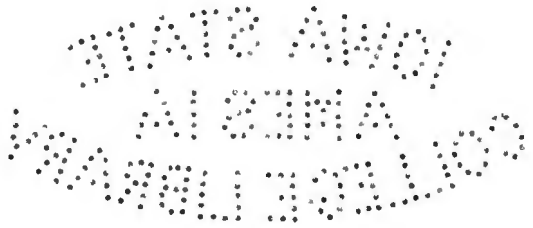

Foreword

It is now sixty-one years since my uncle lit the candle in the North Hall at Ames that I have carried and still carry—the candle of Plant Introduction. It was in that autumn of 1888 that I came to stay with my uncle, Dr. Byron D. Halsted, and he taught me how to grow pollen grains of the long and the short stamens of the buckwheat flower. Professor Buel was still alive and I, a boy of scarce 19, used to listen to his quaint accounts of how the Russian apples were introduced. I really began my career in this North Hall on the campus of the Iowa State Agricultural College, although I graduated from the Kansas State Agricultural College of which my father was president.

I see myself tagging my uncle in the fields and prairies of Iowa or listening to my aunt as she played Beethoven's sonatas in the little red brick house there on the campus. That was sixty-one years ago. Sixty-one years of romantic life—with useful plants always as the golden thread that ran through it all.

I think youths of this new era will get from reading this book the notion that to "work" with plants as the Plant Introducers have done is not really work at all but intense interest—absorption, in a world that lives and changes every instant of time.

This account presents the facts as they have come down in stories and personal narratives relating to the first arrivals of foreign crops in the United States. The author has distributed credit for these first introductions and it seems to be the instinct of human beings to accord credit to whoever is first to do a thing, no matter how many people took part in the later development of that thing—be it a crop or an invention. But we cannot overlook those persons who sent in foreign seeds that had promise of proving valuable as additions to the varieties or species of

plants in cultivation in this country. Over 160,000 such entries were recorded and may be found in "Plant Inventories of the Section of Seed and Plant Introduction of the Department of Agriculture," which my colleagues and I—especially the late O. F. Cook and P. H. Dorsett and Walter T. Swingle, who is still living—took great pains to record.

I am still so in the habit of writing out and exploring for new plants that life holds the freshness which comes to those who play with living rather than inanimate objects and to whom the future events have greater attractions than have the events of the past.

I hope this book will touch the lives of many thousands of men and women who were still unborn in 1898, but who are wondering what kind of cultures the humans inhabiting the globe will build during their lifetimes. They cannot build without plants the beautiful world of our dreams.

DAVID G. FAIRCHILD

The Kampong
September, 1949

Preface

Through a historical account of the introduction of America's present crops, this book endeavors to close a gap in the story of American economic development. It is intended primarily to unfold to the general reader the origin of familiar agricultural products, but also it may serve as a text for courses in agricultural history. Students of economic history and the various plant sciences should find it a useful reference. It is my hope that it will afford an insight into the ancient process of cultural transference—the contributions of other ages and countries to America.

The study illustrates how young and growing nations progress by adopting the tools of economic production from older nations. The search for and introduction of agricultural plants by the United States Government and other agencies, exhibits this borrowing process, and reveals America's agricultural debt to foreign countries.

Plant introduction by individuals and agencies other than governmental is necessarily slighted, because the records of individual efforts are scantier and less reliable. The work of the Federal government in this field has been more significant because it was better organized and because more adequate records of introductions have been kept.

The *introduction* of seeds and plants for the development of new crops or superior varieties of established crops has been emphasized more than the methods of selection, breeding, and adaptation. Particular attention has been given to the organization, aims, methods, and effects of Federal plant introduction prior to the establishment of the Bureau of Plant Industry.

The Library of the Department of Agriculture at Washington, D. C., which houses the greatest collection of documents on

agricultural history to be found, supplied much of the material for this book. Supplementary information was found in the manuscript archives of the Patent Office and the Departments of Agriculture, Navy, and State. I also consulted sources in the Library of Congress. Other bibliographical references will be found at the end of each chapter.

I wish to acknowledge here the assistance I received from Dr. W. P. Webb, chairman of my supervising committee for the doctoral degree, and other members of the committee at the University of Texas who gave much time to reading and helpful criticism in the first preparation of this work as a doctoral dissertation. Dr. Wood Gray, George Washington University, and Mr. B. Y. Morrison of the Bureau of Plant Industry gave valuable guidance and useful information. I also frequently consulted Dr. Everett E. Edwards of the Bureau of Agricultural Economics.

Acknowledgements for criticism, suggestions, and information also are due to Mr. Marshall Townsend, Mr. Merritt Bailey, Dr. Earle D. Ross, and Dr. Max M. Hoover of Iowa State College, and to Mr. C. O. Erlanson, Assistant Chief of the Division of Plant Exploration and Introduction. I am grateful to Dr. David G. Fairchild for permission to use several photographs he made; and I am indebted to my wife for her assistance in proofreading and invaluable cooperation.

NELSON KLOSE

February, 1950

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AMERICA'S
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~1~

Early American Agriculture

PLANT INTRODUCTION has played a significant role in the growth of American agriculture. It has wrought tremendous changes in the American landscape, and has added many new food elements to our diet. As the dean of American plant explorers, Dr. David G. Fairchild, once wrote: "The era of pork and hominy has passed forever in this country, but so short a time ago that our fathers refer to it as the time of plain living."

The importation of new agricultural plants has been a constant necessity in America, from the first attempt of the Europeans to settle here until the present day. Although the colonies teemed with plant life, the Indians cultivated few crops in comparison with the wealth of plant life which the immigrants brought with them. Even today it is estimated that we have in America only a fourth of the plant resources of Europe and not more than a tenth of those in Asia. This enormous reserve of plant life is a challenge to those who hold that the diminishing food supply of the world, in face of an increasing population, is a threat to our survival.

A list of the fruits, vegetables, and small grains brought to this country from the Old World would include most of our familiar market and garden varieties.[1] Henry A. Wallace, as Secretary of Agriculture, said that of our seventy-eight leading crops in 1937, only about ten were native to the United States. Maize, or corn, and the "Irish" potato are probably the outstanding contributions of the Indians to American agriculture. The Indians used many

[1] The fruits include apple, pear, quince, loquat, peach, certain plums, apricot, orange, grapefruit, lemon, lime, kumquat, fig, olive, pomegranate, mango, pineapple, date, European grapes, currant, and the more important mulberries. The vegetable crops would include onions, lettuce, cabbage, asparagus, eggplant, muskmelon, watermelon, cucumber, okra, beets, Brussels sprouts, carrots, cauliflower, celery, kale, collard, kohlrabi, leek, parsley, parsnip, peas, radish, salsify, spinach, and turnips.

other plants whose cultivation awaited "discovery" by the plant explorers sent out from Europe. Seeds and cuttings of many of these native plants were sent to Europe for trial before they were brought back to the North American colonies for cultivation.[2] Some of them have been adapted to our agriculture through the persistent efforts at adaptation by the settlers. Many others are tropical plants not suited to the temperate zone. (1)

METHODS AND TERMINOLOGY

In discussing plant introductions, we are interested chiefly in living flora imported for agricultural or other economic uses, rather than for botanical purposes. The returns to society from this work are comparable to the benefits derived from scientific invention and discovery. Frequently the discovery of a single useful plant is of sufficient value to offset the expense and labor of collecting many hundreds of worthless introductions.

Plant introduction has been practiced since the dawn of agricultural history; but to be successful, it requires a knowledge of the methods of cultivation, harvesting, and uses of plants. In increasing farm production, superior plant varieties are factors that need to be considered along with tillage, rotation, fertilizers, and irrigation. Recent methods of introduction are based on plant breeding according to the relatively new laws of genetics. Even these efforts, however, depend heavily upon a wealth of plant stocks for the factors not already present in our native or acquired flora.

Breeding experiments seek to develop such qualities as resistance to disease and insects; indifference to cold, aridity, heat, and wind; and tolerance of peculiar soil conditions such as acidity and alkalinity. The extension of the harvest season—and changes in the character of the product such as color, size, shape, flavor, and strength—are also factors. Other changes bring about advantages in handling the plants from planting to marketing, or make possible the extension of the crop into new areas.

The traditional means of improving plants is by *selection;* and skilled breeding, or hybridizing, has helped to create new

[2] Among these are the agave, arrowroot, many varieties of kidney and lima beans, cacao, chili pepper, cashew nuts, cherimoya, cocoa, cotton (*Gossypium barbadense*), gourds, guava, Jerusalem artichoke, manioc or cassava, mate or Paraguay tea, papaya, peanut, pineapple, prickly pear, pumpkin, quinoa, squash, sweet potato, tobacco, and tomato.

plants almost according to need. The work of testing and breeding plants for particular climates, soils, or commercial uses is known as *adaptation.*

Acclimatization was often used synonymously with the term *introduction* in the nineteenth century. Many experimenters believed that plants could be inured to cold and adapted to survive in temperatures lower than those found in the original environment. So strong was this belief that as late as 1882, Alphonse De Candolle, a noted Swiss botanist, considered it necessary to refute this view. De Candolle is recognized as the greatest modern authority on the origin and distribution of cultivated plants. As professor of botany and director of the Botanical Garden at Geneva, he published many works on botanical subjects.[3]

The acquisition of new territories by the United States opened up regions of new climates and soils, and intensified the search for new plants. During this period vast areas of land were coming into cultivation by the settlers moving westward. The task of finding crops that might be grown in these regions fell first upon the Patent Office and later upon the Department of Agriculture. Many crops were imported and tried for a time, only to be found unsuited to the land and climate or inferior to native varieties.

Since very early times, rulers interested in the prosperity and independence of their governments have favored plant introduction. An inscription found in Mesopotamia tells of Sargon crossing the Taurus Mountains to Asia Minor and bringing back specimens of trees, vines, figs, and roses for acclimatization in his country about 2500 B.C. The earliest recorded account of an expedition organized for the collection of plants is that of Queen Hatshepsut of Egypt who sent ships to the "Land of Punt" in East Africa in 1500 B.C. to procure the incense tree. At Kamo-

[3] In his famous *Origin of Cultivated Plants* De Candolle concluded that: "I have not observed the slightest indication of an adaptation to cold. When the cultivation of a species advances toward the north . . . it is explained by the production of early varieties, which can ripen before the cold season, or by the custom of cultivating in the north in summer, the species which in the south are sown in winter . . . the northern limits of wild species . . .have not changed within historic times although the seeds are carried frequently and continually to the north of each limit. Periods of more than four or five thousand years, or changements of form and duration, are needed apparently to produce a modification in a plant which will allow it to support a greater degree of cold."

Mura in the province of Wakayama, Japan, there is a monument to one Taji Mamori who went to China in 61 A.D. on an imperial order to bring back citrus fruits to Japan. He spent nine years on this project and the monument records, "How magnificent is the result of Taji's work." (2)

The introduction of new crop industries is necessarily a responsibility of governments. Plant exploration and introduction is generally too costly and risky an undertaking for individuals. A great deal of time and effort must go into a plant before the grower can realize a profit, and even then he is not well protected by patent laws. While individuals have made many contributions to plant introduction, the recognition by governments of the importance of this work is largely responsible for its effect on agriculture.

COLONIAL INTRODUCTIONS

America's adoption of European crops began with the second voyage of Christopher Columbus to found the colony of Hispaniola (Haiti). Columbus brought with him livestock and the seeds of many Spanish crops, as well as sugar cane from the Canaries. Cane thrived so well in the new colony that the sugar industry spread rapidly to Cuba, Mexico, and other provinces of the New World. The Spanish conquerors brought with them many introductions which later found their way into the United States. Cultivation of figs, dates, grapes, olives, and pomegranates dates back to the founding of the Spanish missions in New Mexico and California. The Spaniards also gave us such crops as alfalfa, lemons, oranges, and ginger.

Lyman Carrier, in *Beginnings of Agriculture in America,* quotes an English fisherman's letter published by Hakluyt, concerning the fisherman's experiences in Newfoundland in 1578. The letter stated: "I have in sundry places sowen Wheate, Barlie, Rie, Oates, Beanes, Pease and seeds of herbs, kernels, Plumstones, nuts, all of which prospered as in England."

Several explorers have mentioned such instances of sailors' testing European plants in American soil. Cartier recorded that on his voyage to Canada in 1541, his men sowed European cabbage, lettuce, and turnips. The chronicles of Sir Humphrey Gilbert's Expedition to Newfoundland in 1583 show that peas were sown and harvested. Carrier suggests the possibility that

some plants mistakenly considered native to America may have been preserved by the Indians or may have grown wild until "discovered" in later years.

A variety of the common agricultural crops of Europe were planted during the founding of the American colonies. *Guinea corn,* a sorghum plant grown on plantations in the South prior to the Civil War, was called "guine Corn" in the West Indies in 1601. It flourished in the summer of 1671 along with cotton and indigo on the Ashley River in South Carolina. The common use of Guinea corn in Africa, and as a food on slave ships, makes it seem probable that it was brought in with slaves at an early date.

During their first two years at Jamestown, the colonists tried planting European crops. The plants did not mature because they were started too late in the season, and by 1609 most of the colonists were concentrating on Indian methods of agriculture. William Strachey, in writing of his travels through Virginia from 1610 to 1612, stated that the natural Virginia tobacco was inferior to varieties brought in from the West Indies. (3) Carrier attributed the importation of the improved tobacco seeds to Sir Walter Raleigh who brought them from Trinidad via England in 1595. John Rolfe first cultivated tobacco in Virginia in 1612.

Silk production began its long, unavailing struggle for a place in American agriculture in 1621, when England encouraged mulberry planting in Virginia in order to feed the silkworm. Five years later, the Dutch West India Company was sending samples of wheat, rye, barley, oats, buckwheat, beans, and flax back to the West India Company in Holland. Three hundred trees were shipped to Massachusetts Bay in 1630 to promote orcharding there.[4] Hemp was among the first plants, and was used along with flax for sails and cordage for shipping. But there was no surplus for export. Further efforts were made in 1658 to promote silk production, and in 1661 the cultivation of flax and hemp was stimulated as part of the colonial mercantilistic policy of encour-

[4] In Massachusetts the Endicott expedition for the Massachusetts Bay Colony in 1628 was directed to take with it seeds of wheat, rye, barley, oats, beans, peas, stones of peaches, plums, cherries, and seeds of filberts, pears, apples, quince, and pomegranate, woad seed, saffron heads, licorice seed, madder roots, potatoes, hop roots, hempseed, flaxseed, and currant plants. By 1630 such vegetables as cabbage, turnips, lettuce, spinach, radishes, onions, peas, and beans had been introduced into the gardens of Massachusetts.

aging crops thought to be of value to the empire. By 1679 the Dutch had introduced clover; and orchards planted to apples, peaches, pears, and cherries were thriving. There is also some evidence of the introduction of clover about 1615.

CEREALS AND GRASSES

Many accounts of the introduction of rice varieties in South Carolina are questionable, but the proprietors of South Carolina wrote in 1677 that they were trying to get rice seed for distribution. Rice was first planted in the area about 1688, and during the next decade the rice industry was encouraged by the appearance of new, superior varieties. These introductions, probably from many parts of the world, led to an era of experimentation in the eighteenth century. (3) The rise of the rice industry, like that of the cultivation of tobacco in Virginia, marked the beginning of a successful colony in South Carolina. During the eighteenth century rice became an exportable commodity much in demand in England. Later, John Bradby Blake brought the upland rice from Canton to Charleston in 1772. Rice culture was inaugurated in Louisiana by the "Company of the West" in 1718.

Many pasture and forage crops were introduced during the colonial period. *Bent grass,* had become a wild pasture grass by the middle of the seventeenth century. Millet, a rather common crop of Old World origin, was probably brought in at a very early date. *Pearl millet* is thought to be a native of Africa, and was brought to America by slaves. It was noticed growing in Jamaica on Negro plantations in 1689 and was later grown by slaves in the South. The common millet was grown in Massachusetts in 1637, and a hundred years later, planters were fattening poultry on it.

Cowpeas are mentioned by the earliest writers on American products. They were grown in New England before 1663, in South Carolina before 1682, and were found in North Carolina about 1700. Sloane, the English botanist, noted the black-eye pea in 1707 and called it the "Calavance." Alfalfa was undoubtedly brought in by Columbus in 1493. Its early history, which is confused with that of lucerne and bur clover, is impossible to unravel. It was grown in Georgia in 1735 and four years later was found growing in South Carolina. *Red clover* was

noted in cultivation for hay near New York in 1749 by Peter Kalm, but it probably was brought in before this by early colonists in Maryland.

Bluegrass was identified in Montreal by Kalm in 1751. It was probably taken by the French a half century earlier to Indiana and Illinois and spread from there to Ohio and Kentucky. *Orchard grass,* not considered of special value in England, won popularity in America where its cultivation seems to have started in Virginia prior to 1760. *Nut grass* was growing in the colonies before 1775. The nuts on its roots made it desirable for hogs, but it is now considered a pest in the South. At the same time, crab grass was grown in the southern colonies.[5]

INTRODUCTIONS OF THE EIGHTEENTH CENTURY

Indigo cultivation for dye had been encouraged for at least half a century before it was grown to any considerable extent. It apparently awaited the arrival of superior varieties and favorable market conditions to assume economic importance. The successful cultivation of indigo was assured when George Lucas, governor of the island of Antigua in the West Indies, sent some seeds to his daughter, Miss Eliza Lucas. Her experiments in 1742 were so successful that in a few years the production of indigo became one of the main industries of South Carolina. In later years, cotton, also of West Indian origin, supplanted indigo as an important staple. (3)

Sugar cane was introduced early in the eighteenth century into Louisiana, but almost a century of experiment and trial passed before sugar was successfully produced. Some of the first experiments were made between 1726 and 1744. The introduction of 1751 was instrumental in bringing about the commercial production of sugar in Louisiana. It arrived in a troopship carrying sugar cane sent by the Jesuits at San Domingo, to other Jesuits in Louisiana. Many difficulties were encountered in attempting to produce sugar from the transplanted cane, and it was 1794 before the first successful crop of sugar was produced commercially in Louisiana by Etienne de Bore.

Cotton was not cultivated commercially in the United States until about 1770. Some 138,328 bales of the *Sea Island* variety

[5] In 1782 Thomas Jefferson listed some of the forage crops of Europe which were grown in Virginia during his lifetime: lucerne, St. Foin, burnet, timothy, orchard grass, red, white, and yellow clover, greensward, bluegrass, and crab grass.

THE WORLD SOURCES FOR AMERICA'S HERITAGE OF CROPS.

were exported from the United States in 1792, but the invention of the cotton gin in 1795 made it possible to use the upland or short staple cotton commercially. The upland cotton (*Gossypium hirsutum*) is of Mexican origin. The seed of the variety, *Gossypium barbadense,* usually regarded as native to the West Indies, received its commercial name because it thrived in the Sea Islands and the coastal region of the Southeast. (1)

CONTRIBUTIONS OF INDIVIDUALS

John Bartram is credited with starting the first botanical garden in America, on the banks of the Schuylkill River three miles above Philadelphia, in 1730. A diligent collector, Bartram traveled widely, studying American plants and selling seeds and plants to finance his work. During his lifetime, several other well-known private gardens were developed in eastern Pennsylvania. (4) In 1728, Bartram began the exchange of trees and plants with distinguished friends abroad. His son, William, continued his father's botanical work.[6] In an extensive tour of the South he recorded evidence indicating the early importation of many common fruits by early colonists in the deep South.

George Robbins of Easton, Maryland, imported the seeds of the peach and the pear in 1735. The Linnean Botanic Garden at Flushing, Long Island, founded about 1730, tried to procure foreign and native plants, especially grapes. As a commercial firm under the Prince family in the early nineteenth century, this same garden did much to introduce and popularize various new plants.

Henry Laurens imported to Charleston in 1755, olives, capers, limes, ginger, Guinea grass, the Alpine strawberry, red raspberries, and blue grapes. From southern France, Laurens imported apples, pears, plums, and white Chasselas grapes. The notable garden of Charles Drayton, containing many foreign plants, also was located in Charleston. At St. Paul's, William Williamson tended a garden planted with native and foreign flowering trees and shrubs. Many of the well-known gardens of

[6] At Charleston, South Carolina, he found large plantations of European mulberry. In Savannah, William Bartram found fruit trees and flowering shrubs. On the site of Frederika, the first English town in Georgia, he saw peach, fig, pomegranate, and other plants growing among the ruins. Near the St. John's River in Florida orange groves were found flourishing from trees brought by the early Spanish settlers. Alabama had apple trees planted by the French. On Pearl Island near New Orleans he found peaches, figs, grapes, plums and other fruits; and near Baton Rouge, William Bartram saw a garden with many curious exotics.

lower South Carolina were founded in colonial days, and alien plants were shipped in by sea from the West Indies.

A colony of 1,500 Greeks, Italians, and Minorcans was established at New Smyrna, Florida, in 1767 by Andrew Trumbull. The colony produced sugar and indigo, and cultivated the vine, fig, pomegranate, olive, orange, and other tropical fruits. In 1769, Benjamin Coates of Salem, Massachusetts, advertised garden seeds imported from London. George Heusler, a well-trained German gardener, did much to promote gardening in New England. William Hamilton of Philadelphia collected curious exotics, or foreign plants, and in 1784 imported the Lombardy poplar.

Early agriculturists included the introduction of foreign plants as an important part of their work to promote agriculture. The first organized efforts along this line began with the formation of the Philadelphia Society for Promoting Agriculture in 1785. Seven years later, a similar society was formed in Massachusetts; and in 1795 the Agricultural Society of South Carolina was incorporated. (5)

PUBLIC EXPERIMENTATION AND EXPLORATION

The earliest record of organized public efforts to encourage crop cultivation in this country, is found in the annals of the experimental farm established in 1699 on the banks of the Ashley River in South Carolina. This farm was set up by the Lords Proprietors to test the adaptability of agricultural crops. They recommended that wine, oil, silk, indigo, tobacco, hemp, flax, and ginger be grown for export. After two years of trial, sugar cane and cotton were reported unable to withstand the South Carolina winters. The cotton that failed was a perennial variety. Some annual varieties were tried as early as 1682, and more than a century later they helped to make South Carolina a profitable cotton growing area.

The Trustee's Garden of Georgia, a government experimental farm at Savannah, was laid out in 1733. This garden was planned in England prior to the colonization of Georgia. One of its primary purposes was to make Georgia a center of silk production, since the native mulberry trees flourished there. Each male inhabitant was required to plant 100 European white mulberry trees supplied by the trustees.

In the spring of 1733, a ten-acre plot was set aside by General James Oglethorpe as an experimental garden for botanical pur-

poses and for testing agricultural plants. This garden continued as a public institution up to the Revolutionary War. Although silk production was later subsidized, only rice and indigo became staple crops. Many tropical plants were found to be unsuited to the Georgia climate. (6)

The famous Royal Botanic Gardens at Kew in west London, made many contributions to America through its pioneer work in plant introduction. Founded in 1760, the garden was dedicated to botanical study by the British royal family, and assisted in the spread of valuable plants among the British colonies. George III increased the original nine acres in 1772, and the Earl of Bute was made scientific advisor. On the death of Bute, Sir Joseph Banks became director. Banks held his post for forty-eight years, and became known as the guiding genius of Kew. He sent the first professional plant hunter, Francis Masson, to Africa in 1772. For three successive years Masson returned to Africa where he collected about a hundred new species of plants. He later explored for many years in the West Indies and South America.

Plant explorer, David Nelson, took part in the explosive drama of the mutiny on the *Bounty*. On a previous voyage in 1771, Nelson had been a member of Captain Cook's third expedition, exploring for plants in Tasmania. The ill-fated *Bounty* expedition was sent out to introduce the seedless breadfruit tree into the West Indies as food for slaves. Nelson died from exposure after the mutineers had captured the *Bounty* and set him adrift in a small boat with Captain Bligh.

WORK OF JOHN ELLIS

Prior to the American Revolution, the British were interested in introducing agricultural crops into the colonies. John Ellis in his first book, published in 1770,[7] told how to pack seeds to prevent them from spoiling on long sea voyages. Ellis depended especially on packing the seeds in beeswax.

At that time, it was thought best to procure seeds from the resident-factors in China. China was considered—as it still is—a rich source of new plants. Missionaries were mentioned as able to give information on where to secure the most valuable seeds

[7] *Directions for Bringing Over Seeds and Plants . . . with a Catalogue of Such Foreign Plants as are Worthy of Being Encouraged in Our American Colonies. . . .* Ellis' second book was titled *Some Additional Observations on the Method of Preserving Seeds from Foreign Parts, for the Benefit of our American Colonies—with an Account of the Garden at St. Vincent. . . .*

and how to forward them. Ellis listed many plants which he hoped would be tried in the American Colonies. In his next book, published in 1773, Ellis gave some more information on plant introduction in the British Colonies.

> I must further add, that there is at present a laudable spirit among many of the curious East-India captains, who are determined if possible, to bring over olive, plants of the true black pepper, the Cassia Lignea, the Rattan, and true walking Cane, Mangos and Mangosteens, Cardamums, Sago Palm, Sappan-tree the Assa Foetida, and to search for the valuable spices near some of our settlements; so that in a few years, I hope ... our Colonies in North-America and the West Indies, will be in possession of all the useful plants of the East, as well as those of the Spanish and Portuguese settlements in South America.

Ellis made special mention of John Bradby Blake, resident-factor in China, who brought upland rice to South Carolina from Canton, and also credited him with bringing over "Cochin China Rice," seeds of the "Tallow tree," a single gardenia, and other curious and useful seeds from Canton. Ellis mentions rhubarb as having been sent into North America for introduction a year or two previous to 1773.

Although some of the plants native to America are of economic importance today, the European immigrant brought with him a much greater store of plant life. While most of our leading field, fruit, and vegetable crops were introduced during colonial times, much work remained to be done in finding varieties suited to special needs and growing conditions. The development of present day crops is due in a large measure to the successful importation of foreign plant varieties.

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2

Search for New Crops 1770-1840

MANY OF AMERICA'S early statesmen were sharply aware of the agricultural problems facing the young, growing nation. Men like Franklin, Jefferson, Madison, John Quincy Adams, and William H. Crawford took an intelligent interest in the development of agriculture, and were constantly striving to promote the economic interests of the nation. They enjoyed associating with scientists and enlightened agriculturists, and cooperated with the work of agricultural and scientific societies.

BENJAMIN FRANKLIN

Franklin's intellectual drive and broad interests brought him recognition as one of the busiest men of his time. This same activity and curiosity led him to consider agrarian problems, and he did much to promote agriculture at home and abroad. While in England from 1764 to 1775 as an agent of the colony of Pennsylvania, he carefully observed farming methods and sent back many plants to his friends in America.

As Carl R. Woodward says in his book, *Meet Dr. Franklin* (1), ". . . on excursions about the countryside to seek relaxation from the formalities of court and tension of diplomatic circles, Franklin was quick to perceive new varieties of plants, along with new ideas of culture, to pass on to his American friends. On one occasion he sent John Bartram from England seeds of new varieties of turnips, cabbage and peas; again he forwarded to his wife some naked oats, recommended for oatmeal, and some Swiss barley, 'six rows to an ear,' with the request that she divide it among his friends Hugh Roberts, Samuel Rhoades, John Bartram and others . . . then it was Penshurst peas, and again a new sort of beans that he sent home across the water."

Franklin is definitely known to have sent to this country two vegetables which are of economic value today, rhubarb and Scotch kale. John Ellis considered rhubarb among other crops as "worthy of being encouraged in our American colonies," and in 1773 remarked that it had been sent to America within the last three years. This probably refers to the seed Franklin obtained in 1772 in Scotland and sent to Bartram in Philadelphia. Franklin wrote concerning this, the first rhubarb on record in America:

> I hope the Rhubarb you have sown and distributed will be taken care of. There seems to be no doubt of its doing well with us as in Scotland. Remember that for Use the Root does not come to Perfection of Power and Virtue in less than Seven Years. The Physicians here who have try'd the Scotch, approve it very much, and say it is fully equal to the best imported. (2)

Franklin's name is linked with the history of three field crops which achieved economic importance: upland rice, broom corn, and soybeans. In England he expressed a desire to have upland rice from China tried out in America. Dry rice was sought so that rice cultivation might be extended into upland areas. (3) Franklin is credited with being the first to introduce broom corn culture into America when his "shrewd eye found a single seed on an imported broom." He became enthusiastic over the soybean as a result of his membership in the French Academy of Sciences. Soybeans sent from China to France as early as 1740 were grown after 1779 in the famous Botanic Garden of Paris. From France, Franklin sent some of the seeds to the United States, but the soybean did not find a favorable reception until the technology of the twentieth century demanded it.

The culture of grapes, hemp, flax, and silk interested Franklin, but it is not known whether he procured any new stocks for propagation in America. He took an active interest in the growing of *Rhenish grapes* and worked to promote wine production through the culture of satisfactory varieties. For friends in France, he procured from Pennsylvania, scions of the *Newton Pippin apple* as well as hickory nuts, walnuts, and chestnuts.

Franklin believed there were great possibilities in America for silk and often encouraged its cultivation. Silk producers faced the problem of importing new varieties of trees, such as the mulberry, for feeding the silkworm. The British Government offered a bounty for silk produced in the Colonies, and similar

bounties were offered by the Pennsylvania and New Jersey assemblies—through Franklin's influence, it is thought. While in England, Franklin gathered information on silk for the Colonies, and, in 1773, auctioned off a shipment of American silk.

GEORGE WASHINGTON

Washington is credited with no "first introduction," probably because he did not go abroad as Franklin and Jefferson, and did not indulge in the same scientific interests. However, he is thought to have made the first recommendation that a branch of the National Government be organized to care for the interests of farmers. Washington's letters show that he wanted plants for trial and for the improvement of his estate at Mount Vernon. In them, he comments on agriculture in Virginia and its dependence upon Britain for leadership in that field.

A letter Washington wrote in 1786 requested Arthur Young, an English agriculturist of Bury in Suffolk, to procure for him "implements of husbandry, seeds, &c." This letter, which was addressed to Wakelin Welch of London, Washington's business agent in England, reveals that Young had offered to procure these articles for Washington. He accepted because Young was careful that the seeds were "good of their several kinds; a thing of much consequence, and which does not often happen with seeds imported into this country from Europe."

Washington asked Welch to have the captain of the vessel keep the seeds in the cabin and out of the ship's hold where they would heat and spoil. (4) The next day Washington wrote Young himself, listing the seeds and implements he desired:

A little of the best kind of cabbage-seeds, for field culture
Twenty pounds of the best turnip-seeds, for ditto
Ten bushels of sainfoin-seeds
Eight bushels of the winter vetches
Two bushels of rye-grass seeds
Fifty pounds of hop clover-seeds

He also wanted burnet, if Young thought it valuable as an early food, or any other kinds of grass seeds of value, especially for early feeding or cutting.

Several months later, Washington again wrote Young requesting:

Eight bushels of what you call velvet wheat, of which I perceive you are an admirer
Four bushels of beans, of the kind you most approve for the purposes of a farm
Eight bushels of the best kind of spring barley
Eight bushels of the best kind of oats and eight bushels of sainfoin seed.

The first shipment of seeds arrived in a damaged condition. Apparently the captain of the vessel did not have the space or the desire to share his cabin with the twenty-one bushels of seeds Washington had ordered.

The Board of Agriculture of London sent Washington seeds of the perennial succory brought over from France by Arthur Young. In the winter of 1789, Washington received gooseberry plants from William Persse of Ireland. He thanked Persse for these, and acknowledged his obligation for Persse's offer to send "other natural Productions" of Ireland. Five thousand white thorn plants sent from England in 1794 for planting hedges arrived in late spring. Only a few survived, and they were not thrifty. The same year, Washington ordered thirty-nine varieties of tropical plants, including the breadfruit tree (an economical food in the West Indies for feeding slaves) from the trustees of the Botanical Garden of Jamaica. Washington's third misfortune in his efforts to procure seeds and plants from overseas occurred when the vessel carrying this order was lost at sea. His interest in these plants had been that they would "combine utility, ornament, and amusement."

Washington, and other persons of ample means, used greenhouses to protect tropical plants for botanical and experimental purposes. Since the glass structures maintained sufficiently uniform conditions of heat and moisture, they were used to grow grapes for wine. "The orangery" was a name often given to glass structures used to protect citrus fruits before they became available on the market at popular prices.

THOMAS JEFFERSON

Jefferson's interest in agriculture was more profound and practical, more extended and continuous in time than either Franklin's or Washington's. In Jefferson's philosophy, the agrarian way of life was the basis of national economic and political sanity. Long residence on the estates of Shadwell and Monticello gave him the opportunity to practice and experiment with various

plants. Jefferson's Garden Book, kept from 1776 to 1824, attests to his persistent, practical research for improved crops. According to the records, Jefferson took more advantage of his foreign residence to study European agriculture than did Franklin. Jefferson shared his plants and his discoveries, and went to considerable trouble to find promising new plant crops to introduce.

Aid to Agriculture—Jefferson believed that agricultural societies should experiment with new crop productions and bring them to the attention of their members. "In an infant country, as ours is, these experiments are important. We are probably far from possessing, as yet, all the articles of culture for which nature has fitted our country." He realized that "to find out these will require abundance of unsuccessful experiments. But if, in a multitude of these, we make one useful acquisition, it repays our trouble." It was not the duty of the Federal Government, but "perhaps it is the peculiar duty of associated bodies, to undertake these experiments." (5)

In this letter to William Drayton just quoted, Jefferson offered his whole-hearted cooperation to the South Carolina Society for the Promotion of Agriculture. This institution, established in 1785, was the first agricultural association incorporated in the United States to provide a farm for testing introduced seeds and cuttings. The members were especially active in testing the olive and grape, but only the olive gave promise. ". . . I shall be attentive to procure for them the seeds of such plants, as they will be so good as to point out to me, or as shall occur to myself as worthy of their notice." Jefferson was active in the Albemarle Agricultural Society, organized in 1817 by his neighbors in the county where some of his own farms were located. He was made a member of many others because of his help in securing new plants.

Seed Collections—Jefferson was active during the greater part of his life in collecting and exchanging seeds and plants with persons abroad. He gathered prized field crops from all over the world for trial at Monticello. Jefferson also collected domesticated trees and shrubs, both native and foreign, which were able to withstand the Virginia winters. American agriculturists at first looked to Europe and especially to England for leadership. Many of the settlers sent to the Old World for plants, animals, implements, and agricultural information. Jefferson imported not only seeds, but also the English methods of cultivation and general agricultural practices.

For a period of twenty-three years, Jefferson received annually a box of seeds from his friend Thouin, Superintendent of the Garden of Plants at Paris, containing exotic plants thought suitable for the Virginia climate. Jefferson sent these seeds to public and private gardens in other states for many years, but in 1826 he proposed that they be utilized by a new school of botany at the University of Virginia. He also suggested that a botanical garden be started, and proposed that the professor make a list of trees and plants to be introduced before taking measures to secure them.

Promotion of Rice—Jefferson regarded his efforts to introduce the olive and the dry, or upland rice, as his most worth-while achievements in plant introduction. While in Paris in 1787, he became interested in rice after seeing large quantities consumed in France. He traveled to southern France to study the agriculture and to secure the *Piedmont rice* grown in Lombardy. Jefferson considered it different from the rice grown in the Carolinas and hoped to increase the demand for rice by increasing the varieties in the markets. At the same time, he secured rice seeds from the Levant at Marseilles and forwarded these to America. When he learned of the dry rice, he made arrangements to get some from Cochin, China, for trial "the young Prince of that country. . .having undertaken that it shall come to me." (5)

Jefferson shipped a quantity of Egyptian rice seed to Charleston in 1788. He dispatched two shipments, hoping that at least one of them would arrive unspoiled and in time for planting. Two years later, Jefferson secured a barrel of heavy upland rice from equatorial Africa. He hoped the upland varieties might replace the wet rice and the malarial pestilence that accompanied its cultivation. From Charleston some of the upland rice was sent to Georgia. In reviewing his plant introductions shortly before his death, Jefferson recalled that his rice had spread over upper Georgia, but he did not know to what extent it came to be grown in South Carolina. (6)

Next to a grain for bread, Jefferson considered an oil crop as especially worthy of introduction into a new country. "The olive is a tree the least known in America, and yet the most worthy of being known. Of all the gifts of heaven to man, it is next to the most precious, if it be not the most precious." He was impressed with the pervasiveness of the olive in Mediterranean cookery and thought that it might claim a preference even to bread. Jefferson thought the Society for the Promotion of Agriculture in South

Carolina should undertake the introduction of the olive and offered his services to William Drayton in securing plants. He had a number of olive plants sent from France in 1789-90 for South Carolina and Georgia.

Miscellaneous Introductions—The search for suitable pasture and cover crops in the South is an old one. In 1786 Jefferson sent Drayton seeds of the sulla of Malta, or *Spanish St. Foin,* a legume belonging to the same family as clover and alfalfa. In a letter to the editor of the *American Farmer* of May 2, 1820, Jefferson wrote that the consul at Leghorn, Italy, had sent him some of the seed, *Italian clover,* which was arousing some interest at that time. He considered it the same as the sainfoin grown in the Mediterranean region. Thirty-five years before, Jefferson had procured some of the clover seed from Malta and sent it to the Agricultural Society of South Carolina. They found it less advantageous than the Guinea grass, and did not pursue its culture.

Jefferson sent a parcel of acorns from the cork oak to South Carolina in 1787. No successful plantings came from these seed which were probably received in a non-viable condition, but Jefferson continued his efforts to introduce cork for another forty years. In 1803 he sent to Europe for grains of a wheat said to withstand the attacks of the Hessian fly.[1] However the wheat he received later that year and distributed among his friends never proved equal to this requirement.

WORK OF AGRICULTURAL SOCIETIES

Agricultural societies during the nineteenth century performed much the same functions for agriculture that Federal and state governments later did in communicating agricultural information to each other and exchanging seeds and plants. The first agricultural periodical published in the United States, the *Agricultural Museum,* devoted much space to the work of agricultural societies. Activities of the Columbian Agricultural Society of Washington and the Berkshire Agricultural Society of Massachusetts were frequently reported upon. As the earliest recognition of Russian wheats, the *Agricultural Museum* noted in July, 1811, that *Cas-*

[1] This tiny midge or fly is very destructive to wheat in the eastern United States. Wheat growers in the nineteenth century were continually searching either for wheat varieties that would resist its ravages or the means to prevent its attacks. It is said to have been brought to America in the straw used for horse feed during the Revolution by the Hessian mercenaries of George III.

pian, Persian barley, and *Mammoth rye* were distributed by Joel Barlow to members of the Columbian Agricultural Society.

The Albemarle Agricultural Society of Virginia, the best known of these societies, may be considered as typical of such organizations at that time. Among the thirty organizers in 1817 were Thomas Jefferson, two later governors of Virginia, a future senator and justice of the Supreme Court, and many statesmen, physicians, lawyers, and farmers. Later, James Madison joined and was chosen first president. Excerpts taken from the minutes of the society show that shipments of seeds were frequently received from abroad and distributed among the members for trial.

The South Carolina Agricultural Society was the leader of the interest in foreign plant introduction in that state. The society appointed a committee to consider what beneficial effects would accrue from the introduction of foreign seeds, plants, and implements of husbandry. In 1823 the committee pointed out that in their state such profitable crops as rice, indigo, and cotton had resulted from plant importation. Further introductions, they felt, might produce new crops for sale as well as for provisions and not merely for domestic consumption. The appointment of the committee probably resulted from the general uneasiness over a surplus of cotton, with resulting low prices for land and the cotton crop.

The Society thought that a new staple might be substituted for cotton, and a recommendation was made that a committee of three be appointed to introduce such seeds and plants as would be designated by the society as of possible value for the state. This was to be done by corresponding with consuls of the United States and other persons in foreign lands and with officers of the Navy. An appropriation of $200 was to be made annually from the society funds to meet such expenses. The seeds and information acquired were to be distributed gratis to members.

In New York, *The Genessee Farmer* of 1836 praised the farmers of Monroe County for presenting a petition to the New York legislature for an appropriation to aid a state agricultural institution at the head of the county agricultural societies. The money was to be spent for premiums for agricultural products and for procuring useful seeds for public distribution.

DR. HENRY PERRINE

The history of tropical plant introduction during the second quarter of the nineteenth century is largely the story of Dr.

Henry Perrine, physician and plant enthusiast. His role was that of an agricultural pioneer working for the development of the newly-acquired Territory of Florida. Perrine's work came at a time when new crops were needed to diversify and bolster the agriculture of the South—before the Federal Congress had begun to bureaucratize this work in 1839.

Perrine's interest in the introduction of tropical plants began while he was in Cuba in 1826 recuperating from an illness. Here he observed agricultural practices, compiled statistics, and drew some favorable conclusions about the prospects of tropical agriculture in Florida. When Perrine was appointed the United States consul to Campeche, Mexico, in 1827, he began an intensive campaign to export Mexican plants, especially the fiber-producing agaves.

He gave unstintingly of his services as a doctor to the Mexicans, hoping to persuade them to part with their jealously-guarded seeds and plants. Although the natives appreciated Perrine's help during epidemics of yellow fever and cholera, they repeatedly defeated his efforts to ship live plants or seeds out of Mexico. The farmers disliked losing a valuable market for their crops by assisting in the development of a rival crop industry abroad. Often the seeds were reported either not ready to gather or already lost. Transportation of plants was delayed so that they died on the way out of the country. When plants did reach the United States, frequently there were no facilities for their care.

Perrine wrote letters to the newspapers in an attempt to interest the public in the cultivation of tropical plants. He made experimental shipments of the century plant (*Agave americana*) and other plants to friends in New York and New Orleans.

Perrine hoped to obtain a land grant from Congress, or to get permission to purchase land in Florida and there set up an experimental farm for tropical plants and seeds. He expected the results of his farm would extend the cultivation of tropical plants northwards, and hoped to find some profitable crops that would attract settlers to Florida. His plan was based upon the belief, common at that time, that tropical plants could be gradually acclimated to the colder temperatures of the north. Such plants, Perrine thought, would utilize the sterile, swampy, pestilential lands of southern Florida. What the soil lacked, he explained, the air and moisture would supply to the plants he sought to cultivate. Perrine felt that this combination would be so successful that in a few years

the West Indies would be smuggling in lower priced sugar from the United States!

Work With Plants—Perrine was quite interested in agaves, particularly the *Agave sisalana.* Many species of these plants were common in Mexico and Central America and one species, the century plant, could be used in more than a dozen different ways. Perrine claimed to have invented a method of separating the fibers from the leaves of the *Henequen Agave,* commercially known as Sisal Hemp, by means of rotary scrapers. This invention, which he compared to Whitney's cotton gin, he expected would revolutionize agriculture.

A great many tropical plants other than the agaves attracted Perrine's attention. He thought of the logwood tree in Yucatan and suggested that a monopoly on logwood be established by plantings in America. The demand for vegetable dyes caused him to study many other dye-producing plants. Among these were the cochineal cactus with its insect parasite which produces a reddish dye, the "shrub Indigo," the common indigo of Tabasco, and a tree indigo. He sent seeds of these and of nankeen colored cotton, the India rubber tree, the "Pasture tree," a soap tree (its saponaceous fruit was used as a substitute for soap), the "Purgative Pinion," "Spanish Cedar," a large ground gourd, tree-cotton, and others.

The House and Senate each originated bills in 1838 for a land grant to Perrine and each published a *Report* on his activities. (7) The grant became a law in July of 1838. Perrine and his associates were awarded a township of 23,040 acres in any portion of the public lands below twenty-six degrees north latitude. It was to be occupied within two years and each section had to be occupied within eight years from the date of the location of the tract by an actual settler cultivating useful tropical plants—otherwise the land would be forfeited.

Perrine apparently planned to spend the rest of his life on his plant work at Indian Key, a twelve-acre island in Florida where his land grant was located. Against the advice of the Secretary of War who warned him that the Seminoles were rising, Perrine landed his family on Indian Key, Christmas morning of 1838. Six months later Perrine was shot, and his home and valuable notes on his work burned by a Seminole war party. (8) Most of Perrine's plants were destroyed during the massacre, but some of them were later carried off by Army officers to greenhouses in the North or

to Army posts to be used as ornamentals. Perrine had imported nearly 200 varieties of tropical plants and made sisal plantings on every section of the grant before his death. This was the last land grant made by Congress for the purpose of encouraging plant introduction.

Perrine's zeal often led him to make overly enthusiastic statements about his work, and it is doubtful if he ever would have achieved the results he dreamed of. His attitude in plant introduction, as in medicine, had been philanthropic. The location of his land was an excellent choice climatically, for the present tropical plant introduction garden of the Department of Agriculture at Coconut Grove, Florida, is located next to the site of his grant.

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Federal Promotion of Crops

DURING THE FIRST HALF-CENTURY of our nation's growth the government played only a minor role in the promotion of agriculture. The search for new plant varieties during this era was largely in the hands of individuals and farmers' associations. However, agriculturists realized that they could not cope with the problems of importing and disseminating new varieties and conducting experimental work without government aid. Organizations like the Berkshire Agricultural Society made repeated demands for Federal assistance. The grain and sugar interests wanted government help in the importation of new seed stocks.

DUFOUR AND ASSOCIATES

The first move by Congress to encourage the introduction of new agricultural products was the Act of May 1, 1802. John James Dufour and his associates were authorized to purchase up to four sections of land, northwest of the Ohio River between the Great Miami River and the Indian boundary line, at the rate of two dollars per acre, "in order to promote the culture of the vine within the territory of the United States." This act was passed in response to the demands of many men for an American wine industry, and to help overcome serious difficulties encountered in growing the European grape in the eastern United States.

After operating for a number of years, Dufour reported that he had succeeded in making wine of good quality. However, he and his associates ran into financial difficulties. In 1813 they applied to Congress for a remission of their debt or an extension of time for payment. The Committee on the Public Lands of the House reported on Dufour's lack of success ". . .owing to many difficulties and embarrassments incident to their new establishment, the length of time which must elapse before vine-dressers

can receive a reward for their labor, together with some misfortunes peculiar to themselves." In 1818 Congress granted Dufour and his associates a five-year extension on their lands, but the project was never successful. (1)

THE TOMBIGBEE ASSOCIATION

A group of French emigrants known as the Tombigbee Association settled in western Alabama in 1819 to raise grapes and olives. The government had granted the association four townships of 92,160 acres, with the stipulation that at least one acre of each quarter section was to be planted in vine. Five hundred olive trees also were to be planted in the settlement unless it were found impossible to grow the olive in that climate.

The land selected was near the junction of the Tombigbee and Black Warrior rivers. It sold for two dollars per acre, and the failure of any one of the emigrants to pay for his land was cause for forfeiture of the benefits of the grant to all the settlers. This provision of the law was finally repealed after repeated complaints by the emigrants. A Treasury Department report in 1822 showed that eighty-one families had actually settled by that time, with 2,500 acres under cultivation, and 10,000 vines planted.

The young colony soon ran into difficulties and many of the colonists failed to live up to their contracts with the government. An inspection of the project by the Treasury Department revealed that members of the association were composed chiefly of refugee military officers and merchants, with little knowledge of agriculture. The region selected was a wilderness, and hunger forced the settlers to cultivate food crops instead of the grape and olive. (2)

A lack of roads and other transportation facilities limited the settlement temporarily to small lots around the town of Aigleville (Eagleville). Exorbitant prices for corn and foodstuffs charged by their American neighbors soon exhausted the settlers' funds. Squatters moved into the settlement and threatened the most violent vengeance on those who should interfere with them. There was trouble in clearing the land for planting the vine and olive. The cuttings arrived out of season from Europe and died. The olive was peculiarly unsuccessful. Each winter's frost killed the tree except for the roots, and these put up fresh shoots which in turn were frozen the following winter.

The settlers were given several extensions of time on the payments for their land, but the project never succeeded. Further

attempts to establish the vine and olive in the southeastern part of the country continued for two generations with little success.

THE TREASURY CIRCULAR OF 1819

William H. Crawford, Secretary of the Treasury, attempted to stimulate interest in plant introduction with the Treasury circular of 1819. This document called for the assistance of naval and consular officials in foreign countries in sending to this country whatever plants or seeds they might deem of value to American farmers. Found in the archives of the Treasury Department, this circular states clearly the problem and its relations to American agriculture at that time:

> The introduction of useful plants, not before cultivated, or of such as are of superior quality to those which have been previously introduced, is an object of great importance to every civilized state, but more particularly to one recently organized, in which the progress of improvements of every kind, has not to contend with ancient and deep rooted prejudices. The introduction of such inventions, the results of the labour and science of other nations, is still more important, especially to the United States, whose institutions secure to the importer no exclusive advantage from their introduction. Your attention is respectfully solicited to these important subjects.
>
> The collectors of the different ports of the United States will cheerfully cooperate with you in this interesting and beneficent undertaking, and become the distributors of the collections of plants and seeds which may be consigned by you to their care. It will greatly facilitate the distribution, if the article shall be sent directly to those sections of the Union, where the soil and climate are adapted to their culture.
>
> At present, no expense can be authorized, in relation to these objects. Should the result of these suggestions answer my expectations, it is possible that the attention of the national legislature may be attracted to the subject, and that some provisions may be made, especially in relation to useful inventions.
>
> I have the honour to be, very respectively, sir, your most obedient servant.
>
> WM. H. CRAWFORD

One introduction which may be attributed to this circular was the work of Consul Appleton in Italy. He sent in "barrels of the Lupinella" of Italy, which was received and distributed by Crawford. Very little was actually accomplished by the circular, however, because no money was authorized for the work.

In addition to this circular, Crawford's interest in agriculture is recorded by the *Southern Cultivator* of Augusta, Georgia. A letter from a correspondent reporter that Crawford, while Secretary of the Treasury, procured seeds of the *doub grass* and of the *teak tree* from India. He sent them to Thomas Spalding, Sapelo Island, Georgia, who convinced himself that doub grass was identical with the *Bermuda grass* introduced in Colonial days.

THE TREASURY CIRCULAR OF 1827

The second Treasury circular was largely the work of John Quincy Adams. Months before this circular was issued, Adams noted in his diary that he had discussed the matter at some length with friends and ". . .thought we might venture upon some small expense to collect certain specific seeds or plants and have them planted in the garden of the Columbian Institute." Adams suggested to Southard, Secretary of the Navy, that a circular letter be sent to the captains of our public ships requesting that they lend their assistance in cooperation with the consuls to effect the object. He also recommended that an alphabetical list be made of the plants recommended for importation, their uses and the countries from which they would be procured.

As in the previous circular, no expense could be authorized, but the hope was expressed that Congress might make some provision to defray expenses incurred.[1] The second circular went into much more detail than did the first. Information on the cultivation, the preferred climate and soil, the propagation, and the uses of each plant was requested. Southard endorsed the circular with a request for cooperation addressed to the ships of the Navy. Detailed directions for putting up and transmitting seeds and plants accompanied the circular. These were necessary to insure the live arrival of seeds and plants in the United States from distant overseas locations.

Probably such materials were to be sent to Washington to be placed in the government botanic garden, which Adams is supposed to have established for receiving and distributing them. This was the nucleus of the botanic and propagating gardens which were greatly expanded a quarter century later. (3)

ASSISTANCE OF THE NAVY

Before a special office for plant introduction was established, the Navy had greater opportunities to render voluntary assistance in this work than did any other department of the government. Captains of merchant and naval vessels often owned farms, and used their positions to bring livestock and plants from abroad for trial. Navy Captain Jesse Elliott, for example, overindulged his interest in foreign livestock to the extent of giving his animals preferred passage aboard ship to the discomfort of his men. The

[1] See Appendix Sections I, II, and III.

resulting complaints led to a court martial for Elliott and the issuance of a general order forbidding the transportation of livestock aboard public vessels.

The Navy kept a squadron in the Mediterranean, and many plant items were sent back from that region. The orders of the Navy Department to Commander William Crane in 1827, furnish a typical example.

> It will probably be in your power, while protecting the commercial, to add something to the agricultural interests of the nation, by procuring information respecting valuable animals, seeds, and plants, and importing such as you can, conveniently, without inattentions to your more appropriate duties, or expense to the Government. There are many scientific, agricultural, and Botanical institutions, to which your collections might be profitably intrusted, and by which whatever you procure will be used to the most extensive advantage of the country. Among those is the Columbian Institute of this city.

In 1824, Captain John Harris, USN, brought seeds of the large type of lima beans from Peru. The bean became quite popular in subsequent years. The *American Farmer* published instances of clover and alfalfa importations by naval officers. Ballard, a captain with the Mediterranean Squadron, brought about five bushels of *lupinella* from Italy and distributed it among friends near Annapolis. Commander Jacob Jones sent a keg of alfalfa seed from Valparaiso in 1827 to John S. Skinner, a postmaster and editor of the *American Farmer.*

Skinner, a former naval officer, was with Francis Scott Key at the bombardment of Fort McHenry and is said to have had a part in writing the National Anthem. For nearly half a century he enlisted the aid of prominent naval officers in bringing foreign livestock and seeds into America. The seeds Skinner received were liberally distributed under his frank as postmaster.[2]

The House of Representatives passed a Resolution in 1830 requesting the assistance of the Navy and our officials in foreign countries in securing new varieties of sugar cane and other plants suitable to the American soil and climate. Under Lieutenant-Commandant Boerum, the West India Squadron procured several varieties of sugar cane from the Island of Trinidad. These cuttings were brought to Pensacola and distributed by the governor of Florida.

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[2] Skinner's editorial in appreciation of the services of naval officers may be found in Albert Lowther Demaree, *The American Agricultural Press,* 1819–60. New York: Columbia University Press, 1941. Pp. 253–54.

THE WILKES EXPEDITION

This expedition, sent out in 1838, was the first major effort made by the Navy to encourage plant introduction. Commander Charles Wilkes headed the expedition which cruised the Pacific from 1838 to 1842 under orders to secure any noteworthy new agricultural plants. The botanist, William Rich, accompanied the expedition to collect botanical specimens, agricultural seeds, and plants.

Other nations, particularly France and England, had long been dispatching botanists on plant explorations. In 1821 the French Government sent a corvette under Samuel Perottet to collect a load of rare plants and seeds including the *Morus multicaulis* from the Philippine Islands and parts of Asia.[3]

Introductions From Madeira—All the information available regarding seeds and plants brought back by the Wilkes Expedition comes from two volumes of the original letters from members of the expedition to the Secretary of the Navy. A shipment of fifteen kinds of plants, roots, and seeds was made to John McArau of Philadelphia, from Funchall, Madeira, in 1838. Another box of seeds collected at Madeira, with directions for planting, was sent from Rio de Janeiro. To Buist, a florist at Philadelphia, Wilkes sent "Box No. 5" which contained seeds from Madeira, St. Iago, and the vicinity of Rio de Janeiro. There were also roots of various Brazilian plants. A box of seeds was delivered by the Navy agent at Philadelphia to John Kann, who distributed them to members of the Philadelphia Horticultural Society.

Early in 1840, William Rich shipped to Boston two cases of seeds given him by the Government Botanic Garden of Sydney, New South Wales. Some of the seeds were from "rare if not new plants." Rich requested that these be placed in the hands of persons who would take proper care of them.

Fiji Tomatoes—In October of that same year, Wilkes sent James Paulding, then Secretary of the Navy, twenty-eight papers of seed including some of a tomato from the Fiji Islands. These tomato seed had no visible effect on our tomato culture, but a variety of some significance did come from the Fijis in 1862. Most of the seeds in the papers from the Fijis came from ornamental shrubs

[3] The *Morus multicaulis*, the mulberry for feeding the silkworm, caused great speculation in America for many years during the first half of the nineteenth century.

and trees. These were distributed to ten different individuals in the eastern part of the country. About the same time, Titian R. Peale, "Scientist," sent flower seeds from Honolulu to his family in the United States.

On November 9 Wilkes wrote that he had shipped aboard the *Lausanne* consigned to the Navy agent in New York, seeds and roots, flower seeds, and "1 box Sandwich Island wheat." Joseph Drayton, also a member of the expedition, sent watermelon and muskmelon seeds from Tonga Taboo and the Sandwich Islands to a friend in New Jersey. Wilkes later wrote:

> I have the honor to inform you that I have sent to New York per ship Lausanne, one of Wards boxes with living plants from the Figi Islands . . . and have requested the Navy Agent to hold them subject to your orders. . . . Much time has been consumed in gathering and preserving these seeds, and it will be a loss of credit to the Expedition if it should fail to benefit the Country by the introduction of the many new and valuable plants among this collection.

The farm papers of the time show that other Navy officers were sending back seeds of plants expected to be useful to the farmer. An African maize, reported as an excellent cattle feed (possibly a grain sorghum), was sent back from the coast of Africa. From Italy, Commodore Charles Stewart brought back an "Etrurian wheat." Daniel Zollickoffer, who tested seeds of this new wheat, wrote the farm papers that it was a superior introduction, and anticipated that the country would owe its gratitude to Stewart.

The Wilkes Expedition was not expected to spend all its time on agricultural objectives, and no instance of a first introduction can definitely be attributed to its members. Seeds and plants collected were placed for trial with reputable horticulturists. Botanical collections brought to Washington by the expedition made it necessary to construct a greenhouse in 1842. This later became known as the Botanic Garden.

EAST INDIA AND CHINA SEA SQUADRON

A decade after the return of the Wilkes Expedition, a planter from Louisiana wrote the Patent Office calling attention to the degeneration of sugar cane in his state. He suggested that the situation could be remedied by procuring some seed of new varieties from a foreign country, through the help of our foreign consuls and naval commanders.

The Secretary of the Navy, William Graham, initiated this work by ordering the East India Squadron to secure sugar cane cuttings and samples of whatever other plants and seeds they might

find during their tour of duty. The Sloop of War *Marion* was to be held in readiness to rush the collection back to the states. The idea of securing sugar cane was probably suggested by Leonard Wray's book, *The Practical Sugar Planter,* published in 1848.[4]

This book called attention to the *Salangore* cane, which Commander Aulick had direction to secure at Penang, off the west coast of the Malay Peninsula. Aulick also was instructed to give special attention to procuring seeds of the tea plant. He reported in the winter of 1852 that he had obtained cuttings and roots of the Salangore cane as well as a few samples of the *Otaheite* and *Mauritius* canes which some of the Penang planters preferred to the Salangore.

The *Marion* was immediately ordered to take passage home, and another ship of the squadron, the *St. Mary's* was instructed to secure an additional supply of the Salangore sugar cane seed. When the *Marion* arrived home, the roots and cuttings were found to be decayed and worthless. Aulick assured the Secretary of the Navy that the plants had been packed by persons highly recommended, and had been well cared for while on board his ship. Specific instructions, however, were given for packing future shipments. Later that same year the *St. Mary's* arrived in Philadelphia with a cargo of cane.

THE PERRY EXPEDITION AND JAMES MORROW

One of the duties of the Perry Naval Expedition, sent to Japan in 1853 to open that country to trade with the United States, was to exchange agricultural implements and seeds with the Japanese. Dr. James Morrow accompanied the expedition as the representative of the Agricultural Division of the Patent Office and recorded in his Journal detailed information. Morrow was in charge of American agricultural implements and seeds to be exchanged and his instructions were to ". . .carefully note and collect all indigenous vegetable products within your sphere of operations, with a view to their introduction into the United States, preserving seeds and dried specimens of as many plants as possible." [5]

An oversight occurred in the instructions, for no funds were pro-

[4] *A Complete Account of the Cultivation and Manufacture of the Sugar-cane, according to the Latest and Most Improved Processes.* "Describing and comparing the different systems pursued in the East and West Indies and the Straits of Malacca, and the Relative expenses and advantages attendant upon each: Being the result of sixteen years' experience as a sugar planter in those countries."

[5] See Appendix IV for full text of this letter of instructions from Edward Everett of the State Department.

vided for purchasing plant materials. The Interior Department, however, did authorize necessary expenditures for collecting and shipping the sugar cane cuttings to the United States. Morrow's first opportunity to buy seeds came at Hong Kong. He notified Perry of his lack of funds, and Perry gave him a small advance until he could receive further instructions.

Chinese Seeds—Morrow's *Journal* records that his first collection was a small box of flower seeds secured in September, 1853. These he sent to the president of the Philadelphia Horticultural Society. At Macao, in October, Perry instructed Morrow to precede him to Canton and to collect as many seeds as possible. They were to be put aboard the clipper ship *Coarser* which was to return the sick of the squadron to America. Morrow collected vegetable seeds from the vicinity of Canton and field seeds of rice, beans, and wheat from a northern province. Along with two other shipments these were sent to New York and Philadelphia. These shipments from around Canton also included tea seed, cotton, Chinese cabbage, and varieties of such common vegetables as cabbage, turnips, greens, peas, and beans.

The Japanese Emperor sent Morrow a small bag of thirty kinds of garden seeds from the Imperial Gardens at Tokyo. Barley, wheat, turnips, and various other garden seeds were procured in Japan at other times. In the spring of 1854 Morrow sent large papers of seed to the Department of the Interior. Other packages were sent to the seedsmen, Landreth and Buist of Philadelphia, and to gardeners in South Carolina. Morrow obtained large quantities of field, garden, and flower seeds in Simoda Bay. These are listed and described as "White Pease, Black beans, Red beans, Buck-wheat, Broom corn, Small red beans (soya), Large white pease, Small white pease." Rice, wheat, barley, and a number of vegetable and flower seeds were procured at the same time. That summer, Morrow potted some plants among which were three persimmons and a honeysuckle.

Plant Spoilage—Morrow's attempts to bring back living plants must have been particularly exasperating. Many of his plants died on the way down from Japan to China. At first he had no glass cases for their protection, and the plants were badly wilted at sea by salt water and wind. The Navy apparently had neither the space to shelter the plants nor an understanding of their needs. Seeds were exposed to rain, and plants subjected to salt spray or

placed in unsuitable locations. At Macao, Morrow ordered fourteen cases constructed for his plants, and those put in jars soon improved.

When glasses in the cases were found broken, more plants were secured in Java. Sugar canes obtained there by the *Lexington* were stowed in glass cases. Many of these plants were brought through safely, and in 1855 Congress appropriated $1,500 for the erection of a suitable house for the Japanese plants. Four plants each, of several kinds of persimmons, tangerines, kumquats, roses, and ornamentals were brought back. Tobacco and cotton seeds from the island of Mauritius were forwarded to the Patent Office. The ship *Plymouth* arrived at Norfolk in January, 1855, with four boxes of sugar cane seedlings of Salingore and Mauritius and three barrels of the best wheat of Cape Town.

THE *WATER WITCH*

About the same time that Perry was in Japan, Lieutenants Page and Donaldson abroad the *Water Witch* engaged in a reconnaissance of the Paraguay River. They collected seeds and botanical specimens which they forwarded to the Patent Office. Among these seeds was the matè, or *Paraguay Tea*—the familiar beverage of the Paraguay River region.

Another expedition contemporary with these voyages was the John Rogers Surveying Expedition to the North Pacific Ocean. Charles Wright, botanist of the expedition, collected many seeds which he sent to the Botanical Garden and the Smithsonian Institute at Washington. Wright, however, was primarily interested in collecting botanical specimens, and there is no record of any significant plant introduction resulting from either of these expeditions.

JOURNEY OF THE *RELEASE*

In an attempt to secure viable sugar cane cuttings, the Patent Office sent the Naval barque *Release* to South America in 1856. Previous attempts to collect the cuttings in the East Indies had not been successful because most of the cargo died during the long trip home. The expedition was given an appropriation of $10,000 and relieved of regular naval assignments in order to hasten the return of the cuttings. The Patent Office hoped that this importation and another from China would completely change

the cultivation of sugar cane in the United States. At that time the trip was unique because the *Release* was the first American naval vessel sent out on a purely agricultural mission.

Lieutenant C. C. Simms was placed in charge of the *Release,* with Townend Glover of the Patent Office heading the agricultural activities. These instructions for the voyage, from the Commissioner of Patents, form an accurate description of the expedition's work.

> . . . you have been selected to go to South America to procure a fresh supply of the Cuttings of the Sugar Cane for . . . experiment in our Southern States. . . .
>
> The United States Brigg "Release" has been fitted out by the Navy Department . . . you will please repair on board, forthwith, providing yourself with the necessary provisions for your support, for two months to be paid for out of your regular salary.
>
> You will receive . . . adequate means and personal directions for the procurement, packing, transportation, and delivery of the Canes . . . you are requested to proceed in the "Release," with all possible dispatch to the port of Georgetown in Demarara, and procure as many cuttings of the most healthy and hardy varieties of the Sugar Cane which grow in that region, as can be safely packed in the boxes provided for that purpose, and cause them to be compactly stowed, below deck, in said vessel, which will then proceed to the port of La Guayra, in Venezuela.
>
> You will next proceed to the most elevated regions of Caracas, where the Sugar Cane is successfully grown and obtain as many bundles of Cane Cuttings as can be safely stowed in any place which may be unoccupied in said vessel, and then proceed directly to New Orleans, where you will receive further orders.
>
> Should you find it convenient to procure any valuable seeds which would be likely to thrive in any part of the United States you are hereby authorized to purchase a small quantity of each kind for experiment from the funds which will be placed in your hands by Mr. Browne.

On February 7, 1857, *The New Orleans Picayune* reported the *Release* had arrived ". . .with over 1,000 boxes of cane cuttings, plantain, banana, eddo and other plants including buck yam roots. The cuttings had been made with a great deal of care, and several planters who examined those not in boxes, expressed themselves highly pleased. . . ."

Cane Borers Imported—Great benefits were expected to accrue to the sugar interests. But several days later, the cane cuttings were found to be badly infested with the cane borer. One planter who inspected the cuttings thought only one box in six of any value. But he took some home which he intended to plant at a distance from other canes to prevent infestation! The Plaquemine *Sentinel* reported this planter brought them a piece of the cane through which the borer had made a perfect road or tunnel. Some judged the enterprise a failure and said it was "worse than that if it intro-

duces the terrible borer worm into Louisiana." The Patent Office reported in 1857 that the cuttings were thriving and were expected to compensate amply for the introduction.

Glover, who procured the canes, came to America from England in 1836 to engage in agricultural experiments. He eventually became an entomologist in the Department of Agriculture and later taught at Maryland Agricultural College. His importation of additional cane borers into Louisiana is a commentary upon the rudimentary state of entomology and plant quarantine in his day.

DIPLOMATIC ASSISTANCE

Diplomatic officials also were called upon to procure plant introductions while residing in foreign countries. The many separate instances of such assistance do not tell a connected story. But they do show the devotion of many of the consuls to the improvement of national agriculture, and indicate that the Patent Office never expected to operate without the consuls' support.

In 1849, John Davis, the consul at Canton, China, sent seeds to America. These had been given to him by S. Wells Williams, a prominent missionary and linguist, who later served as interpreter for the Perry expedition to Japan. Williams obtained this supply from another missionary who in turn had received them from a Chinese physician. Davis sent a second box of seeds to the Patent Office in June of 1849 which he had also received through Williams. During the summer and autumn of that year, Williams continued to gather seeds for the Patent Office, including Japanese persimmon, olive, watermelon, and muskmelon seeds.

THE IRISH POTATO

An American consul at Panama in 1851 made an enormous contribution to the agricultural wealth of the United States, probably without suspecting the significance of his act. This consul, whose name is not known, sent a small quantity of potatoes from South America, the original home of the "Irish potato," to the Reverend Chauncey Goodrich, of Utica, New York.

Goodrich's interest in potato breeding sprang from the widespread want and suffering in Europe and the crop failures in America due to the severe epidemic of potato rot during 1843-47. He attributed the blight to long-continued asexual propagation, which he thought had weakened the vigor and disease resistance

of the tubers. Sexual reproduction should rejuvenate the potato. Goodrich allowed the potato flowers to pollinate naturally, and in this way crossed the old seed stocks with the new potatoes from South America. Rigid selections of superior plants were made from hundreds of seedlings.

Special Varieties—He called one of the South American potatoes the "Rough Purple Chili," believing it had come from that country. "From naturally fertilized seed balls of this variety, produced in 1852," the potato authority, Stuart, tells us, "he grew some seedlings in 1853; and from this lot one was selected as worthy of propagation." This seedling was introduced in 1857 under the name of "Garnet Chili." This variety and other natural hybrids selected by Goodrich were the breeding stocks of numerous successive potato breeders. Most of the 200 or more potato varieties found today in the United States descended from the original consignment by the unknown consul in Panama. (4)

HELP OF OTHER CONSULS

Many other American consular officials cooperated in securing seeds for the Patent Office. Charles Huffnagle, the consul at Calcutta, sent a shipment of *Dacca cotton* seed to Edmund Burke in 1849. John P. Brown, of the United States Legation at Constantinople, complied with Mason's request for 100 bushels of the best *flint wheat* of Turkey. All of the consuls were expected to gather information on the agriculture of the countries where they were stationed. Chile and Peru were looked upon as sources of valuable seeds, especially of wheat, alfalfa, and beans, and special attention was given to the exchange of seeds with those countries. Several varieties of pepper, beans, and corn were received from Callao, Peru, in exchange for American seeds sent there. From Algeria, 12,000 pounds of wheat were procured by the American consul, John J. Mahony. Two Wardian cases of plants of great economic value were sent from Ningpo, China, by D. S. MacGowan in 1856. The Consulate-General of Egypt sent a quantity of seeds of different kinds collected there during his residence. Townsend Harris, Minister-Resident at Yedo, Japan, sent a box of various seeds to the Patent Office in 1861.

Japanese Contributions—Robert H. Pruyn, Minister-Resident at Tokyo in 1862, sent eighteen boxes of upland rice and grape cuttings from the government of Japan to the Department of Agriculture. Both items were quite welcome—the rice because

of the loss of the southern supply during the Civil War, and the grape cuttings in view of the efforts to found a native wine industry in the eastern United States. Commissioner Newton was notified that another shipment of 900 choice grapevines had been sent by the Japanese government. Pruyn also tried to procure sorghum seeds. Newton expressed the widespread interest in the agricultural plants of Japan when he wrote:

> Our people look upon every natural production of this description . . . with a more lively interest than upon similar articles from *any other country;* believing as they do, that they are actual and rare acquisitions—unexpectedly coming from a hitherto unknown and inaccessible country—capable, perhaps, of improvement in our soil and climate, under the progressive ideas of our people.

Thomas Hogg, American consul in Japan from 1865-75, sent Japanese plants to America to be propagated by Parson's Nursery in Long Island; one of these was a hydrangea.[6] Other consuls sent seeds and plants to friends or brought them back occasionally with the idea of capitalizing on them. Plant introduction by diplomatic officials became less important when the Department of Agriculture expanded its activities and depended more upon its own agents for plant materials.

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[6] Isaac Newton revealed that Hogg sent choice grape cuttings packed carefully to his brother in New York. At the same time he sent grape cuttings to the Department of Agriculture with little preparation and care. Newton, jealous that the department should have the honor of *first* introducing valuable new plants, resented this partiality to a commercial firm to the disadvantage of the nation's agriculturists. Newton wrote Hogg expressing his disappointment with his action.

4

Leadership of the Patent Office 1836-62

PRIOR to the agricultural appropriation of 1839, the government had made several sporadic attempts to encourage plant importation. In revising the tariff regulations in 1816, Congress permitted foreign plants and trees to enter duty-free. Efforts were made in 1822 to use the Mall, an area of 200 acres between the Capitol and the Washington Monument, as an experimental farm for propagating new seeds and plants. Dufour and Perrine had received land grants to carry on their work, and a committee on Agriculture was created in the House in 1820 and in the Senate in 1825.

The grant of 1839, however, was the first significant Federal achievement in the field of agriculture. It called for an appropriation of $1,000 from the Patent Office funds to aid in collecting and publishing agricultural statistics and for the collection and distribution of seeds. Known as the Agricultural Division of the Patent Office, the new bureau came under the jurisdiction of the State Department. This work of handling new seeds and plants was considered a function of the Patent Office because of the department's concern with new discoveries and inventions.

ELLSWORTH FAVORS PLAN

Oliver Ellsworth, head of the Patent Office during this period, was instrumental in securing the appropriation of 1839. In the first *Annual Report* of 1837, Ellsworth recommended the establishment of a "depository" for new varieties of seeds and plants until they were distributed. Introductions brought in by the Navy had often failed for the lack of a regular means of distributing plant materials left with customs collectors. Although no immediate action was taken by Congress, Ellsworth continued to receive and

distribute improved varieties of wheat, corn and other seeds. Distribution of the seeds was done under the postal frank of friendly members of Congress. This was the beginning of the congressional practice of free seed shipments to constituents.

In January of 1839 the chairman of the Committee on Patents in the House wrote Ellsworth for information on the collection and distribution of seeds and plants and the gathering of agricultural statistics. Ellsworth strongly advocated an appropriation for this work. President Van Buren also recommended the appropriation in order to widen the scope of the Sixth Census by the collection of agricultural information. Ellsworth's testimonials from farmers, particularly those regarding improved Indian corn, had made evident the benefits to be gained by planting better varieties. The appropriation was passed in the Act of March 3, 1839. (1) Because it focused Federal attention on the place of agriculture in our economy, this act led to the establishment two decades later of a Department of Agriculture.

WORK OF THE PATENT OFFICE

During his term as Commissioner, Ellsworth solicited the aid of the diplomatic corps and the Navy in collecting seeds for the Patent Office. The farm press recognized him as a benefactor and credited him with making great efforts to secure new plants. (2) The original appropriation was duplicated in 1842 and increased gradually in succeeding years until 1848, when the bureau received $3,500 for its annual budget. A tariff act in 1842 further encouraged plant introductions by exempting foreign garden seeds from duty. (3)

The Patent Office *Report* of 1845 praised consuls abroad for procuring seeds and information, and requested more funds to continue purchases. Difficulty in establishing agencies abroad for the collection of new seeds had hindered the work of introduction, and varieties frequently had been distributed to parts of the country where they could not grow.

A record distribution of more than 60,000 packages of seed was made in 1847. Some of these seeds were presented by the Minister of Agriculture and Commerce in France, through the efforts of Alexandre Vattemare, promoter of international plant exchange. C. F. Hagedorn, the Bavarian consul at Philadelphia, imported seeds from his government. The Bavarian Government had re-

quested him to establish an exchange of plants between the Royal Botanic Garden and the botanical garden in America. (4) By 1848, more than 250,000 packages of seeds had been dispersed, and reports of poor seed germination, which became common in later years, were being received.

The Patent Office *Reports* of 1847-48 indicate that the government wanted more information on wheat, especially imported varieties. *Multicole rye* was imported from France in 1843 for trial, and the Commissioner of Patents attempted to get enough seed of the *Mark Lane Express* barley from England to distribute. That same year, the Patent Office planned to distribute seeds of some very hardy varieties of Hungarian tobacco procured by Charles L. Fleischmann. The attention of the public was also invited to a new, successful Turkish tobacco.

AGRICULTURE UNDER THE DEPARTMENT OF THE INTERIOR

A Congressional Act in 1849 transferred the Patent Office from the Department of State to the new Department of the Interior. With this, the reorganized Agricultural Division of the Patent Office achieved enough prominence to make a separate *Annual Report* of its activities. These reports continued until the work was absorbed in 1862 by the newly created Department of Agriculture.

The chief concern of the Agricultural Division continued to be the introduction of seeds and plants. Charles Mason, Commissioner of Patents from 1853 to 1857, proved unusually resourceful in this work. Mason felt more keenly than his predecessors the need for a vigorous program of plant introduction. The *Report* for 1854 showed that earlier commissioners had allocated a considerable share of their appropriations to the work of plant dissemination. But Mason felt that the prime object in expending this money was "the introduction and naturalization of new and useful vegetable products, hitherto unknown in the United States." Mason believed that "the advantage resulting from the introduction of a new commodity of average utility for consumption or commerce is of more value to the country than the acquisition of a new province."

The *Report* for 1861 reflected the attitude of another commissioner who favored plant introduction. D. P. Holloway, who was also a prominent agricultural editor, spoke out for this work

because "great diversities of heat and cold, ardity and moisture, desolation and extreme productiveness, these very contrasts open up a wide field for scientific investigations, to ascertain what crops and modes of culture are best adapted to all these diversities." The commissioners also urged that the vitality and productivity of plants propagated by buds or cuttings should constantly be increased by the dissemination of new seed stocks.

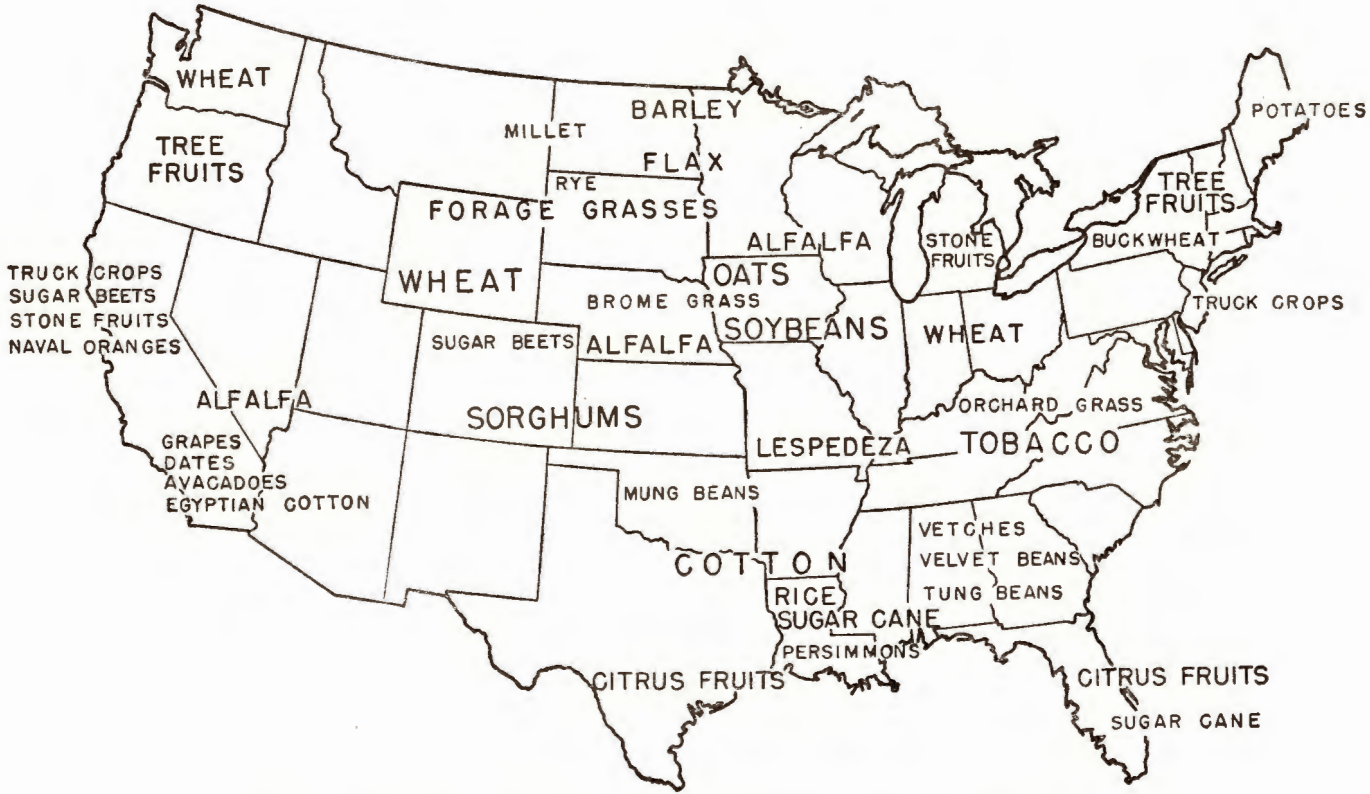
Foreign Seed Buyers—Among those plants commanding the interest of the Patent Office, tea and the Chinese sugar cane received the greatest emphasis. An agent of the office went to Europe in the fall of 1854 to procure seeds of grains, grasses, and leguminous plants direct from the growers. At the same time, the dissemination of choice varieties found within the United States was not negelected.

D. J. Browne, agricultural expert, made two trips to Europe to procure seeds from reliable sources, and spent large sums of money with the principal foreign seed establishments. This buying program was severely criticized by dealers in America, and a Senate committee's investigation followed. Browne's activities were above criticism, however, and his work in Europe makes him our first accredited agricultural explorer.

As in earlier years, considerable attention was directed to viticulture in conjunction with experiments to promote a domestic wine industry. Temperance, the argument ran, would be encouraged by substituting wine consumption for distilled and "factitious" liquors. An assemblage of citizens from most of the states and territories met at the Patent Office on January 3, 1859. They supported the program, and resolved themselves into an "Advisory Board of Agriculture of the Patent Office."

New Plants From Asia—The vast vegetable resources of eastern Asia received much attention during the nineteenth century as sources of new plants for America. In 1856 the minister to China was requested to procure seeds and plants up to the value of $1,000. The similarity of the climate of the eastern United States and regions of Central Asia led the commissioner to believe Chinese crops would thrive in America. Long a rich source of plant life, Central Asia was still an unexplored region and appealed to gardeners because of its rare plants of high value.

The Navy brought sugar cane cuttings from islands in the Pacific area, but the amber sorgo, tea, and many other plants



General Cultivation Areas of Important Crops Introduced Into the United States.

came from China. For improved varieties of the common field and vegetable crops the Patent Office turned to Europe. England and France were considered sources of improved varieties of bread grains, but after 1850 the search was extended, and small grains were procured from Poland, Algiers, and the borders of the Black Sea.

DISTRIBUTION OF SEEDS

By 1850 more than 80,000 packages of seeds were being distributed annually, although the budget for *all* agricultural activities was only $4,500 per year. Congress first made specific provision for collecting and distributing seeds in 1852, and in 1854 increased the annual appropriation for agricultural work to $25,000. (5)

This increased appropriation during Mason's term made it possible to enlarge the program of distribution, and in 1861 2,474,380 packages of seed were sent out, including 15 varieties of garden and 230 of flower seeds. Mason proposed to send many small packages to a large number of people. He believed this policy would give the new plants a better trial in every section, and the laws of chance would place them in many conscientious hands. Mason secured his mailing lists by requesting postmasters to send him the names of persons likely to give the seeds a fair trial. Agricultural societies requested seeds for distribution among their members. The legislature of South Carolina appropriated $5,000 a year for experiments with plant materials.

Seed Firms Employed—With more funds at its disposal the Patent Office for a time was able to send its own agents to Europe in search of seeds instead of having to depend entirely upon the Navy and the State Department for help. In 1855, however, arrangements were made with the seed firms of Vilmorin-Andrieux in Paris, Charlwood and Cummins in London, Ernest Von Spreckelsen and Company in Hamburg, and William Skirving in Liverpool to supply foreign seeds. The French and the English concerns continued to fill large seed orders for the government for more than ten years.

Congressmen continued to assist in seed distribution by sending parcels to their constituents, and would not limit the benefits of the system to experimentation. Consequently, many of the seeds distributed were those of the ordinary field and garden crops. The government purchased large quantities of these common

seeds from European firms for distribution, and in 1856 flower seeds were also sent out. Congress appropriated $75,000 for agriculture in 1856, and a report of the purchases made with this money show that the bulk of it was spent on seeds of the commonly-grown crops.

Imported seeds were admitted duty free by the Treasury Department, and they came in so frequently that Mason requested that a general order covering all such shipments be issued so that the Patent Office would not have to make out a separate authorization on each shipment.

SEED DISTRIBUTIONS CURTAILED

Following Mason's term as commissioner, the work of the Agricultural Division was subject to the alternate expansion and retrenchment of its budget caused by political changes. In fact, Mason felt it necessary to temper the generosity he had displayed earlier. Individuals receiving seeds were reminded that they were public servants, working for the common good. Free seed distributions had caused some persons to look upon the Patent Office as a common seed store for planting their vegetable gardens. Mason, who was charged with collusion with seed dealers, felt that the government should take care lest the people come to look upon it as a fountain of favors and benefits. His criticism did not become valid, however, until the government quit confining itself to the introduction and distribution of new and important plants.

Economy measures in 1859 cut the appropriation for the Agricultural Division so much that only projects already under way could be continued. Commissioner William D. Bishop recommended that the money be used only to distribute varieties not previously introduced. There was also the problem of government competition with industry. Actually the seed distributions by the Patent Office had promoted the sales of commercial seed firms by calling the farmers' attention to the utility of fresh plant stocks and a variety of crops. However, the government did not wish to compete with the efforts of the seed dealers who by this time were established in all the principal cities.

SEPARATE CROP HISTORIES

TEA CULTIVATION

For many years growers pondered the question of raising tea in America in order to relieve the dependency upon foreign sup-

pliers. They believed that if this important staple could be produced at home, it would improve the balance of trade and national self-sufficiency. A new crop industry would employ more labor, increase the national wealth, and add diversity to southern agriculture.

First Plantings—The first known tea grower in America was Andre Michaux, the French botanist. Michaux set out tea plants around 1800 on the banks of the Ashley River, about fifteen miles from Charleston. *Niles' Register* reported in 1823 that genuine *Hyson tea* had been successfully cultivated in North Carolina from a viable seed found among tea leaves. This is surprising, since at a later date it proved impractical to import viable tea seeds because they frequently turned rancid during the long ocean voyage. In November of the same year, a large bed of tea shrubs was reported growing in Louisiana, and *Niles' Register* recorded that a specimen of Southern tea was found to be palatable and refreshing.

Even at this time there was some doubt about the success of tea growing in America due to the large amount of cheap labor needed for its cultivation. Tea said to compare favorably with the best China varieties was reported in Louisiana in 1825. The successful cultivation of the tea plant for more than fifteen years in South Carolina was announced in 1828. Such reports were not widely available, however, as evidenced by the fact that the editor of the *Genesee Farmer* hoped in 1837 that some enterprising shipmasters would introduce tea from China.

Government Interest—America's desire to grow tea grew out of the successful cultivation of the plant by the British East India Company in the middle of the nineteenth century. Dr. Junius Smith was the first to experiment seriously with tea growing for agricultural and commercial purposes. He selected a farm in the foothills of western South Carolina as the preferred climate for the tea plant, and in 1848 imported plants of seven-years' growth from London and India. The Patent Office took an immediate interest in Smith's work and recorded the introduction in anticipation of the future interest this "enterprising projector" would arouse. Smith also promoted his own publicity through the farm papers. The Department of the Interior asked the Navy to secure some tea seeds from the East Indies in 1851, but the effort did not succeed.

FORTUNE HIRED TO FIND TEA

In a report on plants worthy of introduction, Commissioner Mason listed tea as being desirable for home consumption. Many people believed that American growers could compete successfully with the Asiatics for the tea market. America had new machinery for processing tea, a plentiful supply of skilled and cheap slave labor, and superior transportation facilities. An article in the *Annual Report* for 1855 described the Chinese methods of cultivating and harvesting tea. As interest in the subject grew stronger, Mason engaged Robert Fortune, a plant explorer, to obtain tea plants from China.

Fortune had already acquired a reputation for his services to the British Empire, exploring for three years in the interior of China and collecting seeds and plants for the London Horticulture Society. He also had been employed by the British East India Company in 1848 to procure tea seeds from the Himalaya region, and this was the beginning of a successful tea industry in northern India. Fortune is also remembered for the many varieties of the chrysanthemum he sent to Europe, which later found their way into American gardens.[1]

At the request of the Patent Office, Fortune sailed from England for China in March, 1858. He wrote from Shanghai that he had made arrangements with natives for large supplies of seeds and plants at the proper season. Commissioner Joseph Holt, who was Mason's successor, hoped through Fortune's efforts to be able to found a new agricultural industry in the South. Meteorological and geological studies were made to determine the areas most similar to the native environment of the plants to be imported.

Fortune sent tea and camphor seeds to the Patent Office and entrusted two cases of plants and seeds to the *Nabob* bound for New York. These cases contained specimens of *indigo* tea, the *soap bean*, and the *grass cloth* plant. Apparently deciding that the plants needed no further expert attention, Holt dismissed Fortune before he could return to America.[2]

The tea seed, which was shipped in Wardian cases, flourished,

[1] His various explorations are described in his three books: *Three Years Wandering in the Northern Provinces of China* (1847), *A Journey to the Tea Countries in China* (1852), *and Yeddo and Peking: A Narrative of a Journey to the Capitals of China and Japan* (1863).

[2] Fortune expected to be paid six months' salary for this sudden change of mind on the part of Holt.

and had grown to a height of eighteen inches when taken from the original cases in Washington.[3]

Distribution of Tea Plants—In 1859, 30,000 well-rooted tea plants were ready for distribution to southern growers and to gardeners in the North who had greenhouses. The Patent Office expected to continue supplying these plants in order to give tea cultivation a fair trial over a period of years. Some growers were optimistic enough to hope that the substitution of steam power and machinery for hand labor in the preparation of tea might eventually make it an article of export.

The dissemination of tea plants was a prominent part of the work of the Agricultural Division until the Civil War halted communication with the South. The Department of Agriculture continued to propagate the plants after its formation in 1862, and efforts to introduce the tea plant were not given up until recent years.

SORGHUMS FOR SUGAR

During the decade preceding the Civil War, the production of sugar from sugar cane declined sharply while prices and per capita consumption of the product were steadily increasing. This was due in part to the rapid degeneration of sugar cane importations—which had to be supplanted with new cuttings periodically. The annual consumption of cane sugar in America reached 822 million pounds in 1855, and more than half of this had to be imported. Sugar beets were considered impractical for our economy because their cultivation required a lot of cheap labor. Maple sugar production had increased, but it failed to make any appreciable difference in the shortage of native sugar.

Chinese Sorgo—To step up sugar production, the Patent Office turned to the sorghums as a substitute for the sugar cane. The Chinese sorgo and other sorghums aroused more interest than any other single plant introduction during the nineteenth century be-

[3] The use of Wardian glass cases for transporting plants great distances at sea came to be widely practiced soon after the discovery of their principle by a London physician, Nathaniel B. Ward, in 1829. The Wardian case is simply a closed glass case that protects plants from various unfavorable conditions. It protects them from impure air, salt spray, cold air, and high winds. It maintains constant humidity and moisture in the soil, because it permits only negligible air circulation. With the advent of transportation by airplane, the Wardian cases have become largely obsolete.

cause of their wide adaptability and variety of uses. Chinese sugar cane, identical with the black amber cane commonly sowed today as a hay crop in Texas, was first referred to by the Patent Office in its *Report* of 1854 as the "Sorgho Sucrè." This was the French name for a variety sent from northern China in 1851 by the French consul at Shanghai. At the request of his government, the Count de Montigny had forwarded a collection of plants, seeds, and cuttings to the Geographical Society of Paris. The seeds were sent to the director of the Marine Gardens at Toulon.

According to the accounts, only one cane seed of the entire lot sprouted, and the survival of this plant was accidental. Such lore is rather common in the early history of the migration of crops into different lands. It springs, no doubt, from the fascination of such stories of the chance survival and reproductive capacities of plant life.

The Patent Office took an immediate interest in the French sorgo when it heard that the juice of the plant could be processed to make sugar, that three crops might be taken from the same ground in one year, and that it could be used as a forage crop. The French also had hoped that the new plant would supersede the sugar beet in the production of sugar and alcohol.

First Introductions—Credit for the introduction of the new sorgo belongs to D. J. Browne of the Patent Office, who brought over from France about 200 pounds of the seed in 1854. D. Redmond, editor of the *Southern Cultivator,* also obtained some of the seed about the same time from the firm of Parker, White and Gannett of Boston. He planted a few ounces in the spring of 1855 and distributed seed from this crop throughout the South. Redmond therefore claimed credit for introducing this cane into general cultivation in the South.

Another claimant for the honor of having been the first to introduce the cane to America was William R. Prince, head of one of the leading seed and plant businesses of the time. Prince's claim that he brought the cane in a year before either Browne or Redmond is accepted by Peter Collier, in charge of sorghum experiments for the Department of Agriculture during the 1880's.

The Patent Office had about 175 bushels of the cane grown near Washington in 1855, and imported another 100 bushels from Vilmorin in France. *The American Agriculturist,* a leading agricultural journal in the North, assisted in disseminating the cane. Its editor, Orange Judd, distributed 1,600 pounds of seed in 1857

to some 31,000 subscribers to his magazine. Judd obtained his seed from Vilmorin in time to grow a 75-foot row in 1856. Two years later, Judd distributed 34,500 one-pound packages of the seed. (6) This work helped to extend cultivation of the cane to every portion of the country.

PROMOTION OF SORGHUMS

Five acres of land—the beginning of the Federal propagating garden—were set aside in Washington, D.C., for the production of cane seed. The first seed crop from this land was distributed during 1856-57. After this time the Patent Office did not make any more general distributions of cane seed because enough seed had already been given out to make them generally available. Subsequent distributions were mainly of special varieties, or else made for the sake of giving something free to the voters.

Value of Sorgos—Commissioner Mason actively promoted the Chinese sugar cane because he was enthusiastic over its many uses. It could be employed in the manufacture of sugar, syrup, alcohol, or beer. From the cane came a dye to make wool or silk a permanent red or pink. Livestock ate it avidly, either dry or green. The rapid growth and the amount of nutritious fodder produced by this cane could not be matched by any other crop grown on an equal space. It would also support large numbers of livestock for the production of beef, milk, and fertilizer. Interest in the Chinese sugar cane reached a peak in 1857. The possibility of its extensive cultivation—up to 25 million acres—as a partial substitute for Indian corn was foreseen.

D. J. Browne, in promoting the crop at a meeting of the United State Agricultural Society, saw its chief value as cattle fodder and prophesied that it would be revolutionary in this respect. Such promotion probably was necessary to counteract the skepticism of farmers who remembered the *Morus multicaulis* speculation. Its merits for certain uses were already well established, and a chemist worked for the Patent Office to determine the amount of alcohol and saccharine matter in the cane stalk. Experiments in sugar manufacture were already under way in Texas and other states.

The first recorded instance of the sorghum's recognition as drouth resistant is that of a farmer at Gonzales, Texas, who found it ". . .an important acquisition to our agricultural resources. It stands drouth better than any other plant that I am acquainted

with. Its introduction into this country must produce an entire revolution in our rural operations. Its culture will supersede that of Indian corn."

A cursory examination of the farm papers of this time quickly shows the interest current in the new crop and its value to almost every section of the nation. By 1857 the Patent Office had distributed 100,000 papers of seed, and other suppliers had furnished so much other seed that Olcott estimated 50,000 acres were cultivated in that year. The Patent Office reported in 1858 that the Chinese cane had proved especially successful in the southern, middle, and western states, and that an estimated 100,000 acres worth two million dollars had been planted that year.

African Sorgos—At the same time that interest in the Chinese sorgo was running high, another introduction of sorghums was made from Natal, South Africa. These sixteen varieties imported in 1857 were the most important group of sorghums ever brought to America. The man responsible for their introduction was Leonard Wray, a planter from England who discovered the varieties in South Africa and took them with him to Europe before coming to this country. (7)

Wray came to the United States at the invitation of Governor Hammond of South Carolina. A similar invitation had been sent to him by the Patent Office but was never received. Wray had applied to the Patent Office for a patent on his process of making sugar from sorgo. His arrival from Europe heightened the interest in the production of sugar from sorgos and increased the hopes of success. Wray at first intended to maintain a monopoly of his plants. Either he failed to do so, or saw that the attempt would not prove profitable. At any rate, his introductions came to be widely grown in this country. For three decades the Patent Office, state agencies, and individuals carried on expensive experiments with sorgos hoping to find in them the basis of a sugar and syrup industry.

MISCELLANEOUS INTRODUCTIONS

The vigorous efforts of Charles Mason to introduce new plants are well illustrated by the number of crop possibilities he considered and investigated. In his search for better varieties of the commonly grown grains, a dwarf variety of Indian corn called *Forty Days Maize* was re-introduced from southern Spain. It reputedly ripened in forty days in the Alps, and was to be tried in

the high valleys of America where other varieties did not succeed. This is the first instance in the United States of plant introduction for the purpose of breeding desirable qualities of the immigrant into the ordinary native varieties. This Indian corn was crossed with larger sorts to improve their taste and to hasten the time of ripening. A *Cuzco corn* from Peru was obtained through Vilmorin of Paris.

Field Crops—Bald barley from Italy, *giant rye* from England, and various small grains from Poland, Algiers, and the borders of the Black Sea were imported for testing. Many legumes, forage crops, and grasses were obtained. The problem of improving southern pastures continued to interest farmers throughout the nineteenth century. As with a great many plants, no details are available about these importations. They were merely enumerated and their separate histories swallowed up in the experiments to find better crops.

From England the Patent Office obtained a variety of trefoil or clover, a *cow grass* or perennial clover, the *alsyke* or Swedish clover, a variety of red clover, two varieties each of *Perennial Ray Grass* and *fescue grass,* Rough-stalked Meadow Grass, and *Sweet-scented Vernal.* From France came two varieties of sainfoin and rape and specimens of Vernal, *burnet grass,* and *spurry.* A variety of alfalfa was brought from Chile.

In 1857 Wendelin Grimm, a German immigrant farmer, brought with him to Minnesota from Baden the valuable alfalfa to which he gave his name. This hardy type occupied over 700,000 acres in 1930. A white lupine from southern Spain and a yellow lupine from Germany were imported for forage and soiling.

M. B. Bateham, editor of the *Ohio Cultivator,* called attention to his importation of the *alsike clover* in 1839 from an agricultural society in Scotland which in turn had received it from Sweden. Like other farm papers, the *Ohio Cultivator* imported and distributed many field and garden seeds.

Vegetables—The Patent Office imported new varieties of peas and beans from England, France, and Germany in 1854. *Chick peas* and *lentils* came from Spain and France. Twenty-six varieties of turnips came from Charlwood and Cummins of London with the condition that they be distributed in every state and territory, and a report published on the results. The variety names resembled the descriptive names given to turnips by present day seedsmen.

Several varieties each of nearly two dozen familiar garden vegetables were imported from England, France, and Germany. Irish potatoes were again brought from England and Germany. The *Chinese yam* brought in from France was proposed as a substitute for the Irish potato because of the potato blight then raging. By 1857 it was well adapted and proved to be a possible substitute for potatoes. The Patent Office expected immediate adoption of the *earth almond,* or chufa, imported from southern Spain as a feed for cattle and hogs.

Opium—Import statistics were often used by the Patent Office to prove that certain items should be produced in the United States for the home market. One such suggestion was that opium be produced to supply the $400,000 market in this country. A variety of the common or Opium Poppy was distributed in the South and proved easy to cultivate in that region. Directions for cultivating and processing the extract were printed and the experiences of growers related.

Liquorice roots were imported and distributed in the middle and southern states to supply the $300,000 import market which existed. The *Report* of 1854 carried an article on the cultivation and preparation of the plant, and growers reported successful cultivation of the roots.

Grapes—The Patent Office printed long articles in support of the current experimentation with grapes. But failure of the European varieties caused growers to turn to the native grapes. Plant explorers were sent to Texas, Arkansas, and some of the northern states in 1857-58 to collect cuttings of native varieties for trial. Twelve thousand vines were ready for distribution from both foreign and native stocks in 1858.

The possibilities of growing figs and olives in the South were studied in 1859 and American consuls were to procure seeds and cuttings. Cork production would provide an auxiliary industry to wine culture. Thus wine, grapes, figs, cork, and olive oil were expected to become staple crops for the South.

Cork Oak—Acorns of the cork oak, an evergreen tree grown commercially in Europe and Africa, were secured from France in 1856 and from Spain two years later. The tree proved to to be adaptable to the climate and soil of the southern states, and the acorns were considered a valuable hog feed. It was also considered essential that America free herself from dependence upon foreign sources for cork in the event that war might deprive the country

of its supply. Many of the plants failed to mature because they had been distributed indiscriminately, but those in the government propagating garden grew successfully.

Other introductions of this period include the seedless pomegranate of which 900 cuttings were distributed in 1859. Robert Fortune sent camphor seeds from China. Seeds of the carob tree, widely grown in Spain and southern Europe, were introduced in 1854. The Persian walnut came from France. An article of several pages containing information about the plant, and a long article listing many other plants is included in the *Report* of 1854. Many plants introduced in later years were first mentioned in this report in an effort to arouse interest in their cultivation and secure cooperation from travelers in foreign lands in securing specimens.

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5

The Commissionership 1862-89

THE MAIN POINT which boosters of a national department of agriculture stressed during the 1850's was the great value of plant introduction work to the nation's agriculture. Farmers, agricultural societies, and periodicals all joined in advocating a separate government organization devoted to agriculture, and equal in importance to any other department. The Board of Agriculture in England and similar organizations in France and Prussia were cited as precedents. Commissioner Holloway of the Patent Office urged that agriculture be separated from the Patent Office so that it might become more than an appendage designed "to furnish members of Congress cuttings and garden seeds to distribute among favored constituents."

After more than a decade of agitation for such a measure, Congress established the Department of Agriculture, May 15, 1862. The Department, as organized, was headed by a Commissioner of Agriculture. Not until 1889 did Congress give the Department a Secretary enjoying a seat in the President's Cabinet.

The act establishing the Department of Agriculture followed hard on the heels of the secession by the southern states. The new western states now reaped their reward for siding with the North, for the Department quickly turned its attention to the agricultural needs of the West. The Homestead Act and Morrill Land Grant College Act also became laws shortly after the founding of the Department of Agriculture.

AIMS AND METHODS OF THE COMMISSIONERS

Isaac Newton, a dairy farmer from Pennsylvania, was the first man to head the new Department of Agriculture. Before his appointment as Commissioner, Newton had become acquainted

with Lincoln. He was detailed to watch the President's food supply when Lincoln was threatened with poisoning. He also became a confidant of Mrs. Lincoln, who sometimes abused her charge accounts at the stores, and he carried out the ticklish business of interceding in her behalf with the President.

Criticism of Newton—As Commissioner, Newton became the center of a storm of controversy; some considered him a person of wisdom, others thought him unlearned and incompetent. The farm journals of the time criticized him viciously. Earlier, they had been highly critical of the agricultural activities of the Patent Office. Now they looked upon the increased dissemination of agricultural information and free seed as competition from the government, in what they considered their own special province. Probably only Newton's death, due to sunstroke while supervising work at the experimental farm, prevented his dismissal by President Johnson. The substantial objections to Newton were based on his political scheming and on his failure to appreciate the needs of scientific specialists under him.

During his term as Commissioner from 1862 until his death in 1867, Newton worked hard to carry out the provisions of the act establishing the Department of Agriculture. These aims were: first, to educate the public by collecting and presenting agricultural information, and second, to collect valuable plant materials at home and abroad for distribution under the postal franking privilege. Foreign ministers, consuls, merchants, missionaries, travelers, and naval officers were urged to collect materials from foreign countries.

Plans for the South—The war with the South, and "postwar" plans for the reconstruction of its agriculture after the North should conquer, gave Newton the opportunity to plan a modification of the South's dependence on its staple agricultural crops. Newton realized that the agricultural possibilities of the South were yet to be exploited. Tropical and sub-tropical plants as well as the cereals, grasses, fruits, and vegetables of the temperate zone offered a wide variety of potential crops for the South. Solving the food problems of this area might help to create entire new crop industries. The great staples would continue to be grown, Newton thought, but the notoriously limited diet of the South could be varied by the production there of an abundance of every kind of food. Newton believed that smaller farms, managed by intelligent and interested labor, would make it feasible to produce

imported crops, some of which required intensive cultivation.

Many of the plants Newton investigated were later subjected to extensive experimentation.[1] Some of them were found to be economically impractical while others became the bases of new crop industries. Newton worked closely with diplomatic representatives abroad to obtain new seed stocks for America, for millions of dollars were leaving the country each year—spent on foreign agricultural products.

An important auxiliary to plant introduction work was the Division of Gardens and Grounds for purposes of experiment and propagation of untried plants. William Saunders became superintendent in September, 1862, and remained in that office for thirty-seven years. He helped to promote many new introductions, and in contrast to some other enthusiasts, used guarded judgment in the evaluation of new plants. He furnished plans for conservatories, and other structures were erected under his direction. Saunders, born in Scotland in 1822, was well prepared for his fruitful career in America by studies in the plant sciences at Edinburgh and by his services to the Royal Gardens at Kew. He came to America in 1844 and became horticulturist for the Department in 1862. As a landscape architect, he designed the park and garden system of Washington and landscaped many cemeteries in the eastern United States, including Gettysburg.

Plea for More Land—During the 1850's, while agricultural work was still under the control of the Patent Office, officials in charge of the Agricultural Division had frequently urged that the area devoted to experimental work be increased. But the country at that time was not prepared for any such extension of Federal paternalism. When Newton took office he repeated the request for more land, and suggested that the Department set up a model farm to test the adaptability of seeds and plants before sending them to farmers. It was becoming more apparent each year that superior varieties and other means of increasing agricultural production must be found. Tests of 576 varieties of garden seeds were conducted in 1867, but the area available was still too limited for

[1] Tea, coffee, opium poppy, vanilla, ginger, castor bean, assafoetida, quassia, silk, gum arabic, mastic, camphor, the Chinese yam, sweet chestnuts, chufa (or earth almond), the almonds of southern Europe, the Persian walnut, the cork and gall-nut oaks, arrowroot, licorice and orris roots, and various hemps and grasses; fruits included were the prune, fig, date, pomegranate, olive, tamarind, guava, nectarine, shaddock, and pineapple; other productions were the pistache nut, Iceland moss, cochineal, indigo, dyer's madder, frankincense, balsam, and Egyptian senna.

the best results. Newton realized that enough land was needed to enable the Department to propagate forty to fifty thousand plants each year. Congress did not appropriate money for more land, however, and later commissioners also tackled this problem without success.

Growth of Seed Distribution—The account of the free distribution of seeds and plants by the Department of Agriculture is parallel to that of the changing motives and aims of plant introduction. Seed distributions came to be abused by members of

TABLE 1

SEED DISTRIBUTION BY THE FEDERAL GOVERNMENT 1862–89

Year	Total Distribution	Annual Appropriation	Year	Total Distribution	Annual Appropriation
	No. of packages			*No. of packages*	
1862	306,304	.....	1876	1,520,207	$ 65,000
1863	1,200,000	.....	1877	2,333,474	65,000*
1864	1,000,000	.....	1878	1,115,886	75,000
1865	763,231	.....	1879	1,545,739	75,000
1866	992,062	.....	1880	1,581,253	75,000
1867	1,426,637	.....	1881	1,878,772	80,000
1868	592,398	.....	1882	2,396,476	80,000
1869	317,347	.....	1883	2,467,230	80,000
1870	358,391	$25,000	1884	3,622,738	75,000
1871	647,321	45,000	1885	4,667,826	100,000
1872	814,565	45,000	1886	4,267,165	100,000
1873	1,050,886	55,000	1887	4,561,741	100,000
1874	1,286,335	65,000	1888	4,655,519	100,000
1875	2,221,532	65,000	.....	.....	.....

* An additional $20,000 was appropriated for a special distribution of seeds to aid farmers in the area blighted by a grasshopper plague. Approximately one million of the seed packages distributed in 1877 were for this special purpose.

Congress, and valuable materials often were sent to persons not qualified to test them. Increased congressional appropriations for this purpose were frequently made over the commissioners' protest, and many growers complained that very ordinary seeds were being distributed. Statistics of distributions indicate in a rough measure the growing or declining interest in specific new crops and the local adaptation of varieties. The policy was to test plants in localities where they might become known for their merits. Attempts to eliminate the wasteful distribution of varieties of no particular value led to intermittent retrenchment of the program.

As mentioned earlier, agricultural journals of the day—which distributed free seeds of new varieties to subscribers—resented the

competitive liberality of the government. Seed firms also disliked the competition, and taxpayers always opposed what seemed to be wasteful expenditure. But Isaac Newton, unlike former agriculture chiefs, found no fault with the practice of liberal seed distributions. He argued that no equal sum of money expended by the government gave so large a proportion of the people so much "substantial enjoyment."

The result of Newton's expanded program was an increasing demand for seeds. In 1863, Newton had made the sweeping statement that all correspondents reported good results obtained from seeds tried, and in 1864 he asserted that the imported seeds had been of immense benefit. He pointed to the large national acreage of sorghum then being grown as an example of the value of the Department's plant introduction work.

However, by 1864 Newton had admitted his dissatisfaction with the large orders of vines and trees. A new propagating house was erected in 1865, but Newton strengthened his resolution to prevent the propagating garden from degenerating into a commercial nursery. He suggested that members of Congress distribute more seeds to agricultural societies to encourage these associations and to lessen the evils of indiscriminate distribution.

HORACE CAPRON

Following the death of Newton in July, 1867, John W. Stokes was acting Commissioner of Agriculture until December. Then by formal appointment, General Horace Capron succeeded Newton as Commissioner of Agriculture and served from 1867 to 1871. Capron had a record as a successful farmer and manufacturer in Maryland, as a Union army officer, and as a breeder of Devon cattle in Illinois. He continued Newton's policies and kept the confidence of the government and those interested in the Department throughout his career.

Attitude Toward Introductions—When Capron first came into office he was shocked by the growth of the government seed business. His first reaction was that the seed establishment had become a drain upon the Department's resources, but within a year he had become an enthusiastic supporter. Capron believed that seeds should be new to the community receiving them and should not be sent out unless distinctly superior varieties. Like Newton, he advocated a wider distribution to agricultural societies, and cir-

cularized them about the program. Capron stated that "the result of a single importation of wheat has alone been worth more than an annual appropriation for the whole Department." Figures were given to show that an increase in the annual production of wheat by only one bushel per acre would be worth $30 million. In defense of seed distribution, Capron said that, "If nine-tenths of the seed distributed are sheer waste, and the rest judiciously used, the advantage to the country may be tenfold greater than the annual appropriation for agriculture."

In his first *Report,* 1867, Capron favored the extension of the various agricultural crops until "everything consumed in the country, to the growth of which our various soils and climates are adapted, shall be produced on our own lands." With regard to the South, Capron stated that there was a great search in that section for new crops and that the aid of the government in finding new fruits, grasses, and fibers would help the return of prosperity to the whole nation.

Capron was interested mainly in new crops, in contrast to Newton's emphasis on the search for better varieties of the old crops. The Department encouraged the commercial production of sugar from the sugar beet in Illinois by distributing seed imported from France and Germany. Capron favored a domestic silk industry, and the entire nation was invited to advance grape culture. Ramie, an old fiber plant of the Far East, excited the attention of growers and continued to hold interest beyond the turn of the century.

Capron wrote the congressional committees of agriculture asking for remission of duties on imported seeds in order to encourage their distribution by agricultural societies. Nevertheless, in 1870, foreign plants, trees, and seeds were made subject to duty except when introduced by the Federal government.

In 1869, Capron advocated exhibitions of plant collections of commercial value. The emphasis on diversification of crops, especially in the South, pointed to the need for a study of the various oil, gum, and sugar-bearing plants and fiber-producers. Congress voted an appropriation of $25,000 for a glass conservatory building to protect trees and to propagate economic crops. Dr. C. C. Parry, botanist for the Department, explored for plants in San Domingo in 1871. He planned to bring back live specimens of some of the 500 items he had collected for museum purposes. The Department made an exhaustive study of western plant life to find hardy grasses and other plants of economic value.

ARGUMENTS FOR DIVERSIFICATION

The House of Representatives passed a resolution in 1870 requesting Capron to submit a report on the extent and value of foreign imports which might conceivably be produced in this country. From this report the House hoped to find foreign crops which would give diversity to American agriculture and lead to a fuller employment of labor and land. Diversification of agriculture was sorely needed, and it was closely identified in Capron's mind

TABLE 2

DISTRIBUTION OF MAJOR CROP SEEDS BY THE FEDERAL GOVERNMENT 1868–89

Year	Vegetables	Flowers	Tobacco	Turnips	Miscellaneous*
	No. of packages	*No. of packages*	*No. of packages*	*No. of packages*	*No. of packages*
1868	430,511	90,871	23,680	4,876	9,733
1869	196,024	37,352	20,607	6,478	4,447
1870	233,577	41,725	30,258	7,808	5,578
1871	365,933	183,259	18,560	.....	16,691
1872	477,662	196,809	31,664	.....	21,283
1873	617,564	227,296	24,595	.....	29,173
1874	778,319	332,881	25,696	.....	34,510
1875	1,654,058	337,960	56,053	.....	30,442
1876	983,974	372,088	64,107	.....	32,188
1877	1,811,100	302,395	45,398	.....	36,282
1878	669,334	201,597	57,155	.....	74,958
1879	1,270,372	71,280	36,673	.....	64,830
1880	.....	.....	.....	.....	..... †
1881	1,325,922	135,269	115,199	.....	54,715
1882	1,651,704	179,452	83,215	70,700	89,399
1883	1,884,514	233,440	76,232	86,148	60,801
1884	2,351,535	563,638	114,671	425,858	65,993
1885	2,989,655	764,950	168,295	554,732	94,506
1886	3,268,434	337,436	132,057	419,431	63,323
1887	3,609,748	394,137	100,191	375,473	57,230
1888	3,642,018	383,446	123,477	431,497	50,992

* Includes such crops as herbs, opium poppy, tree seeds, grasses and sorghums.

† No figures are available for 1880.

Complete figures for seed distributions prior to 1868 are not given in the USDA *Reports*. Figures for cereals and textiles for this period are given in TABLE 3.

with plant introduction as the means of achievement. Large surpluses of staple crops, caused by overproduction, brought sharp reductions in the prices producers received. The continued planting of a single staple crop robbed soils of their fertility. Diversity would permit planning for rotation and more continuous employment of agricultural labor. "The great extent of our territory," Capron argued, "its variety of soil, climate, and capability, all

point to the want of, and the benefit desirable from, a varied cultivation."

Many Southerners were interested in supplying this home market for new crops recommended in Capron's report. These were tea, coffee, cinchona, jute, ramie, sugar beets, sumac and madder for dyes, sisal hemp, okra and esparto grass for paper, and oil-producing plants, including the caster bean, caraway, anise, and lavender.

FREDERICK WATTS

Frederick Watts of Pennsylvania, Commissioner of Agriculture from August, 1871, to June, 1877, received his appointment as a matter of political patronage to his state. He put less emphasis on the introduction of plants than Capron, but expenditures for this purpose increased during his term in office. Watts denied that plants could be acclimatized to the cold, but the demand for semi-tropical plants continued to grow in the South. Chinese tea plants were in great demand and many thousands were distributed annually. The Department's collection of exotic economic plants was increasing yearly in number and in value. The "orange-family" was cited as particularly valuable and the best commercial varieties were propagated for distribution. Attempts were made to satisfy the demands of the South for pasture grasses. Watts was enthusiastic over the importance of fiber-producing plants and believed ramie and jute were about to assume places of importance.

He also felt that the farmers were securing tremendous benefits from the distributions of wheat, oats, and grasses. As the farmers increased their requests for seed, Congress enlarged the appropriation for this work. The trial of new seeds made farmers conscious of the value of experimental work, and their reports of the results they got were helpful to all concerned.

By 1874 the Department was becoming more discriminating in its purchases of seeds from firms proved reliable by experience. By buying direct from growers, larger quantities for distribution were secured at a nominal cost. Much attention was given to the selection of seeds, and many recipients vouched for the excellence and good germination of seeds distributed by the Department.

Watts more than tripled the number of seeds distributed each year during his term, and Congress increased the appropriations for this work from $45,000 in 1872, to $75,000 in 1878. Roughly

one-third to one-fourth of the annual appropriation for agriculture was being spent at this time for the distribution of seeds and plants.

WORK OF COMMISSIONER LE DUC

General William Le Duc of Minnesota succeeded Watts in 1877 and served until June, 1881. A former salesman, lawyer, and land promoter, Le Duc proved an able administrator whose work won the favorable attention of Congress and of the public. His reports stressed two themes: the introduction, experimentation, and promotion of sugar-producing plants, and the need for more funds and facilities for testing new plant introductions. His promotion of sugar is discussed topically in Chapter 7.

During Le Duc's term, many plants were propagated and sent to localities where they might flourish. Buildings for and plantings of various fruit trees had taken most of the land available for experiment by 1878. Le Duc recommended the purchase of a thousand acres near Washington and the establishment of eight or ten experiment stations in different climatic and geographical regions. He enthusiastically promoted tropical and semitropical crops including tea, coffee, oranges, lemons, olives, Japanese persimmons, bananas, pineapples, cacao, tamarind, cinchona, pepper, ginger, and dates. Scions of Russian apple trees and plants of European wine grapes were distributed.

Le Duc was in turn critical of the extensive seed distributions by his predecessor. He planned to favor agricultural societies over other applicants, and devoted much space to criticism of distributions by members of Congress. Le Duc's views were endorsed by resolutions of farmers' organizations, by newspaper editors, by some members of Congress, and individual citizens.

Le Duc's interest in tropical and semitropical products was reflected in his unusually large distributions of such plants. He claimed that large increases in yields valued at millions of dollars had resulted from his efforts, and he also believed that more diversification had been achieved. The appropriation act of 1881 required that "three-fourths of plants, seeds, and cuttings" should be made available to members of Congress for distribution. The proportion thus reserved varied from year to year, but had increased to five-sixths when the distributions were discontinued in 1923.

COMMISSIONERS LORING AND COLMAN

Commissioner George B. Loring of Massachusetts headed the Department of Agriculture from 1881 to 1885. Loring took only a mild interest in seed distribution, but continued appropriations by Congress assured an increase in the quantities sent out. During 1885, a record number of seed packages was shipped out. The distribution of plants, however, was not under Congress' thumb, and since Loring devoted more attention to other phases of the Department's work, plant distribution declined during his term in office.

Norman J. Colman served as the last Commissioner and the first Secretary of Agriculture from 1885 to 1889. His background as a lawyer, agricultural journalist, and legislator made him well qualified for the position, and he performed his work with great credit.

Colman accelerated the search for new crops and varieties. He felt that the West needed an abundance of new stocks, and shipments of seed packages more than doubled during his term. Reforms in the method of seed distribution were instituted to prevent the seeds from falling into incompetent hands, and to make certain that the seeds purchased were of good quality and suited to the needs of the various climates. A regular program of seed distribution to the new experiment stations established under the Morrill Act was set up, thus implementing the work of plant testing on a regional basis.

In regard to the value of distributions of new varieties, Colman asserted:

> There are the most ample statistical data at hand in the carefully-kept records of the Agricultural Department to show that the increased production of wheat, oats, and other cereals and grasses, has, by reason of the wide distribution of improved varieties, paid tenfold the entire amount expended by the Department of Agriculture since it was established.

Some success was reported in meeting the demands of farmers for new grasses for summer and winter grazing on the plains. The Department looked to Egypt, India, and Japan for vegetable stocks for the arid and tropical parts of Texas and California. There was a steadily increasing demand for semitropical plants of economic value in the southern states. As the olive industry in California assumed commercial importance, the best European varieties were imported for further trial. In 1899, a site was chosen for an

experiment station at Garden City, Kansas, where grasses and forage crops for the Great Plains would be tested.

Dr. Earle D. Ross has observed in reference to the activities of the Commissioners in promoting new crops that:

> These persistent efforts to introduce new crops and types of cultivation took no thought of the operation of comparative costs or of the ultimate effect upon foreign commerce; and back of each of the ventures were groups of producers who resisted any attempt to lessen the aid to such alleged sources of national treasure. Consequently measures to improve and stabilize the fullest established systems and to secure the best long-time utilization of natural resources had to compete with those for the new and unproven. (1)

An important result incidental to seed distribution was the development of seed tests for quality, germination, the presence of disease, insects or weed seeds, and proper labeling. Germination tests came to be used (to learn whether fresh seeds were adulterated with old stocks) in order to prevent low yields due to poor stands.

THE INTERNATIONAL EXCHANGE OF PLANTS

The policy of exchanging plants and seeds with foreign governments began during Commissioner Newton's term. In addition to securing rare foreign plants, it was hoped the program would promote international relations and an exchange of agricultural information. Commissioner Capron announced in 1868 that international agricultural exchanges had been set up with many of the governments of Europe, Asia, and South America. Arrangements had also been made to exchange rare agricultural products with the major botanical gardens throughout the world. The following year Capron reported that similar arrangements had been adopted with at least a dozen more countries and botanical gardens.[2]

Commissioner Watts continued the system of plant exchanges, and many valuable additions were made to the Department's collections. Some of the outstanding contributions came from the Kew Gardens of London, the Royal Gardens of Melbourne, and the Imperial and Royal Ministers of Agricultural Affairs of Austria-Hungary. Such exchanges were often arranged through

[2] Among the governments Capron mentioned were Austria, Prussia, China, Japan, India, Guatemala, British Honduras, Brazil, Bavaria, Russia, and Switzerland. The societies and botanical gardens listed were Kew, Melbourne, India museum in London, Cape of Good Hope Agricultural Society, British museum, Central Agronomical Society of the Grand Duchy of Posen, Horticultural Union Society of Berlin, Royal Society of Brussels, Royal Gardens of Madrid, Horticultural Society of Bremen, Royal Meteorological Society of Edinburgh, and the Agricultural Society of Sydney, New South Wales.

American ministers and consuls in foreign countries. The Department exchanged 3,450 packages of seed with foreign governments in 1871, and frequently received plants that could not be bought from commercial establishments.

Reports by the Department stressed the fact that this work had paid high dividends in establishing amicable relations with other countries, and that much valuable agricultural information was exchanged. This informal exchange of seeds and plants continues to the present time, and is a natural outcome of the association between plant explorers and agriculturists.

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Main Importations

DURING the nineteenth century, wheat was frequently imported from Europe to supplement American crops. Samples of these shipments were often planted for trial, along with other European varieties brought into the country by immigrants and other travelers.

For several years prior to 1792, *Siberian wheat* was introduced into New Hampshire from England. However the wheat degenerated and new importations had to be made.

A bearded red winter variety called *Mediterranean wheat* was the most popular new wheat during the first half of the nineteenth century. It was introduced in 1819 from islands in the Mediterranean as part of a search for an early maturing variety that could be sown late in the season. Its chief competitors were the white soft wheats, commonly grown during this period and the favorites of millers and flour users. The Mediterranean was a red wheat producing a fine, red bran, difficult to separate because of the poor milling methods then in use. Farmers liked the Mediterranean because of its resistance to the Hessian fly.

The records of *Purplestraw,* whose origin is unknown, date back to 1822. It was planted to 116,000 acres in 1924. The *Gold Drop* variety was imported from England prior to 1843; and *China wheat,* which is still being grown, came from China about 1845.

The *White Australian* or *Pacific Bluestem,* decended from the *White Lamma* of England. It reached California from Australia before 1850, and proved to be superior to the other varieties then being grown on the Pacific Coast. Another wheat, *White Winter,* which is probably of English origin, was being widely grown in the Willamette Valley of Oregon by 1855 and is still found there. (1)

Some of the varieties imported during this period still are grown extensively in the United States, and have served as breeding stocks for other successful varieties. The Mediterranean wheat, for example, was planted to 2,770,000 acres only a hundred years after its introduction to American agriculture.

Agriculturists of the nineteenth century were keenly interested in improving the familiar varieties of wheat. Even before 1860 they were making selections from admixtures, mutants, and the natural hybrids found in their fields.

Some of the most important varieties were discovered from these selections. Zimmerman of Frederick, Maryland, selected in 1837 a variety of either red or white wheat. Which variety was the original is not known, but both soon came to be widely grown under his name. The *red Zimmerman wheat* was still in cultivation a hundred years later.

Red Fife, a hard red spring wheat, came to America from Scotland, although it was grown previously in Danzig and Poland. It was selected by David Fife of Ontario in 1842 from a small packet of what proved to be winter wheat brought from Glasgow. The Red Fife entered Wisconsin in 1860 and became the basis of the great flour industry of Minneapolis after the introduction of the roller mill and the purifier.

Marquis wheat, "the outstanding hard red spring wheat of the world," was developed in Canada from Red Fife which was its male parent.

During the 1850's the Patent Office tried many new wheat introductions in a search for productive varieties that would withstand rust and the attacks of the Hessian fly. The *Turkish Flint* wheat, from near Mount Olympus, proved to be hardy and prolific in the states along the Mason-Dixon line and the extension of its culture was recommended. This wheat was approved as a hardy, productive fall variety which ground into excellent flour. The hard grain gave it protection in the storage bin.

Algerian Flint, a large grain wheat from the province of Oran, was sown in the valley of Virginia and produced a large yield. *Pithusian Flint,* a fall wheat producing a large "berry," came from the island of Ivica. *Syrian spring wheat* from the Holy Land proved to be an early maturing variety.

The *"Cape Wheat,* from the Cape of Good Hope, procured by Com. Perry of the Japan Expedition," was sown but not commented upon. *Spanish spring wheat* was a fine variety from

Alicante. Still other wheats came from France, England, Chile, and Mediterranean areas.

After the Department of Agriculture was established and an experimental farm set up, the Federal government took a hand in solving the problems surrounding the national wheat crop. Various state governments cooperated in the study of wheat on their own experimental farms. Dozens of wheat varieties were distributed among growers and sown by the Department in search of desirable qualities. During 1861, approximately 1,000 bushels of wheat were imported from different agricultural regions of Europe and tried throughout the country.

Isaac Newton imported several hundred bushels of choice wheat and other cereals in 1864 from England, France, Belgium, Russia and Sweden. The results were so satisfactory that Newton distributed a similar shipment the following year.

DURUM WHEATS

The first Russian macaroni (durum or hard) wheat was introduced into America from Odessa in 1864 by the Department of Agriculture. Two varieties called *Arnautka* and *Sandomirka* were distributed by the Department for several years after 1864. The Sandomirka and Arnautka were considered superior wheats wherever grown. Favorable accounts of their strong growth, early ripening, and high yield were still being received in 1871. But culture of the Arnautka was abandoned because of opposition to its hardness. Its possibility as a macaroni wheat was not considered at this early date. The Sandomirka was introduced again from Hungrary by Le Duc in the summer of 1877, because it was famous in Europe and the flour was being imported into the United States for special purposes. The seed, distributed with great care in the fall of 1877, did not secure favorable results except in Tennessee and North Carolina.

In 1865, the best varieties of English wheat were reported as not adaptable to the climate here. Wheats which succeeded in the long, mild growing season in England did not give good results in America, with the sudden variations of cold and heat, moisture and aridity.

Sixty-five varieties from France, Prussia, Russia, Great Britain, Chile, and China were seeded in 1865 for trial. Of the fifty-five varieties of winter wheat grown, six proved worthy of notice by

the Department. Leading producers were the red and white Mediterranean, the *Tappahannock* (of American origin), and the *Russian Scheffel.* Of sixty-seven varieties of spring wheat sown in 1866, forty-six did well while the *Red Chili* and *Black Sea* varieties scored special commendation.

Many varieties of wheat from the Royal Agricultural Exhibition at Vienna were procured for trial by the Department in 1866. They were part of a shipment of cereal and vegetable seeds. Eight of these were sown in the autumn of 1866, and others were sown the next spring. A number of suitable varieties were found from tests conducted on forty-three varieties of winter wheat and sixty-six of spring wheat grown experimentally in 1867. Capron gave samples of these importations to the governor of Minnesota in an effort to find one suitable for that state.

Generally favorable reports were received after 1870 from two distributions of *Touzelle,* a beardless white winter wheat procured by the department from Marseilles, France, in 1869. Another variety called *Soisette* was also imported from France in 1870 and grown with good results.

AMERICAN WHEATS

The most successful wheats during the next two decades proved to be of American origin. Individuals were selecting and breeding new varieties to meet the demand for better crops. This search for suitable varieties was stimulated by an increase in agricultural education and the need for regional varieties. The government, however, did not depend entirely upon native stocks for experimentation, and continued to make importations from abroad.

The search for new wheat varieties was not the only factor that helped increase wheat production after 1865. There was an emigration to the West due to the Homestead Act and the end of the Civil War. The markets for wheat increased. Methods of cultivation were improved and refinements added to the reaper.

Most of the wheat varieties developed in America were produced by pure-line selection. The *Fultz,* a beardless, soft red winter wheat, is an important example of this method. It was selected in 1862 by Abraham Fultz from a field of Mediterranean and was later grown extensively in the central section of the eastern wheat belt. During this same period, crop breeders were searching Canada for new wheat varieties. A shipment of 100 bushels of

Arnold's Hybrid No. 9 was imported for the fall sowing of 1872. However, the results proved this hybrid to be similar to the Mediterranean.

After 1870 many breeders turned their attention to hybridization or artifical crossing. Out of their efforts came two varieties which aroused much interest among wheat growers. These were the Fultz, and a variety from Virginia called the Tappahannock.

Commissioners Le Duc and Colman realized the need for varieties adapted to particular regions. Le Duc wanted a rustproof wheat for the South, and a wheat that would not winterkill on the prairies. Rusk renewed the interest shown in the Mediterranean and winter wheats, and five varieties of the Mediterranean were procured in 1889 for distribution.

OATS

Although several varieties of oats were imported during the 1850's, little information is available about their effect on the oat industry. It was not until the following decade that a number of superior oat varieties made their appearance in this country. The *White Swedish, Yellow Lithuanian, Black Tartarian, Black Prussian* and *Nun's* were considered the best of seventeen varieties sown in 1866.

During the period 1865 to 1870 a number of other importations were tried. The *Potato, Scotch Dun,* and *New Brunswick* oats were brought from Scotland. Denmark contributed the black and white *Swedish* oats. From England came the *Excelsior* and *Somerset* varieties, and Germany's outstanding contribution was the *White Schonen.* From these the Excelsior and the White Schonen were chosen as the best. The Excelsior was suited to a wide variety of soil and climate conditions, while the Schonen withstood rust.

When the *Fellow* oat from Scotland was first distributed in 1873, it was acclaimed in some parts of the country as superior to the White Schonen. Another English importation, the *Board of Trade* oat, also made its appearance during the 1870's. The value of these importations can be judged from an estimate made in 1879 of the increase in the yield of the nation's oat crop. It was claimed that the White Schonen had raised the yield by two and a half bushels per acre, and that the Board of Trade and *Rustproof* varieties were worth $15,000,000 yearly to oat raisers.

RYE, BARLEY, AND BUCKWHEAT

Charles Mason was instrumental in bringing a number of new varieties of rye, barley, and buckwheat to this country. He imported the *Large Northern Prolific Rye* from Germany to be sown in the central states, barley from southern Spain, and the *Silver Buckwheat* from France in 1854. The *Saxony* rye was considered the best of sixteen varieties sown experimentally in 1866. *Oderbruch* barley from the Oder Valley and other barleys were tried with fair results. By 1872 the barleys, *Chevalier, Probstier,* and *Saxonion* had been established as preferred varieties.

The origin of barley varieties in this country, like many of our familiar crops, is difficult to trace. Many of the present varieties have been bred as hybrids by individuals and experimental farms. Aberg and Wiebe, in a study of the history of barley, have traced the present commercial varieties back to Colonial times, but many of the importations were brought in by individuals and the details were not recorded. (2)

FIBER CROPS

RAMIE

The high prices and planting difficulties surrounding cotton at the close of the Civil War led to the trial of ramie as a cotton substitute. The ramie plant (*Boehmeria nivea*), is a member of the nettle family. It produces a fine fiber used in the orient in weaving clothing. The western world was first drawn to ramie in 1851 at an exhibition of its fibers in England. Plants were brought to Jamaica in 1854 and from there to the Botanical Garden in Washington the following year. Ten years later, ramie seeds were imported from China.

The first *plants* brought to Louisiana, according to Emile Le Franc, came from Mexico in 1867 through the help of Ernest Godeaux, the French consul in New Orleans. Benito Roezl, a Bohemian botanist, returned from Java the same year with a lot of ramie roots for sale.

Interest in ramie cultivation in New Orleans soon after its introduction forced the price up to one dollar for each subdivision of roots. The fiber sold for $375 per ton and was used as imitation silk. A group of ramie enthusiasts in New Orleans in 1873 organ-

ized the Southern Ramie Planting Association to promote their interests. In 1868, the Commissioner of Agriculture imported from Paris seed of two other varieties of Boehmeria for experiment—but many of the small, easily damaged seeds failed to germinate. Ramie was reported in 1869 to be growing in extensive plantations throughout the South.

TABLE 3

DISTRIBUTION OF TEXTILES AND CEREAL SEEDS BY THE FEDERAL GOVERNMENT 1868–89

Year	Cereals*	Textiles†	Year	Cereals*	Textiles†
	No. of packages	*No. of packages*		*No. of packages*	*No. of packages*
1868	31,220	10,498	1879	100,068	2,516
1869	46,763	5,676	1880	.....	.....
1870	38,701	744	1881	216,157	31,590
1871	61,204	1,638	1882	290,862	31,144
1872	86,014	1,133	1883	102,267	23,828
1873	149,696	2,612	1884	100,456	587
1874	112,562	2,367	1885	59,585	36,103
1875	137,468	5,551	1886	38,858	7,626
1876	156,493	1,357	1887	21,203	3,769
1877	132,181	6,118	1888	17,862	6,219
1878	112,026	816			

* Includes varieties of wheats, corn, oats, rye, and barley.
† Cotton, hemp, flax, jute, and ramie.

Despite the successful cultivation of the crop, ramie did not become important commercially. No one was able to perfect a machine that would do a thorough job of separating the fibers from the stalks and bark. Finally, the interest in ramie died out during the 1890's and the crop was practically abandoned. In the 1940's, several thousand acres of ramie were cultivated, and there were reports of new machinery capable of separating the fibers efficiently. (3)

COTTON

The growth of the cotton industry in the South awaited the invention of an efficient machine for processing the fiber. Eli Whitney's cotton gin made it possible for growers to expand their acreages and compete successfully with foreign suppliers. Agriculturists hailed the profitable cultivation of this crop, in competition with cheap foreign labor, as an example of what might be done by machinery in other crop industries.

Many introductions were made by individuals, and the Department of Agriculture tried to find foreign varieties superior to

those commonly grown in this country. Cotton seeds were brought from Egypt and India for trial, for American growers hoped to recapture part of the market which Egypt had come to supply. The results from the trial of Egyptian seeds in Louisiana were so poor that growers did not care to replant the seed. Mildly favorable reports of the Egyptian varieties were received from Texas, Mississippi, and Florida. Generally, the Indian and Egyptian varieties did not mature soon enough in this country.

Spurred on by the high prices American mills were paying for Egyptian cotton, the Department of Agriculture made a number of new introductions between 1892 and 1894. It had previously been urged to import varieties from India in 1868, but the Department found that manufacturers claimed American cotton was superior and that it was preferred even in India. Cotton seeds also were imported from Tahiti, but their cultivation was not extended.

Seeds of three varieties prominent in Egypt were distributed in the South by C. R. Dodge, fiber expert of the Department for many years. These plantings were stopped and the stocks were lost except for trials continued by W. H. Wentworth of Floresville, Texas. Wentworth selected a product of high quality, but the difficulty he had in marketing his cotton caused him to eventually discontinue the undertaking.

H. J. Webber, in charge of plant breeding for the Department of Agriculture in 1897, continued the trials of Egyptian cotton, and extended tests to the river valleys of the Southwest. He used plant stocks of the *Jannovitch* from Egypt, under climatic conditions similar to those in its original home. After 1900, these breeding experiments were continued with fresh seed of several varieties obtained by David G. Fairchild. These experiments were extended to Arizona where the crop is now established as a result of this work by plant breeding scientists in the Department.

JUTE

Jute became the subject of widespread experiment in the South after it was sent there from Calcutta in the winter of 1869-70.

The following year a number of successful experiments in raising jute were reported. Jute cultivation was a pet project of Commissioner Watts, who was enthusiastic about its value to the South because of the quality of the fiber and its superiority to flax and hemp. He felt assured it would become an important crop and hastened to claim credit to the Department for encouraging it.

Watts imported more jute seed from India in 1874, and sent them to farmers in California and the southern states where the crop could be grown. The rotation of plantings of jute with rice every other year was suggested as of possible advantage to both crops. Samples of jute manufactured in Louisiana were sent to the Department in 1874 by President Le Franc of the Southern Ramie Planting Association. An inexpensive separation process was thought to have been perfected, and in 1877 imported jute was made subject to tariff duties in order to raise its price in America. More than 900 papers of the seed were sent out for trial in 1881. Eight years later, Rusk was convinced that the problem of separating the fibers was on the verge of solution, but admitted the production of jute remained in the experimental stage. Jute production subsequently failed to receive notice in the reports of the Department of Agriculture.

FLAX AND OTHER FIBER PLANTS

Several other fiber possibilities were investigated by the Department. A plant called *New Zealand flax* was found to flourish in the South. Like the ramie plant, the use of this flax was hindered by a lack of technological progress in processing the plant.

Increasing public interest in fiber crops led to the assignment of Charles R. Dodge, fiber expert in the Department, to write a special report on "Vegetable Fibers in the Collection of the Department of Agriculture." Dodge discussed dozens of materials including basket-weaving and stuffing materials.

There also was a search on for paper-producing plants during these years. The *Esparto grass,* from which paper was made in England, was one of several plants introduced for this purpose. Seeds of this grass procured in 1868 from Vilmorin, Andrieux and Company, Paris, were distributed in the South. By 1870 several species of palms had been imported for paper making. Other fiber plants, some with names meaningless except to a plant specialist, were procured by the Department in 1870. These included the *Manila hemp plant,* the *Paederia Foetida,* and various species of *Hibiscus, Asclepias, Bromelia,* and *Urtica.* The *sisal hemp* and the *cabuya fiber* were received from San Domingo and distributed about 1885.

GRAPES

Discovery of the *Isabella* grape by Mrs. Isabella Gibbs about 1818, paved the way to an extensive development of the native

grape. Growers interested in developing a wine industry in this country had been hoping for years to find a grape that would grow everywhere. But no European grapes hardy enough to withstand the fluctuations of humidity and temperature in this country had been found. If the foreign grapes were not grown in greenhouses, they suffered from rot and blight. Native grapes flourished under cultivation, but did not produce wines comparable to the European vintages.

Soon after the discovery of the Isabella, a Major Adlum living in the District of Columbia introduced the *Catawba,* supposedly a native of the Catawba River in North Carolina. He had found this variety growing in the vicinity of the Potomac. The famous *Concord* grape was a chance seedling developed by selection from a choice native grape. It was named after its discoverer, Ephraim W. Bull of Concord, Massachusetts. All of these varieties were extensively and successfully cultivated.

The mild California climate lent itself to the development of European grapes during the nineteenth century. Although the *Mission* grape of the padres predominated for many years, the new introductions were almost exclusively European varieties. Colonel Agoston Haraszthy, the father of the California grape industry, introduced more Mediterranean grapes into California than any other individual. Given a commission in 1861 by the governor of California, he brought back 100,000 vines of 1,400 varieties from Persia, Asia Minor, and Egypt.

Attempts at Hybridization—The problem of producing wine in the eastern part of the country was approached in 1858 by the hybridization of American and European varieties. Expert wine-makers and chemists made tests to find suitable varieties. No significant results were achieved, but the cultivation of native grapes was rapidly extended in Virginia. Isaac Newton realized the importance of the grape as a fruit for general consumption, and in 1863 corresponded with growers all over the country seeking information about their results.

The "celebrated *Yeddo* grape from Japan" was received in 1864 from the American Resident-Minister, Robert H. Pruyn, who sent hundreds of grape cuttings to the United States. The Yeddo was propagated and plants sent to various localities to be tested for adaptability.

The public developed a keener appreciation for quality grapes as new varieties made their appearance on the market. Native grapes contained too much tartaric acid for wine and table use,

but Newton claimed that their acid content had been reduced by hybridization with European varieties. Good native seedlings were hybridized with the choice imported varieties to produce a number of fine grapes. The *Black Hamburg* is mentioned as one of the imported varieties used in crossings. Ninety different foreign grapes were planted in glass structures in the spring of 1870.

Those varieties which proved unsuccessful were replaced from time to time with other importations. Additional plantings of foreign varieties were made in Texas and California in 1880. Plans were made in 1889 to secure grapevines from Turkey and Palestine through diplomatic officials. The Section of Seed and Plant Introduction imported 119 varieties from Europe in 1899, which were grafted on American stocks for testing.

OPIUM POPPY

Experiments with opium in this country during the latter part of the nineteenth century indicated that the plant could be grown successfully. Quantities of opium were being imported regularly for medical use, but the supplies were frequently adulterated. Charles Mason was the first to arouse interest in its cultivation, and Isaac Newton later suggested that opium might be grown profitably. An article in the *Annual Report* for 1870 instructed growers in the cultivation of the poppy and methods for collecting the drug.

Experiments conducted in Jefferson County, New York, indicated that the opium poppy could yield a higher money return per acre than any other crop then being cultivated. Growers reported that the poppy had been cultivated in Kansas, Connecticut, and Vermont. The crop was never grown commercially, however, because the intensive cultivation necessary for a successful crop was too expensive using American labor.

EUCALYPTUS

At the close of the Civil War the Department of Agriculture was searching for "anti-periodic" medicines for the treatment of malaria. Reports from German hospitals indicated that the *Eucalyptus globulus* (the *Australian blue gum,* or anti-fever tree) had antimalarial properties. Specimens of this tree were brought from Australia by William Saunders and were kept growing for several years. Seeds of the tree also were obtained from Walter Hill, botanical gardener at Brisbane, and planted in the spring of

1866. Several thousand trees grown from the seed were given out during the years following 1870. The expected cure-all did not materialize, however, for tests proved that the trees did not contain the cinchona alkaloids.

The roots of the Eucalyptus do have absorbent powers, and the trees were found to be useful in drying up marshlands by rapid transpiration. The tree also gained popularity because of the real and imagined antimalarial properties it possessed. Many thought that the leaves gave off a volatile oil and an acid which made the atmosphere healthful and invigorating.

Large plantings have been made, especially in California where it is now one of the most familiar trees of the landscape. Planting the Eucalyptus became a craze in California during the 1870's and in Oakland alone over 100,000 trees were sold in 1875. The tree did not spread widely, however, because it is easily killed by frost. It has proved very valuable in California for timber, windbreaks, shelters, and landscaping and is now voluntarily replanting itself.

BAHIA (NAVEL) ORANGE AND OTHER CITRUS FRUITS

Credit for the introduction of the navel orange is shared by an American missionary, the Department of Agriculture, and the State Department. The first step was taken by the Reverend F. I. C. Schneider, first Presbyterian missionary to Bahia, Brazil, who wrote a letter about this orange to the Commissioner of Agriculture. The story is continued in this excerpt from the Journal of William Saunders.

Sometime in 1869 the then Commissioner of Agriculture, Horace Capron . . . read to me a letter . . . from a correspondent at Bahia, Brazil. Among other matters, special mention was made of a fine seedless orange of large size and fine flavor; thinking that it might be of value in this country I . . . sent a letter asking to be the recipient of a few plants of this orange. This request brought me in course of time a small box of orange twigs utterly dry and useless. I immediately sent a letter requesting that some one be employed to graft a few trees on young stock, and that all expenses would be paid by the Department. Ultimately a box arrived containing 12 newly budded trees, and being packed as I had suggested, were found to be in fairly good condition. I believe that two of them failed to grow. No expenses were charged, so I presume that the correspondent sent them as a gift. . . .

I had a supply of young orange stocks on hand and as fast as I could secure buds, they were inserted on these stocks. The first two young plants that were sent out were sent [in 1873] to a Mrs. [Luther C.] Tibbetts, Riverside, California. That lady called here and was anxious to get some of these plants for her place, and I sent two of them by mail. They prospered with her and when they fruited attention was directed to their size and fine appearance, and when ripe their

excellence was acknowledged, and the fruit was called Riverside Navel, thus ignoring the label attached to the plants which was Bahia, a very distinctive name which should have been retained. Afterwards other Californians, not wishing Riverside to be boomed with the name, changed it to Washington Navel, all of which was uncalled for but this Dept. could not alter it, and it was considered best to adopt the name, and so avoid further confusion. We budded many hundreds from time to time and sent them to Florida where it has never become very popular owing to its not bearing plentifully.

The second introduction of the navel orange was made by Richard A. Edes, the United States Consul at Bahia. Edes wrote Capron in April, 1871: "I have the honor to acknowledge receipt of your letter of February 26th and by the American Steamer which leaves this port in May. I will forward to you as directed the cuttings of the navel orange tree of this province." Commissioner Watts, who had replaced Capron, wrote Edes that summer that the trees had arrived in good condition with but one lost. ". . .you have placed the department in possession of one of the most desirable varieties of Orange known; and one which it has desired."

When the trees mailed to Mrs. Tibbetts came into bearing, the quality of the orange as a market variety was promptly recognized. By the end of the century many thousands of acres had been planted in California, hundreds of carloads of the fruit were being transported to the East annually, and it already had been favorably received in the English market. Saunders called it in 1899 "perhaps the most valuable introduction ever made by the Department of Agriculture in the way of fruits." The Bahia navel orange, making up the bulk of the California orange industry in 1920, had an annual value of $16 million and the average annual production in 1921 was computed at 8,600,000 boxes. A bronze plaque was set up at Riverside, California, in honor of Mrs. Tibbetts' work; an oversight omitted the name of William Saunders!

The Department of Agriculture was urged in 1870 to use ships to introduce various tropical fruits for cultivation at St. John's, Florida. Orange and lemon culture was promising to become important by 1878, and a small glass house for fruiting was set aside by the horticultural division to determine the value of different varieties for propagation. A large collection of citrus fruits was imported from Europe in 1870 and 1871 including the "Tangerine oranges" and the *St. Michael* orange from the Azores. Hundreds of plants were grafted and sent to the Southern and Pacific states. A collection of grafted orange trees received from

Japan in 1868 proved valueless. One of the lot, the *Citrus trifoliata,* was in great demand in 1895 as rootstocks for grafting. But Saunders discredited the plant since it dwarfed the growth of the grafts placed on it. Nearly 14,000 orange, olive, fig, and semi-tropical plants were distributed in 1879.

During the 1880's the demand for citrus plants brought more valuable importations from abroad. The production of lemons was encouraged in Florida and California in 1888 when seedlings of the best European varieties were imported and distributed among intelligent experimenters. Five trees of the *Selecta* orange from Brazil were introduced in 1892 and placed in Florida, Louisiana, Arizona, and California.

JAPANESE PERSIMMONS

The Japanese persimmon tree, or *Diospyros kaki,* bearing the familiar, orange colored fruit resembling a tomato, was first grown from seed sent by Commodore Perry to "Lieutenant Maury" in 1856. From the seed planted at the Naval Observatory in Washington the first fruit was produced on the trees in 1860. None of the progeny of these trees were distributed. It is not known whether the *plants* Commodore Perry brought back from Japan in 1855 survived the voyage.

The successful introduction and distribution which aroused a general interest in this fruit was made by William Saunders, who recollected his work with this fruit in 1899 as follows:

> It has long been known that the persimmon of Japan, Diospyros kaki, had been improved as an edible fruit, and that many fine varieties were grown in that country. Wishing to attempt its introduction, I requested the U. S. Legation in Japan . . . to send some seeds to this Dept. Consequently early in the year 1863, a package of seeds were received and planted. They furnished a great number of plants which made growths from one to two feet in length.
>
> The real introduction of this fruit commenced about ten years after the above date. A young Japanese who had spent some time in European nurseries, and also studied nursery work in this country, and whom I had met in Washington, went to Tokio and started a nursery. He was well educated and a good correspondent in English. One of his first works was to select and propagate the best varieties of persimmons. As soon as he had plants for exportation I ordered 5,000 plants of his best named varieties which came here in fine condition and were distributed mainly south of the Potomac River, my experience with the seedling satisfied me that they would not prosper further north. Other importations were made, and in 78 or 79 an order for 10,000 plants was made and when they reached San Francisco about the half of them was distributed in that State (California) where they prosper. About 100 of this invoice were placed in Norfolk, Va., where they perfect fine fruits.

Many of the trees distributed by Saunders did so well that nurserymen imported other kinds from Japan and sold the trees. There are a great many varieties of this persimmon in the Far East. The Department of Agriculture continued to import plants in order to find some able to endure the cold weather of the middle and northern states. Five thousand plants were distributed in 1879 and the following year the Department considered that the value and good reputation of the persimmon had been established. Fruit growers and the Department, expecting a marketable fruit to materialize in a few years, continued to import plants. After 1873, yearly introductions were made from a nursery at Tokyo, but by 1889 new plants were being supplied by nurseries in America.

Efforts of the Department of Agriculture to find persimmons suited to northerly climates were supported by further introductions in the last decade of the century. Fifteen varieties received in 1891 from the Minister of Agriculture of Japan were selected with care from different parts of the Japanese Empire. The trees were divided and one set was sent to the Florida Experiment Station at Lake City and the other to an individual grower, R. D. Hoyt of Seven Oaks, Florida. They were propagated there so the progeny could later be sent to the North for trial. More hardy varieties of this valuable addition to our fruits from Japan, Korea, and China were placed in the hands of propagators from 1892 to 1897.

CINCHONA

Many attempts were made to introduce the cinchona tree into the United States during the nineteenth century when it was discovered that the sources of quinine in South America were facing extinction.

Britain, Holland, and other countries had shown that new plantations could be readily established. Extensive preparations by the British Government for cinchona plantations in the West Indies excited American interest, and an arrangement was made with Jamaica to exchange other plants for 3,000 cinchona plants for the South. Several hundred plants of different varieties were grown and disseminated by the Department of Agriculture in 1864. A plan for a cinchona plantation was approved in 1866. Two years later, an appropriation was recommended for the establishment of a plantation by the Department.

By 1871 the problems of growing cinchona in this country were well known. It was sensitive to cold and required winter protection, except in southern California where cultivation was carried on for more than a generation. Despite these difficulties many requests for the plants were received. A medical association memorialized Congress in 1872 urging the introduction of cinchona. But William Le Duc discouraged further attempts to grow cinchona, and in 1877 stopped the distribution of the plants.

Congress was repeatedly asked for money for further experiments with the cinchona plant. The House of Representatives passed a resolution in 1882 asking the Commissioner of Agriculture whether it was feasible to grow cinchona in the United States. A letter from a plant authority alleged that the trees would stand frost, but needed exacting conditions of soil and climate. The Department had no faith in the new plant, but continued the experiments to satisfy an unwise demand and give the trees an exhaustive trial. By 1891, the cultivation of cinchona had been abandoned as unprofitable, for the bark could be imported cheaply from British India.

TEA

The records of the Department of Agriculture covering tea culture in the middle of the nineteenth century are rather sketchy. Either Isaac Newton's interests during this period did not extend to the promotion of the tea industry, or the war between the states prevented contact with the southern planters. During his commissionership the Department merely supplied requests for plants. Tea culture in British India was watched with interest, and labor-saving devices adopted there encouraged the belief that tea might be profitable in the United States. Fresh supplies of seed from Japan led to the distribution of more thousands of plants up to 1867. After this date, the plants were grown mostly from seed produced in the southern states, from the plants sent there by Robert Fortune.

Horace Capron, Newton's successor, knew that the southern states were congenial to the tea plant, but he observed that ". . .the amount of manual labor required in its preparation for commerce precludes the possibility of competition with the very cheap labor of China." (4) In California, several hundred Japanese settled with the intention of growing tea and other plants native to their former homeland. They put out 140,000 tea plants at

El Dorado, but by 1872 their experiences had proved the climate unsuitable to the tea plant.

The Department of Agriculture's hopes for the tea industry died a lingering death. Experiments continued under Commissioner Watts in 1873, but the high labor costs could not be overcome. In spite of this, tea growing continued to attract interest. The arboretum annually increased the number of plants distributed, and received encouraging reports from widely scattered areas. The following year the reduced appropriation for the garden prevented further introductions, but 20,000 plants were distributed. Even careful William Saunders now believed tea would become widely cultivated.

When William Le Duc succeeded Watts in 1877, he confidently accepted from his predecessor the challenge of the tea industry. Because he believed that American tea could be put on the world market, he had over 100,000 plants distributed during 1877 and 1878, and 120,000 plants were given out the following year.

South Carolina and Georgia were indicated as favored centers for tea cultivation. The plant was publicized by the Department of Agriculture and information supplied regarding its cultivation in China. Le Duc pointed to the unemployment of 1877 as proof that there was labor available to produce tea in America. Plants were distributed to increase the dissemination of tea and to find which localities were best suited to it. Invention was expected to provide machines for processing the tea leaf, but even without machines it was thought that every family should cure its own tea supply.

THE EXPERIMENTAL TEA FARM

The enthusiasm over tea reached a climax in 1881. Congress had provided $5,000 the year before to "be devoted to experiments in connection with the culture and manufacture of tea." Another appropriation of $10,000 was made in March, 1881, and with these funds an experimental tea farm was established at Summerville, South Carolina.

At the request of Le Duc, John Jackson, a native of Aberdeenshire, Scotland, visited the South to see if tea raising was possible there. Jackson had fourteen years' experience in tea cultivation and in perfecting machinery for processing tea. He became convinced that American tea could be made to compete in price and quality with foreign varieties. Jackson purchased the estate of

Dr. Jones in Liberty County, Georgia, on which neglected tea plants were growing from shrubs set out by Jones about 1850.

From a dense mass of plants growing there, Jackson set out a tea garden of 160,000 plants occupying forty acres of ground. Samples of tea were sent to tea distributors in the United States and England. Jackson's experience therefore made him the logical choice for the superintendency of the tea farm at Summerville. As Le Duc explained:

> Acting under authority of Congress, I have selected, after a careful examination, with the aid of Mr. Jackson's experience, a tract of land suitable for an experimental farm on which the raising of tea on an extended scale will be carefully and thoroughly tried. Of the result there can be no reasonable doubt. American tea, grown and manufactured on our own soil by ourselves, is destined at no late day to supply the demand of our own people and to enter the world's market in favorable competition with that produced by any other country.

New seeds were obtained by importations from Japan, India, and China, but the shifting fortunes of individuals and programs incident to American presidential elections brought a sudden end to this venture.

Commissioner Loring, the Massachusetts conservative, did not share Le Duc's enthusiasm for tea. Believing that climatic conditions were not favorable for tea growing, he directed William Saunders to examine the Department's tea plantation at Summerville. Saunders found that only fifteen acres of poor land had been cleared for cultivation. The tea plants were not thrifty, and he advised cutting the appropriation. Saunders concluded that good quality teas could not be produced in the South. He pointed out that a warm climate with much summer rainfall is needed to produce a strong, well-flavored tea. Jackson's own plantation in Georgia had not produced teas of sufficient strength. Work was curtailed at Summerville. The Department distributed fewer plants than in previous years and these were only to encourage production for the growers' consumption at home. The tea farm in South Carolina was closed in 1887. About the only results were that some hundreds of households had come to grow their own tea.

RUSK RENEWS INTEREST IN TEA

In spite of past results, the new Commissioner, Jeremiah M. Rusk, revived the tea researches in 1889. Rusk believed the previous experiments with tea culture had been arrested before

reaching any definite conclusion, and that better cultivation and preparation might bring success. Seed from the best tea in Asia were secured through the State Department. Special attention was given to climate as a limiting factor in the production of good quality tea. Merchants took an interest in the samples produced, tea tasters judged the brews, and the press published reports on the progress made.

The Department of Agriculture began cooperating with Dr. Charles U. Shepard, in charge of his own Pinehurst Experimental Tea Garden, near Summerville, South Carolina. Varieties tried at Pinehurst came from Japan, China, Formosa, and Assam. Because the cost of picking a pound of tea at Pinehurst proved to be six times greater than the cost in the orient, any tea marketed would be able to compete with foreign tea only on a basis of quality. But testimonials of tea merchants praised the tea as equal to the best foreign teas.

The commercial production of tea was again presented as a tantalizing possibility in the publications of the Department of Agriculture in 1899. It was Secretary of Agriculture James Wilson who then promoted the industry. Dr. Shepard, with machinery furnished by the Department, processed tea which he sold to a distributing house in the North at a profit. A company with assets of $50,000 was being organized in 1900 to produce tea on a more extensive scale. Much experimenting was done to improve the quality of the tea, which could be produced and marketed for fifteen cents per pound, it was claimed—but the enterprise did not succeed.

By 1903, when 8,369 pounds of tea were produced at Pinehurst, the attention of the Department of Agriculture came to be concentrated more than ever on reducing costs of processing the leaves by the invention of labor saving machinery. Study was given to the cup qualities of tea as affected by chemical changes during processing. A tea garden was established at Mackay, Texas, by 1903 in order to test the plant in another climate. In 1905 Dr. Rodney H. True, in charge of the tea culture investigations, continued work along lines of the two previous years. Dr. Shepard had about a hundred acres planted to tea at Pinehurst in 1907, although in previous years he had been harvesting annually about 12,000 pounds of dry tea.

Another garden opened at Pierce, Texas, indicated that the

Texas climate would produce a strong brew, but recurrent floods brought the abandonment of this farm by 1909. In this and the following year it was reported that tea produced found a ready sale in America, but work to lower costs had to be continued. By 1911 George F. Mitchell had introduced successful pruning machinery, and machine picking was being tried. Other optimistic results in 1912 concluded abruptly the mention of the tea experiments in the publications of the Department. The efforts of more than a century have not yet established an American tea industry.

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7

Lesser Importations

DESPITE an increasing demand for sugar, its production in the United States continued to decline during the Civil War and the decade following. Most of the sugar up to this time had been processed from sugar cane. But the stocks of sugar cane deteriorated more rapidly than they could be replaced by the search for new, hardy varieties.

CHINESE SORGHUMS

In an effort to step up sugar production, the industry turned to sorgos. Chemists searched for a method of refining sugar from the *Chinese sugar cane* (black amber cane), one of the first sorgo imports, and the Department of Agriculture introduced other sorgos for experiment. More than forty million gallons of syrup were produced from the Chinese sorgo in 1862, and two mills manufactured paper from the fiber. No quantity of sugar could be refined from the cane, however, and in 1864 Commissioner Newton sent an agent to China to secure fresh seed and to explore for new varieties. Newton believed that the Chinese sorgo had deteriorated through hybridization with broom corn, and that new varieties and information on the Chinese processes of sugar-making might be helpful.

The varieties Newton's agent brought back were not successful so experiments were continued chiefly with the varieties introduced in 1857 by Leonard Wray, and the Chinese sorgo which had been imported in 1854. Wray had brought several varieties from Natal, South Africa, via Europe at the request of Horace Greeley. The original variety names have been lost, but they came to be cultivated widely for syrup and grain.

State experiment stations and individuals also were busy breed-

ing and selecting varieties of sorgos. From the original Chinese sugar cane the *Early Amber* was selected, and from this variety arose the *Minnesota Early Amber* which was widely distributed by members of Congress during Commissioner Le Duc's administration. Growers reported it to be a heavy yielder of syrup and sugar.

Durras From Egypt—Sorghums were found to be adapted to the hot, dry areas of Kansas and Texas where corn would not flourish. The importance of this fact could not be overestimated. Sorghums are especially valuable today for grain production in arid regions of the West. The *White durra* and the *Brown durra,* called Egyptian corn, were brought from Egypt to California in 1874—it is not known by whom. Their success was the beginning of an expanding grain sorghum culture.

"Guinea corn," or White Milo maize from the West Indies, was grown at a very early date in the South. White and Red kafirs from Natal were shown at the Centennial Exposition at Philadelphia in 1876, and the seed distributed. *Shallu* (Egyptian wheat) was introduced from India by the Louisiana Agricultural Experiment Station about 1890. In the course of further introductions came two from Australia—in 1888 the sorgo *Planter,* originally from India, and in 1891, the *McLean. Pink kafir* was introduced from South Africa about 1904, *feterita* in 1906, and *hegari* in 1909. All were procured by the Department of Agriculture from the Anglo-Egyptian Sudan in the Upper Nile.

Teosinte—Growers also attempted to produce sugar from corn, pumpkins, and teosinte during during the 1870's. The teosinte, which is an ancestor of Indian corn, was introduced from Central America by the Department of Agriculture. The first seed crop of teosinte was harvested in southern Florida in 1887. The plant produced an abundance of fodder when it had sufficient moisture.

Interest in sorgos as a source of sugar cane was so high during this period that Commissioner Le Duc prophesied, ". . . it is not too much to say that the success attending the manufacture of cane-sugar from sorghums and maize will mark the year 1879 as an important epoch in the agricultural progress of our people."

During Le Duc's administration the efforts to produce sugar from sorgos reached their peak. Peter Collier received an appropriation of $25,000 from Congress to aid this work. Collier is credited with introducing between 50 and 100 varieties of sorgo from Java, Burma, China, India, and South Africa. In the sum-

mer of 1881, fifty-two of these varieties were grown experimentally. However, from the ninty-three acres of cane worked up, only 165 pounds of sugar could be obtained. Sorgo cultivation was admittedly a failure and investments of private capital in the sorghum sugar industry were wiped out.

The Federal government, however, continued to make expensive experiments with sorgos for some years. Eight hundred varieties and subvarieties had been tested by 1890 for sugar qualities, but the government still intended to continue the introduction of others for test. Only eight or ten varieties had been found suitable, and these only in restricted localities.

Emphasis on Selection—Congress voted an appropriation of $25,000 in 1899 to enable the Secretary of Agriculture to continue experiments in producing sugar from sorghum and beets. Experimenters stressed the selection and analysis of sorghum varieties for sugar content. Nine sorghum sugar laboratories were established in Kansas, and similar experiments conducted in other states. Certain materials in most sorghums prevented the crystallization of sugar in the juices. As varieties were sought with a high percentage of sucrose, and free from the deleterious substances which interfered with refining, more attention came to be given to breeding and selection rather than to introduction.

Sugar cane stocks were also being imported during the period of experimentation with sorgos, though Le Duc and others favored sorghum as a sugar source. Growers believed that fresh canes from Java were necessary for successful sugar planting in the lower Mississippi Valley. Introductions of sugar cane came from Japan, Hawaii, and Brazil. Le Duc reported in 1880 that sugar cane introductions still were being made, but he suggested that growers turn to the sorghums to avoid the recurring deterioration of the sugar cane stocks.

BEETS

The Department of Agriculture was slow to encourage sugar production from the sugar beet, although it had been the basis since Napoleonic times of a sugar industry in Europe where there was an abundant supply of cheap labor. In 1838, the Committee on Agriculture in the House of Representatives issued a report on the culture of the sugar beet because the importation of sugar had quadrupled from 1832 to 1836. The Committee insisted ". . . that when the soil, climate, and other circumstances, will

enable the people of this country to produce, by their own labor, on their own soil, any article which is extensively consumed amongst us, it is the duty of the Government, as far as may be deemed constitutional, to facilitate, by all reasonable encouragement, the production of that article."

The House Committee submitted a bill to authorize the President to lease land for a term of ten years for the cultivation of the mulberry and the sugar beet. Nothing came of this action.

Commissioner Capron argued that beet cultivation would prevent huge sums being spent abroad for sugar. Government publications gave information on sugar beet culture and the progress of local experiments. A chemist in the Department of Agriculture tested the sugar content of the most approved varieties of French and German sugar beets.

By 1864, the exorbitant price of sugar had induced individuals in Illinois to cultivate the sugar beet. Seeds of sugar beet varieties from Germany and France were distributed annually by the Department after 1868, and several large sugar beet refineries were established in Illinois, Wisconsin, California, and Colorado.

Congress appropriated $10,000 in 1881 to continue experiments in the cultivation of sugar beets and the manufacture of sugar. Quantities of select seed were bought in Europe. By 1888, sugar beets were considered adaptable to many parts of the country, and a considerable development of the industry was expected. Sugar beets already had been successful for several years on the Pacific Coast. At the close of the century chemical experiments were being concentrated on the manufacture of sugar from beets. To assist experiments beet seed of several varieties were imported annually for distribution.

FRUITS

Plant introduction during the commissionership did not alter greatly the character of the fruit crops of the Northeast and of the Midwest. The Department's most significant fruit introduction was that of over 200 varieties of apples from Russia in 1871. These came from the Imperial Botanic Garden of St. Petersburg. This introduction, it was hoped, would yield varieties adaptable to the rigorous climate of the North and Northwest, and others which were late ripening.

After 1872, shoots were distributed annually for the next ten

years. More than 95,000 shoots were sent out in 1878, and the next year 80,000 were distributed. Although a few worthy varieties were found, the most significant results were the attention directed to northern Europe as a source of better fruits and the extension of apple culture farther north.

Twenty-four new apple varieties received from Kecskemet, Hungary, in 1893, included Hungarian sorts not previously brought to America. In 1895, twenty-nine choice apple varieties received from Austria-Hungary were distributed to experiment stations for trial. Shoots of eighteen apples received in 1897 from the Pomologist of New Zealand, and varieties from Australia were distributed in June, 1897. Northern growers cultivated the quinces, brought in from Japan after 1854, mostly as ornamentals. A special appropriation in 1886 of $5,000 to pay for a pomologist, promoted collection and dissemination of pomological specimens and information.

VEGETABLES

A great variety of new vegetables were tried during the early years of the Department. Many were imported from England, France, and Germany by Newton and Capron, and enormous quantities were mailed to gardeners. Varieties were not carefully identified and often were little more than trade names varying from one seed house to another. Isaac Newton, especially, imported quantities from Charlwood and Cummins of London.

Of seventy varieties of garden peas tested in 1866, all did well except a few from Germany. Many melons, squashes, onions, and other vegetables were sown with profitable results. A watermelon from China and a variety of other Chinese vegetables were worthy of special mention. Seed of the "Turnip-Rooted Chervil," a vegetable of the carrot family described as a delicious vegetable fit to replace the Irish potato, were sent by Franklin Webster, consul at Munich, Bavaria, to the Department in 1864. Webster enclosed directions for its cultivation and preparation as a food.

In 1877, steps were taken to import the *Turkish rhubarb* direct from that country to promote a potential medicinal crop for the South. Consul Winslow at Paita, Peru, sent stalks of the yucca plant of Peru with instructions on planting. The tubers, which grew up to twenty pounds in weight, were used as a staple article of food among the natives of Peru.

TROPICAL AND SIMILAR CROPS

OLIVES

The history of olive cultivation in the United States goes back more than three centuries. Franciscan fathers first set out orchards in California during the time of the Spanish missions. Two centuries later, the remnants of these orchards were found in San Diego County and repropagated there. Early attempts were made to cultivate the olive in other sections of the country as well. In 1755, Henry Laurens of Charleston, South Carolina, imported olive trees and raised the fruit. A colony at New Smyrna, Florida, planted olives in 1769. Fifteen years later, the Society for the Promotion of Agriculture of South Carolina imported olive cuttings.

Already noted has been the high value Jefferson placed on the olive and the Federal land grant to the Tombigbee vine and olive colony in 1817. Charles Mason introduced olive stocks and cuttings from France in 1854. These were distributed in the Carolinas and the southern states. Many other olive introductions were made throughout the nineteenth century.

The olive was not particularly successful in the East because it required several years to come into bearing, and farmers wanted quicker returns on their investment. Commissioner Le Duc selected some of the best commercial varieties from Europe in 1878 in an effort to encourage olive cultivation, and in 1880 the Department distributed 3,000 olive plants.

Pickled olives were becoming popular, and by 1887 some orchards of more than forty acres were thriving in California. Growers in the southern states began experimenting with olive culture about the same time. The Division of Gardens and Grounds imported many European varieties in response to the frequent requests for olive plants, and in 1892 it was shipping out seedlings almost daily.

COFFEE

William Saunders discouraged would-be coffee growers by pointing out that coffee required a continuous temperature of above fifty degrees Fahrenheit. But Commissioner Le Duc interested himself in some coffee trees in Manatee County. Florida, grown by Mrs. Julia Atzeroth from seed secured from Mexico about 1875. Mrs. Atzeroth wrote Le Duc that she had protected

the trees in the winter by stacking pine tops around the plantings located near warm salt water currents. The Department sent her a number of young coffee trees in 1879 for her own use and for other persons in her locality. In 1880 Mrs. Atzeroth forwarded to the Department a pound of coffee grown outside a greenhouse, and considered her plantation a success. That same year the Department distributed a thousand plants, and many more were raised from seed and distributed in Florida, California, and in some parts of Texas in 1889. Coffee plants from Liberia were introduced in Florida, but they proved unsatisfactory. After 1891 the plants were distributed only to encourage production for home consumption.

OTHER TROPICALS

The government introduced many tropical plants for trial between 1862 and 1889. Isaac Newton set aside an "apartment" in one of the greenhouses to determine what tropical fruits were worthy of greenhouse cultivation and wrote horticulturists for new varieties. Dwarf banana plants and several pineapple and guava varieties were transmitted to the most congenial parts of Florida for trial. The government's collection of tropical fruits included the *mangosteen, tamarind, mango, Indian persimmon, cherimoya,* and other trees. In 1870 the *Mamey apple,* various ornamental tropical plants, and three kinds of avocadoes were received from Santo Domingo. A conservatory was built in 1870 to protect tropical plant collections, and assistance was given agricultural colleges in the construction of such buildings. The government assisted the citrus fruit industry by importing new varieties until northern markets for the fruit became established.

At the request of Commissioner Colman, Prof. J. B. Steere of Ann Arbor, Michigan, secured seed and plants of the mango, cherimoya, and bananas from the Philippine Islands. Guavas, six varieties of bananas from the Philippines, and other tropical plants were allotted to experienced growers. In 1889, growers experimentally raised cocoanuts in Florida. The Department distributed *pyrethrum* seeds for many years. Growers in California reported that this plant had been profitably cultivated for use as an insecticide.

PASTURE, FORAGE, AND OTHER FARM CROPS

The rapid settlement of the West emphasized the need for plants especially adapted to subarid regions. Some of the prob-

The curious, dangling fruits of an Egyptian Sausage Tree growing beside a filling station at Coconut Grove, Florida, attract thousands of motorists every year. (From *The World Was My Garden* by David Fairchild, Chas. Scribner's Sons).

lems of dry farming in the West have been pointed out by Dr. Walter Prescott Webb in his book *The Great Plains.* The shortage of suitable plants became obvious during the 1870's, but the first special appropriation for this work was not made until 1880. Congress set aside $5,000 for research on the agricultural needs of the South and the West, and seven years later voted a like sum to carry on the work. Field investigations were carried out to discover and introduce suitable forage crops to increase the grazing capacity of arid lands.

The value of the grain sorghums to the West was recognized. Native grasses were carefully studied and catalogued by botanists, and the government planned the dissemination of many varieties. *Japanese lespedeza,* a valuable fodder and grazing plant, grew freely on different soils and was planted extensively in the South. An Abyssinian grass was reported very good in Texas, and in other places Russian forage plants, luxuriant in growth, were considered promising.

Guinea grass seed were procured through the American consul at Kingston, Jamaica, and sent to the South in the fall of 1873. This was the familiar *Johnson grass,* a valuable grass for hay but a notorious pest in cultivated fields. The description of these two grasses was the same: they seeded like millet, grew in bunches, withstood drouth and heat, and reproduced from both seeds and roots. Guinea grass had been introduced in Louisiana in 1874, and two years later it was reported the best grass for Arkansas. The grass was known as Johnson grass in Alabama in 1873 where it had been growing for twenty-five years.

Johnson grass has had many names. A correspondent of the *Southern Cultivator* wrote, from Buckhead, South Carolina, in April, 1848, of a grass called Means' grass which from the description seems identical with Johnson grass. He stated that "many years ago" a few seeds were discovered among imported hemp seed from the Mediterranean by "Means" who planted it in his garden. After a few years it took possession to the exclusion of everything else. Means had it dug up root and branch and thrown into some gullies below his house from which place it became distributed throughout the entire section of South Carolina. The grass also was known as Egyptian grass.

The *Silver Skin buckwheat* from Germany proved superior in several respects to the commonly grown varieties. It was well-adapted to the Pacific Coast and gave superior yields. In 1890 a

buckwheat from Japan gave great satisfaction. Because the Japanese variety yields twice the amount per acre and does not blight from the hot sun, it has been adopted as a preferred variety in the Northwest.

Colman directed choice Persian smoking tobacco from the provinces bordering the Caspian Sea to Florida in 1887. Sumatra tobacco, jealously guarded by the Dutch, also was procured. The high prices received for this tobacco caused the formation of a large company in Florida for producing it. In the 1880's the old varieties were being replaced by new tobaccos especially adapted to the needs of the different tobacco growing localities. A new type of America's own Indian corn, found in Rumania and considered a superior bread corn, was tested but found unsuitable for cultivation here. Newton tested Irish potatoes from Great Britain and other places in Europe, but native seedlings proved superior.

FOREST TREES AND MISCELLANEOUS INTRODUCTIONS

There was no need to import new trees for forestation. Instead European nations looked to the United States for better forest trees. As David G. Fairchild explained the attitude of the Department in 1898:

> . . . the United States possesses in its forest flora such a wealth and variety of valuable species that there is little call for increasing the number, at least in the forest regions and for the present, when we have hardly yet begun to be acquainted with the possibilities of our own species and with the necessity of method in their propagation. (1)

The Department of Agriculture did import some species, however, for special reasons. The camphor tree from Japan was distributed annually after 1862, and around 1889 some 3,000 plants were being distributed yearly—mostly in Florida and in Texas where they served as ornamental shade trees. The tree was first used as a shelter for orange groves in Florida, and later for industrial purposes.

Growers expected the *osier willow,* used in basket making and rough furniture, to become a profitable crop since good quality willows could be produced cheaply in America. Cuttings of the osier willow were frequently imported from European countries, and 45,000 roots and cuttings were distributed in the winter of 1862. A small willow plantation was established in 1889 on the Department grounds, and furnished in 1891 thirty different kinds

of willows to 150 applicants. In the same year a second planting of newly introduced cuttings was started.

A third tree introduction during this time was the *cork oak* which had once interested Thomas Jefferson. Reports of success were received ten years after distributions were made in Mississippi in 1859. Le Duc was considerably interested in the cork oak in 1878. Reports from California promised the cork oak could supply the needs of the wine industry there. However, the cork supply for the United States still is imported from the Mediterranean countries because its cultivation depends on a supply of cheap labor.

An arboretum of various hardy trees and shrubs was being collected as rapidly as the plants could be gathered in 1870. Distributions of Spanish chestnuts and English walnuts were reported doing well. The *Laurus* of western China, a good timber tree of solid, durable wood, was forwarded to the Department by the consul-general from Shanghai in 1880. State experiment stations were established at the time these problems in forestry arose and did much to test for adaptation in local areas. California growers in 1889 were enthusiastic over results of the plantings of cork oak, the camphor trees of Japan and China, the Japanese mulberry tree, the eucalyptus, and the English Oak.

Reforestation—As settlers moved westward into the plains region and established their homesteads, the shortage of trees adaptable to arid climates and soils became more apparent. At the same time, the nation suddenly awoke to the fact that forests were rapidly dwindling under the demands of industry and the clearing of land for agricultural purposes. The first move to encourage conservation and reforestation was an act by Congress in 1880 setting aside land for this work. However, the program met with difficulties because proved forest trees were not available in sufficient quantities. In 1897, 500 packages of seed of the *Australian tanbark wattle* were mailed to applicants in the Southwest, Pacific Coast, and Gulf States. A noted botanical collector, Dr. Edward Palmer, was commissioned in 1897 to secure trees of economic importance to the Southwest from the dry regions of the Mexican plateau.

Work by the Department of Agriculture during this period was directed mainly to the South and West because agriculture in these sections was undergoing a complete transformation, and the new areas opening up presented special problems in cultivation.

The search for new crops for these regions had a beneficial effect on the agriculture of the entire nation and led to the discovery of many superior varieties and methods of farming.

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Plant Introduction Under Rusk and Morton

ELEVATION of the Commissioner of Agriculture to the position of Secretary of Agriculture with a seat in the President's Cabinet did no more than accelerate effective trends. Secretary Jeremiah M. Rusk, a Republican, and his Democratic predecessor, Commissioner Norman J. Colman, both were from western states and realized the importance of an experimental approach to the problems of Western agriculture. Colman had pointed out the needs existing in the West for specially adapted varieties of crops and had done much to introduce crops of a tropical nature for the South. Rusk continued to work on these problems. Colman had stressed the search for crops and plant varieties suited to many local needs. Rusk searched for plants for the sake of diversifying the national agricultural economy.

RUSK'S PROMOTION OF SELF-SUFFICIENCY

Rusk asserted that the main purpose of the Department was to introduce or assist in the introduction of new, useful plants. Once an introduction was successful, further propagation and distribution was left to commercial growers.

To Rusk the value of plant introduction lay in the diversification of agriculture and in national self-sufficiency. Tariffs should be used to protect crops which could be grown on our own soil. This would give the farmer the benefits of the home market, Rusk thought. He looked with satisfaction upon the McKinley tariff of 1890 which provided a bounty for the production of raw sugar at home, and had the effect of reducing agricultural imports " . . . which could be, and should be produced in this country." Agricultural experiment stations had been authorized in the Hatch Act of 1887, and within three years more than seventy were

in operation. The Department of Agriculture cooperated with the stations in the introduction and acclimatization of new economic plants. Federal expenses for these experiment stations amounted to $660,000 per year.

The work of plant introduction was organized into several divisions or agencies of the Department of Agriculture. The Division of Gardens and Grounds was responsible for the propagation and distribution of imported trees and shrubs to localities where conditions seemed favorable to their growth. This division, under William Saunders, occupied forty acres including conservatories, propagating houses, and other glass structures known as the Grounds of the Department. A Seed Division was organized in 1864. The Division of Pomology had charge of fruits, the Division of Forestry imported forest species for trial, and the Division of Agrostology, organized in 1895, concerned itself with grasses.

TABLE 4

SEED DISTRIBUTION BY THE FEDERAL GOVERNMENT 1889–97

Year	Total Distribution	Annual Appropriation
	No. of packages	
1889	4,852,512	$104,200
1890	5,605,246	104,200
1891	6,013,613	105,400
1892	5,932,989	105,400
1893	7,704,943	129,637
1894	9,555,318	135,400
1895	9,528,653	148,830
1896	12,000,000*	185,400
1897	20,368,724	150,000

* Approximate figure.

DISTRIBUTION OF SEEDS AND PLANTS

Free seed distributions during Rusk's and Morton's administrations continued to increase rapidly.

Rusk reported that recipients of these seeds felt no obligation to report their results to the Department. For this reason, he recommended that the bulk of future distributions be sent to agriculture colleges and experiment stations. The distribution of plants during this period was handled for the government by commercial firms who packed the plants in damp moss for mailing and then wrapped them in oiled paper and wrapping paper.

A special agent was appointed in 1890 to purchase seeds for distribution by the Department. Following Rusk's recommendation, the distribution that year to experiment stations and agricultural groups was increased considerably, and many seed packages were sent to foreign countries.[1] *Ladoga wheat, Bermuda grass,* and sugar beet seed were some of the more significant importations made during 1890.

The following year, the Department of Gardens and Grounds made a heavy distribution of semitropical plants to growers in the South. Figs, pineapples, olives, camphor trees, and several varieties of foreign grapes made up the list. An encouraging result of this distribution was the extension of pineapple plantations in Florida. However, the government soon realized that such large distributions of tropical fruits were expensive and impractical since many of the plants would not grow satisfactorily in the temperate climate of the United States.

The Department, in addition to its work of seed distribution, gradually assumed many new responsibilities during Rusk's term. Marketing, animal diseases, inspection of materials, standardization of varieties, food adulteration, and favorable tariff legislation were some of the more pressing problems engaging the Department's attention.

Morton's Attitude—A complete reversal in the Department's policy of free seed distribution was effected in 1893, when J. Sterling Morton became Secretary under President Cleveland's second administration. Throughout his term of office. Morton criticized the wholesale distributions. He was opposed to the expense involved in the purchase, packing, and mailing of free seeds, and took steps to reduce these expenditures in line with the economy movement of the administration. He was against the large distribution of common garden and field seeds, specifically—turnips, cabbage, and celery seeds. Morton favored confining the distributions to those seeds which might be considered new and valuable. He charged that the most common and ordinary seeds had been purchased in the years past and had been distributed without design.

[1] Plants of warm climates received much attention and included, roughly in the order of quantities sent out: olive, tea, coffee, camphor, foreign grapes, citrus fruit varieties, date palms, figs, Japanese persimmons, currants, loquats, guavas, pineapples, black pepper, vanilla, mangoes, and bananas. The report of the Chief of Gardens and Grounds for 1890 described 431 of the more important economic plants in the Gardens.

Morton reversed previous policy so far as to suggest that the introduction of rare trees and flowers be left to large seed firms. He claimed that seed firms would get plants into the hands of the growers two or three years ahead of the government. Morton repeatedly defended the commercial seed firms from government competition. Continuance of the Seed Division, which had outlived its usefulness according to Morton, was an infringement on the rights of citizens engaged in legitimate trade pursuits. The building space given to seed distribution should be given to " . . . some useful pursuit, more in keeping with the spirit of our institutions."

TABLE 5

DISTRIBUTION OF MAJOR CROP SEEDS BY THE FEDERAL GOVERNMENT 1889–97

Year	Vegetables	Flowers	Cereals	Textiles	Tobacco	Turnips	Miscellaneous*
	No. of packages	*No. of packages*	*No. of packages*	*No. of packages*	*No. of packages*	*No. of packages*	*No. of packages*
1889.....	3,710,224	307,804	35,029	12,157	186,247	548,009	53,042
1890.....	4,719,691	632,909	80,715	14,473	65,020	55,905	36,633
1891.....	5,058,647	632,066	50,271	14,444	59,624	165,344	33,217
1892.....	5,043,694	722,732	16,143	20,761	76,235	29,994	23,440
1893.....	6,743,586	826,045	13,145	25,022	63,935	3,673	29,537
1894.....	8,127,013	802,102	23,129	34,950	67,897	452,752	47,475
1895.....	8,591,164	771,780	33,841	18,752	74,002	.....	99,114
1896.....	10,125,000	NR	NR	NR	NR	NR	NR
1897.....	19,053,839	1,022,500	NR	NR	NR	2,119,042	NR

* Includes such crops as herbs, opium poppy, tree seeds, grasses and sorghums.
NR—Not reported.

In 1894, Morton stated that the operation of experiment stations obviated the need for distribution to private individuals. In the *Annual Report* for 1894, the Special Agent for the purchase of seeds, Enos S. Harnden, had a report opposing the old system of seed distribution. He mentioned the unjust "interference" with private business, stated that the varieties distributed were not new but only had new names, and that the Department of Agriculture was only a dumping ground for bad seeds. Harnden suggested that an appropriation of $15,000 for determining the number and correct names of varieties should be made and the results published through government bulletins.

In spite of Morton's aggressive opposition, Congressmen were determined to hold on to their patronage and in 1895 appropri-

ated $130,000 for seed distribution. The figures for seed distributions during Morton's term (See Table 2, page 60) indicate that the only effect his tirade against free dissemination had was to bring about a record distribution in 1896. Morton retaliated by taking seventy-nine pages of the *Annual Report* to list the addresses of packages mailed under the congressional franking privilege.

PROMOTION OF SPECIAL CROPS

The Rusk administration regarded the annual expenditure in excess of $100 million for foreign sugar as a challenge to produce more sugar at home. In 1890, five thousand packages of sugar beet seeds, obtained by European growers mainly in France and Germany, were sent to interested growers in America. Tests of beets grown in northern and central portions of the country showed extremely favorable results. In the two-year period between 1898 and 1900 the number of sugar processing plants jumped from fifteen to thirty-seven, and sugar production was tripled.

Silk production was intermittently encouraged by the government for many years. The silkworm eggs and new varieties of mulberry and similar trees were imported for trial. Philip Walker, Chief of the Silk Section, visited Europe in 1889 to study the varieties of mulberry and osage orange used there. One hundred grafted trees of the *rosea* mulberry were purchased for experiment. Successful silk production, however, did not depend upon particular varieties of trees, but upon the invention of an automatic reel as a substitute for expensive manual labor.

DATE INTRODUCTIONS

Date culture became a profitable industry in the United States largely through the efforts of the workers in the Department of Agriculture. In 1880, 500 date "palms" were distributed by the Department, but the results were negligible. H. E. Van Deman, pomologist for the Department, ordered date palms in 1889 through American consuls at Teheran and Cairo, and from growers in Arabia and Algeria. The following year, he received three choice varieties from Algeria and eight from Egypt, a total of sixty-three trees. This shipment was claimed by the Department to be the first successful introduction of rooted date suckers in the Western Hemisphere. Growers besieged the Department

with requests for the suckers. The Southern Pacific Railroad transported a carload of the plants to Arizona and California free of charge. Recipients of the trees were to act only as trustees of the plants, to keep any one grower from cornering a superior variety.

The consul at Muscat, Arabia, sent the Department six plants of the Fard date from that region. These were planted in tubs and sent to California and Arizona. One of these plants was received by the agent of the Southern Pacific Railroad at Indio, California—the present center of the American date industry.

Successful introduction of the date palm is due largely to the work of Walter T. Swingle. Acting under instructions from the Secretary of Agriculture, Swingle visited a flourishing date orchard near the Algerian coast in 1899. He secured a few offshoots for a trial shipment and contracted for a large shipment at a later date.

The Deglet Noor—The following year, he again visited Algeria to purchase additional plants of good sorts from Biskra on the northern margin of the Sahara, and in the foothills of the Atlas Mountains. Through the cooperation of the president of a French company, Swingle was able to study the details of growing and marketing dates in a region south of Biskra. Here at Ourlana, Swingle obtained suckers of the Deglet Noor, the basic variety of the present date industry in the United States, and some other varieties unknown at Biskra. These were transported northward to the Mediterranean shores by camel. In all, twenty-three cases were shipped from Algeria to New York whence they were forwarded to New Orleans. The plants were given free shipment from New Orleans by the Southern Pacific Railroad to the palm garden at Tempe in the Salt River Valley. Some of this shipment of 447 shoots of 27 varieties were distributed at other stations in California and Arizona.

Experiments in California with the cultivation of the Deglet Noor date palm have shown this to be one of the most productive food crops in the world. One palm, as a result of long, continued experiments, can now be made to bear four hundred pounds of dates per year. The effort, patience, and investment required to adapt valuable plant introductions to a new country and the ultimate wisdom of the investment are illustrated by the history of the date palm. The Deglect Noor date required an investment of over $100,000, Swingle has estimated, and over ten years of study before it produced the first paying crop. Previous experi-

ments with many unsuccessful date introductions also helped pave the way for this crop.

THE SMYRNA FIG

Transplanting a crop industry from one environment to another is often a long and exasperating task. Many of our crops have been developed because of the persistence of men who refused to be daunted by repeated failures. Typical of this work is the fascinating story behind the struggle to introduce the Smyrna fig into the United States.

There are records of attempted introductions of figs as far back as colonial times. But our story begins in the latter part of the nineteenth century when government assistance to growers gave impetus to their efforts to adapt the fig to America.

First Shipment From Smyrna—California was the center of experimental work because its climatic conditions most nearly matched those of the original environment of the figs. Attention centered around the Smyrna fig because growers felt it had the best commercial prospects. The first shipment of 448 cuttings from the ancient region of Smyrna (in the Maeander Valley on the west coast of Asia Minor) arrived in 1880. These were procured through the American consul in Smyrna, E. J. Smithers, and brought to this country by G. P. Rixford of the *San Francisco Bulletin*. The next year, 14,000 more cuttings were distributed by the *Bulletin* with a fanfare of publicity. Praise from the growers quickly turned into blasts of criticism at the *Bulletin* when the young trees bore fruits that would not ripen and fell from the trees in shriveled bunches. The *Bulletin* retorted that the failure was due to chicanery by the natives of Smyrna who had slipped them worthless figs in order to deter competition. (1)

For the next two decades growers continued to import seeds and cuttings of the Smyrna fig, but in all cases the fruit refused to ripen on the tree.

Native gardeners of Smyrna followed the practice of suspending fruits of the wild caprifig from the branches of the Smyrna fig trees during the fruiting season. This had the earmarks of some old fertility rite to the scientific minds of American agriculturists, and they dismissed the practice as mere superstition.

Role of Blastophaga—A study of the fig flower in 1885 by Dr. Gustav Eisen, a Swedish scientist who had come to the United States twelve years before, indicated that fertilization of the

Smyrna fig depended upon the *Blastophaga psenes*. The female of this species of wasp somehow transferred the pollen of the wild, inedible caprifig to the blossoms of the Smyrna fig, thus bringing about fertilization and ripening of the fruit. (2)

This discovery made the agriculturists realize that there *was* some significance in the ritual associating the caprifig with the ripening of the Smyrna variety. The missing link—the wasp which acted as a fertilizing agent between the two plants—had been found. In confirmation of this discovery, George Roeding fertilized young Smyrna figs with pollen from the caprifig by transferring the pollen with a toothpick. He also tried blowing in the pollen with a small glass tube. Eisen, too, sealed pollen from caprifigs in a glass container and with it pollinated young figs 200 miles away. However, discovery of the procedure of fertilizing the Smyra figs was not enough. A quantity of the Blastophaga wasps had to be imported if fig cultivation was to succeed commercially.

Importing the Wasps—California growers made a number of unsuccessful attempts to import the live wasps by bringing in caprifigs containing the insects. They appealed to the Secretary of Agriculture, James Wilson, for assistance, suggesting that the insects be imported in figs on living branches instead of detached fruits. A young scientist connected with the Department of Agriculture, the same Walter T. Swingle mentioned previously, was studying in Naples at the time. Swingle was commissioned as an agricultural explorer and given the task of securing a supply of Blastophaga.

Swingle's second shipment of Algerian figs in 1899 was successful. He had wrapped the insect-filled figs in tinfoil, sealed them with wax, and then packed the figs in cotton.

The figs were opened upon their arrival in California and hung on two trees which were covered with tents to ward off the frost. Successful acclimatization of the wasps the following summer was assured when an employee in the orchard noticed what he thought were seeds in an unusual-looking hard, green, plump caprifig. An inspection of the figs growing on the trees showed that many of them were filled with the wasps.

How Figs Are Fertilized—Previous shipments of the Blastophaga had failed to survive because the importers did not understand the life cycle of the wasp. In order to ship the wasps successfully they had to be obtained during their hibernating stage,

which was the last of the three generations of Blastophaga produced each year.

In the spring, the wingless males of the first generation awaken from hibernation in the caprifig. They gnaw into the tiny galls or blisters in the fig to fertilize the imprisoned females. The male then dies and the female frees herself from her winter home and flies to the first fig crop of the year, the profichi. She saws her way into the fig orifice with her strong mandibles and sheds her wings at the same time. Inside the caprifig she deposits her eggs in the gall flowers and dies in her turn. From these eggs new females hatch out and in turn seek new fig homes for their eggs.

From the caprifig male flowers the wasp brings the pollen that fertilizes the female flowers of the young Smyrna figs—if by mistake she should happen to enter a Smyrna fig. And the successful cultivation of the Smyrna fig depends on the female wasp confusing the orifice of the Smyrna fig for that of the caprifig, her natural home. Once inside the Smyrna fig she finds the flowers so formed that she cannot deposit eggs with her ovipositor which nature had adapted to the caprifig flowers. In her frantic search, she thoroughly pollenizes the young Smyrna fig but dies with her own mission unaccomplished. Female wasps from succeeding generations of caprifigs keep the young Smyrnas fertilized throughout the season until the wasp again hibernates in the last caprifig crop of the year.

Once the wasps' life cycle was understood, the wasps were successfully introduced, and the fig industry flourished rapidly. Caprifigs are still suspended from the branches of the Smyrna trees in the Mediterranean area, but in America the College of Agriculture of the University of California succeeded in 1948 in producing Smyrna figs using four synthetic hormones instead of the caprifigs. Approximately 14,500 acres of Smyrna figs are now under cultivation, and the industry markets figs valued at several million dollars annually.

While the Smyrna fig came to be of the greatest commercial value to growers, a number of other fig varieties were also distributed for trial in the southern states at the close of the nineteenth century.

THE DIVISION OF POMOLOGY

A special agency to care for the interest of fruit growers—the Division of Pomology—was established in 1886. Growers had

been clamoring for many years for a share in the $20 million spent each year on imported fruits and nuts. Another important pomological problem was that of finding apple varieties capable of enduring the rigorous climate of the northwest. The Russian varieties imported two decades earlier had not proved satisfactory. H. E. Van Deman, pomologist, reported in 1889 upon the extensive introductions made by his division. He had ordered through American consuls at Bokhara, Turkestan, several bushels of stones of Asiatic peachs in a search for varieties resistant to the disease known as "peach yellows."

TROPICAL PLANTS

The Division introduced many tropical plants from Europe, India, Japan, and other places. From the Philippine Islands came the first named varieties of cocoanuts ever brought into the United States. Japanese walnuts were obtained for the central and southern states. Failure of the mango varieties tried earlier in the South caused the introduction of new varieties from the East and West Indies. The first East India *mulgoba mango* came to Florida in 1889.

The *citron* tree was sought through American consuls in the port cities of Italy. Rooted cuttings from Corsica sent to Florida and California established the new industry to a limited extent in southern California. *Coca* plants were distributed in the South and in California, although previous plantings had not succeeded. *Ginger* roots were also distributed again and *gum arabic* plants sent out. Other distributions of 1889 included Japanese grapes, the *guava* of Mexico, and the *granadilla* of the West Indies. Choice Italian chestnuts were procured in 1892 from Catania and sent to 150 experimenters.

Foreign Exchanges—Further arrangements were made in 1893 for exchanges with foreign nurserymen and growers. Several varieties of different fruits had been secured previously in this way. Seeds or scions of seventy different fruit varieties were obtained for 128 experiment stations and for private growers. From Brisbane, Australia, came trees of the *mandarin orange,* or tangerine, as well as other economic and ornamental plants, including cherries, plums, the *Queensland tamarind,* the *candlenut,* and the *Queensland nut.* Eight varieties of plums and five of cherries from Hungary were scattered over eight states.

Seeds of a hardy variety of avocado were brought across the

border from Mexico and directed to the Gulf States and California. The Division of Pomology hoped to expand avocado culture, which had been limited to the East Coast and adjacent keys since the great freeze of 1894–95. This division allotted 2,000 seeds of the superior variety *Persea gratissima* to eighty-six persons in the southern states and Arizona and California.

FIBER AND FORAGE CROPS

The $15 million being paid annually to foreign countries for raw and manufactured flax, and the $5 million paid to Yucatan for sisal hemp, convinced Rusk that these crops should be grown in the United States. There was much interest in these crops and their importance could not be overestimated. The Harrison administration placed tariff duties on flax to encourage its production. Ramie could become a $20 million crop if suitable machines were developed for processing it. Jute was another fiber crop to be promoted. Considerable areas of sisal hemp were being grown in Florida, and one plantation exceeded sixty acres. Rusk suggested a bounty or a tariff to promote further production.

The government imported seeds of the manila hemp plant and of the New Zealand flax for southern localities. Fiber investigations were conducted by the Department of Agriculture with flax, ramie, sisal, and bowstring hemp. The growing of sisal hemp was said to be out of the experimental stage in southern Florida. In 1891 three varieties of flax seed from Belgium and Russia were assigned to agricultural experiment stations, flax manufacturers, and growers seriously engaged in experiment. Large plantings of bowstring hemp were made in Florida in 1892. Growers reported that it was of rapid growth, produced strong fibers, and was cheaply harvested and cleaned. A few experiments were in progress with the cultivation of Italian hemp and the *sunn hemp* of India in 1894.

GRASSES

Colman, as Commissioner, had accelerated the search for grasses and forage crops for the dry regions of the West. The native grasses of South America, Siberia, and India were suggested in 1890 as possible sources of hardy grasses for the South. Experimenters realized that it might take a long time to discover suitable grasses and pointed out that England had required fifty years to develop her grass industry. Much attention was still given to

studies of native grasses in Texas, New Mexico, and Arizona.

Experiments with native and foreign grasses at Garden City, Kansas, since 1889 had made it plain that the ordinary grasses of the East would never do for subarid regions. The only imported plant which had proved thoroughly successful was the *Bromus inermis* from the arid parts of Austria. Some forage plants from Australia promised to be of value. The Secretary of Agriculture made arrangements in 1894 with the Department of State for consular agents to collect seeds of forage plants from foreign countries and forward them to the Department for experiment. An appropriation by Congress in 1895 made the organization of the Division of Agrostology possible. Prof. F. Lamson-Scribner became Chief of the Division and continued as head of grass and forage investigations.

The guiding motive for finding new crops under Rusk and Morton was to produce some of the imported staples at home and thus achieve a greater national self-sufficiency by diversification. Through Congressmen and through the Department itself, increasing quantities of plant materials were placed in the hands of persons who might adopt locally the crops being promoted. Experiments with sorghum as a source of sugar gave way to experiments with the sugar beet while other trials proved that silk could not be profitably produced. The administrations of Rusk and Morton concluded attempts to found several fiber crop industries, but marked the beginnings of much work with a variety of fruits for temperate and tropical climates.

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Bonanza Years

THE CLOSE of the nineteenth century found America's agricultural frontiers spread beyond the Rocky Mountains, north to the Canadian border and south to the Rio Grande. Farmers who had overworked their land by producing the same staple crops year after year could no longer pull up stakes and seek a new homestead. Their incomes were decreasing as surpluses of the staple crops piled up. The Spanish-American war had created a wave of interest in tropical agriculture and consumers began to demand more varied diets. Millions of dollars went each year into agricultural imports. The economic development of many agricultural areas awaited the discovery of crops which could be grown successfully in a variety of climatic and soil conditions. Faced with the shortage of arable land and the food demands of an increasing population, farmers had an incentive to cultivate their soil with greater care.

GOVERNMENT ASSISTANCE

The government sought to relieve the plight of agriculture by putting crop production on a more efficient basis. One of the first steps in this work was a program making plant introductions systematic and scientific. The Department of Agriculture began to provide many new services to farmers, and a group of scientists and explorers was employed to begin the introduction of an enormous quantity of valuable plants. During the first term of James Wilson as Secretary of Agriculture, an appropriation of $20,000 was alloted for this work.[1] This federal aid in 1897 was

[1] . . . That twenty thousand dollars of the sum thus appropriated . . . may be used to collect, purchase, test, propagate, and distribute rare and valuable seeds, bulbs, trees, shrubs, vines, cuttings, and plants from foreign countries for experiments with reference to their introduction into this country; and the seeds, bulbs, trees, shrubs, vines, cuttings, and plants thus collected, purchased, tested, and propagated shall not be included in general distribution, but shall be used for experimental tests, to be carried on with the cooperation of the agricultural experiment stations.

an agricultural landmark comparable to the first appropriation of $1,000 in 1839 for agricultural work by the Patent Office.

The figures in Table 6, giving the approximate yearly value of our main agricultural imports at the close of the century, were pointed to by growers as strong arguments for producing these crops in the United States.

Plant introduction procedures put into effect by the government were much broader in scope than previous efforts. Growers were to be given full information on cultivation methods. The

TABLE 6

APPROXIMATE YEARLY VALUE OF AGRICULTURAL IMPORTS UNITED STATES—1900

Crop	Value
Sugar	$96,000,000
Rubber	32,000,000
Coffee	55,000,000
Fruits and nuts	18,500,000
Tobacco	12,000,000
Manufactured Fibers	13,000,000
Sisal Hemp	10,000,000
Manila Hemp	6,000,000
Jute	2,250,000
Cotton	10,000,000
Flax	1,000,000
Hemp	500,000
Tea	10,000,000
Wines	7,250,000
Rice	4,000,000
Seeds	1,000,000
Licorice	1,500,000
Cork	1,500,000
Macaroni	600,000

Department was to aid in creating markets and to continue to support new crop industries until they were commercially successful. Foreign plant materials would go either to reliable growers or experiment stations, and in some cases would be retained by the Department for trial. Each shipment represented a step in the solution of a special problem and not merely an unplanned broadcast of stocks.

O. F. Cook, in 1898, began the "Inventory of Plants Introduced" in which numbers were assigned to each new item and information given on its origin, nature, value, and cultivation.

Wilson issued an executive order in 1900 which further coordinated the Department's work by requiring division heads to

confer upon policy matters with the superintendent of the Experimental Gardens and Grounds. The divisions of Vegetable Physiology and Pathology, Agrostology, and Pomology also were consolidated into the Office of Plant Industry. A subsequent order included the Section of Seed and Plant Introduction, and in 1901 the Office was designated as the Bureau of Plant Industry.

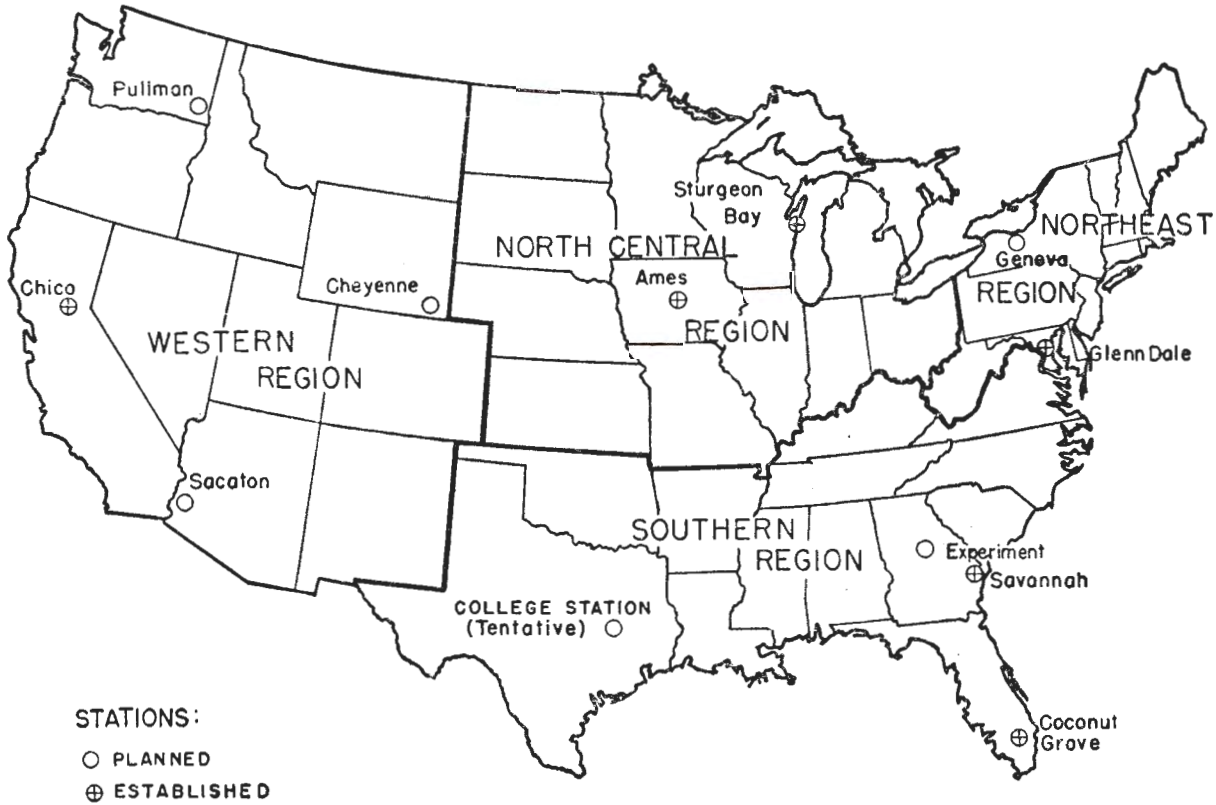
DISTRIBUTION OF SEEDS AND PLANTS

Changes in seed and plant distribution due to the reorganization became apparent in 1898. All seed distributing agencies were placed under the Assistant Secretary. The Division of Gardens and Grounds practically abandoned the testing of new plants because state experiment stations were better equipped and better located for these tests. The government discouraged attempts to grow rubber plants in Florida because the climate was not warm enough, and interest in tropical plants subsequently declined.

Wilson desired to return to the original purpose of seed distribution, that of developing new crops. Seedsmen, too, urged the discontinuance of the general seed distribution. The immediate aims were to find beet varieties sweet enough to produce sugar, drouth- and rust-resisting grains, grasses and forage plants for the West, tea plants for the South, the date palm for Arizona, and rubber plant study for the new colonies. The Division of Gardens and Grounds continued large distributions of strawberry, grape, camphor, tea, olive, privet, and fig plants. William Saunders, who died in 1900, was succeeded by B. T. Galloway as head of the plant work in the Department.

THE WORK OF PLANT EXPLORERS

Probably the most important result of establishing the Section of Seed and Plant Introduction was the employment of "Special Agents," or agricultural explorers. The men contributed measurably to the progress of plant introduction during this period through their plant discoveries in foreign countries. They were trained to recognize plant diseases and pests and to judge the value of certain plants in solving agricultural problems. Each explorer specialized in a particular crop or agricultural area. The designation "Special Agent" was dropped by O. F. Cook, while he was head of plant introduction, because the name aroused suspicion in foreign countries.



Division of the United States Into Four Regional Sections for the Introduction and Testing of New Plants. Puerto Rico is Included in the Southern Region and Hawaii in the Western Region.

FAIRCHILD AND LATHROP

David G. Fairchild, because of his extensive explorations, his writings, and his leadership, is foremost among the American plant explorers. He began work in the Department in the early 1890's. Aboard ship en route to Europe for study, Fairchild met Barbour Lathrop, world traveler. This was the beginning of an association which proved to be of great value to Fairchild and to the Department, for Lathrop explored at his own expense for nearly six years with Fairchild as his expert. From the Malay Archipelago and China they sent hundreds of specimens to the United States for trial. Among these was the *mangosteen,* a tropical fruit which attracted much attention.

In the winter of 1898, Fairchild made his first stop to study foreign products at Kingston, Jamaica. He visited market places, tasting new fruits and vegetables to determine what should be sent to the United States. The trip continued via Panama and the west coast of South America. (1) From Peru he sent back the *Hairy Peruvian Alfalfa,* which by 1920 was recognized as the most productive variety for irrigated lands in the Southwest. Fairchild also collected fruiting cacti for the Southwest, and in La Plata found spineless cacti. A hardy variety of avocado proved to be of value in giving growers experience in avocado raising in California.

From Rio de Janeiro the party proceeded to England and the countries of Central Europe. In Austria they secured the *Maliner Kren,* a flavorful horseradish which was later grown in New Jersey. Large plantings of the "Sultania Rosea Seedless Raisin Grape" were made in California from plants procured in Padua.

Later, varieties of okra, red pepper, vegetable marrow, pumpkin, cucumber, and peanuts, of special interest to the cultivators of the new, irrigated regions of the West, were obtained from Egypt. Onion seeds of a variety grown on the islands of the Upper Nile and exported to England came to be grown extensively in Texas. Hundreds of *lebbek* trees are growing in Florida today from seeds of the trees on the boulevard between the Nile and the Great Pyramids. *Berseem clover,* also introduced for its ability to thrive in hot, alkali desert areas, is grown in limited areas of the West.

After leaving Egypt, Lathrop and Fairchild visited islands in the East Indies and traveled in the interior of China and Ceylon before returning to London. Fairchild brought home about five

hundred different plants and collected many other plant items in subsequent explorations.

HANSEN

Niels Ebbesen Hansen made his first exploration for the government in 1897 to find alfalfa and other forage plants able to thrive in cold and semiarid regions of the prairie Northwest. Stock was suffering for forage, and the winter-killing of alfalfa had cost the farmers of this region millions of dollars. (2)

Hansen discovered *crested wheat grass* during his trip through the steppes of the eastern Volga region and Siberia, when he observed camel caravans loaded with the hay en route to market. From an examination of the hay he concluded that the crop would stand the severe cold and dry weather in the Northwest. In 1944, over 23 million pounds of the seed were grown in the United States, and observers believed it would soon cover millions of acres in the Northern Great Plains.

On the same trip, Hansen secured seed of *bromegrass,* a perennial crop for nutritious pasture and hay, able to stand drouth and cold because of its underground root-stocks. Its good qualities were immediately noticed and in 1899 orders were placed abroad for more seed. The 1944 seed crop of this grass amounted to over 13 million pounds. On this and several later trips to Russia, Hansen also brought back over thirty varieties of *proso,* a grain similar to millet, grown in the drier regions of Asia and Europe.

Hansen tells of his connection with the wheat introductions by Carleton as follows:

> I noticed that wheat bread in European countries was not as snow-white as in the United States. It was more of a creamy tinge. Our ordinary hard spring wheats date back to Galicia in Poland. I learned that much wheat was exported from Russia, and used extensively in blending with their home wheats in France, England, Italy, and other countries in west Europe. I also remembered that German-Russian colonists in South Dakota had brought over some of it from dry regions in Russia, but that millers refused them as rejected wheats, good only for chicken feed. . . . They needed special milling owing to the hard grains. Then in Russia I collected many authentic samples of these wheats, such as Kubanka, Arnautka, Krasnoturka, Belloturka, Chernokoloska (Black beard), and many more. Also brought wheats from Turkestan and Siberia.
>
> Upon my return in the spring 1898 this material and inside report was submitted to Secretary Wilson. It was up to him as a matter of policy, and would involve a fight with the milling interests. But Secretary Wilson wanted to help the northwest farmers who could raise these wheats in dry years and they needed much less rainfall. Secretary Wilson was never afraid of a fight, so decided quickly.

M. A. Carleton, a great wheat specialist from Kansas, was sent to Russia the same spring 1898 to get larger supplies and to extend the work. Many specialists were set at work proving that good bread could be made from durum wheat. In many ways Secretary Wilson extended the work and in due time the fight for recognition was won.

From this exploration Hansen also secured the progenitors of the *Persian* and *Honey Dew* melons seen in vegetable markets today. The Persian winter melon seed were sent in 1897 to Utah and California. Other fine varieties of muskmelons from Russia succeeded in Colorado and in other Rocky Mountain states. Through plant introduction, breeding and selection, Hansen has also made important contributions to such fruits as the pear, apple, and apricot.

CARLETON AND NEW WHEAT VARIETIES

The opportunity to introduce one of our most significant grain varieties, the *Kubanka wheat,* fell to Mark Alfred Carleton, wheat specialist of the Department. This introduction resulted from the search begun by Colman and continued by Rusk to find grains, grasses, and forage plants for the West. Attention had been attracted originally to the hard red winter wheats by the Mennonite German-Russian emigrants to Kansas in 1873 who brought the seed with them. These hard wheats, frequently introduced as Turkey wheat, failed to gain popularity due to the objections of millers. The change to a dependence upon hard wheats was to a large degree a matter of convincing various interests—farmers, millers, bakers, and consumers—of their value. (3)

Carleton's eagerness to search for wheats resistant to rust and cold grew out of his background in a wheat-growing area in Kansas, and from his experiments in Maryland with more than a thousand varieties. These experiments made him realize the wide range of variation in wheats and the possibility of selecting certain varieties for specific purposes. A repetition of these experiments in Kansas in 1896-97 gave Carleton additional data and made him eager to obtain more varieties from the original sources. Paul de Kruif, in *The Hunger Fighters,* has vividly depicted Carleton as a martyr who overcame great odds. Fairchild in turn wrote that de Kruif "perhaps carried away by the drama of the situation represented Carleton as having to fight for an opportunity to visit Russia. This was not the case." Carleton went as a Special Agent of the government and his reports were published in the records of the Section of Seed and Plant Intro-

duction. (1) Carleton left for Russia in July of 1898, returned the following year, and made a second trip in 1900.

During his first exploration, Carleton obtained seed of the Kubanka spring wheat from the wheat growing in the Turghai territory of Kuban in the Kirghiz Steppes, forty miles southeast of Orenburg. He also secured several other strains of Kubanka including the *Arnautka, Gharnovka,* and *Pererodka.* Sixteen varieties of other Russian cereals and seeds of forage plants, buckwheat, melons, and garden vegetables were brought back by this exploration.

TABLE 7

DISTRIBUTION OF PLANT STOCKS BY THE FEDERAL GOVERNMENT 1863–97

Year	Total Distribution	Year	Total Distribution
	No. of plants and cuttings		*No. of plants and cuttings*
1863	25,750	1882	70,000
1864	30,000	1884	100,000
1865	35,000	1885	74,000
1866	34,000	1889	45,000
1867	42,123	1890	80,000
1868	30,000	1891	117,000
1869	31,700	1892	66,000
1878	57,155	1893	60,000
1879	36,673	1894	75,000
1880	156,862	1895	73,485
1881	100,000	1897	56,100

Success of Carleton's Introductions—Carleton returned to Russia to secure larger quantities of wheats and to search for more varieties. This time he obtained the *Kharkov wheat,* a standard hard red winter variety which came to occupy the greater part of 21 million acres of hard red winter wheats in 1921. (4) From an introduction of a very hard red winter wheat made in 1900 from the Crimea, the *Kanred* was selected in 1906 and occupied 1,538,573 acres in 1939. In 1898 and 1900 Carleton also obtained seeds of the *Ghirka,* now known as the Alton and planted to 140,000 acres in 1939.

The justly famous wheat introductions of Carleton had significant results not only in changing the character of the American wheat industry but in winning public appreciation of plant introduction by the government. Two years after the introduction of

the Russian wheats, 60,000 bushels were produced, while only five years later 20 million bushels were grown. The United States has progressed nationally from the production of only soft wheats to the production of three different classes of hard wheats as the basis of milling and export wheats. The resulting interest in the study of wheats ushered in a period of research and of the application of the laws of Mendelian inheritance which led to significant results from 1901 to 1930.

The acreage in Turkey wheat, a term applied to Kharkov and many other synonyms, in 1939 amounted to 12,637,403 acres, or 19.77 per cent of the total national wheat acreage. However, these figures include neither related wheats, nor selections developed from this class of wheats, nor the durum wheats. Probably a third of the wheat acreage in 1939 was sown to varieties traceable to Carleton's introductions.

The estimated durum wheat acreage in 1939 was 3,372,405 acres, mainly in North Dakota, South Dakota, and western Minnesota. The Kubanka estimated acreage in 1929 was 724,864 acres and in 1939, 431,630 acres. The acreage of durum varieties is expanded in dry years. About one-third of this wheat is used in macaroni and related products and some is exported.

Other Wheat Introductions—New wheat varieties have been brought to the farmer in various ways, and it would be a mistake to leave the impression that wheat improvement was due almost entirely to introductions by the Department of Agriculture. Experiments in Canada paralleled those in the United States. Dr. William Saunders and his sons, Drs. A. P. and Charles E. Saunders, working at the Central (Dominion) station and at several substations, began crossing wheats in 1888. They developed the *Huron, Preston,* and *Stanley* varieties, and in 1892, the famous *Marquis* hard red spring wheat. All of these came to be grown commercially in the United States. The seed filtered across the border or came in as commercial shipments of grain.

William J. Farrer, in New South Wales, Australia, worked to breed varieties from 1886 to 1906, and many of his varieties now are grown commercially in America. The various Federal and state experiment stations worked at hybridizing wheat varieties. Consular officials continued to bring in plants from abroad. Immigrants brought their favorite plants from the Old World, and individual farmers and seedsmen were breeding and selecting varieties. Frequently, varieties have humble beginnings without

historical records. Whatever the source, the tendancy for the old varieties to be replaced by new hybrids was accelerated after 1900.

At the turn of the century, the Department of Agriculture was giving attention to the improvement of the soft white wheats preferred in the Pacific Coast states. The best of these varieties were introduced from Australia, Japan, China, and Europe to replace the old varieties which were deteriorating. The variety *Baart,* originally from South Africa and imported to Australia in 1880, was introduced by the Department in 1900. Baart wheat was first distributed by the Arizona Agricultural Experiment Station in 1910. After becoming well established in Arizona, its cultivation spread to the Pacific Coast states. In 1939, 890,000 acres were grown on the dry and irrigated lands of the West.

KNAPP

Seaman A. Knapp, while working with a land development company in Louisiana, became interested in rice production and gained much experience in cultivation of the crop. Knapp made two trips to Japan to secure rice varieties with milling qualities superior to those commonly grown in the South during the 1890's. The *Kiushu rice* he brought from Japan is the basis of the present rice industry in Louisiana and Texas.

The chief difficulty with the common Honduras or South Carolina rice at this time was its poor milling qualities which caused excessive losses to the growers. Knapp selected ten tons of seed from the varieties grown on Kiushu. These seed were allotted to selected rice farmers in Louisiana for trial. The Kiushu rice was found to be 25 per cent more productive than the Honduras, and milling losses were cut in half.

This introduction was a brilliant piece of pioneering, for it opened up extensive regions in Louisiana and Texas to rice cultivation—land that formerly could be used only for grazing. Texas increased its rice plantings from 8,711 acres in 1899 to 376,500 in 1904. The production of rice in Louisiana soon was increased by more than $1 million a year. During the three years from 1899 to 1902, America's rice imports declined to less than half their previous figures, and today the United States exports rice.

While in Japan, Knapp also procured five varieties of the Japanese persimmon, and varieties of alfalfa, plums, pears, oranges, and rare lily bulbs. On his second trip in 1901, Knapp obtained

seed of fifteen kinds of rice for trial in Louisiana, and sorghums and vetches for the West.

MINOR INTRODUCTIONS

From 1897 to 1901 the Department secured other plants of value. Tests of forage plants and grasses included the *March rape* from France, which proved valuable for the Sierra foothills, and the *Goat's rue* from the same country. Common, scarlet, purple, and hedge vetches, European lupines, and many forms of field peas were procured. The sources of new forage plants—New South Wales, Victoria, Algeria, Cape Colony, Natal, northwest India, the Royal Botanical Gardens at Kew, and Switzerland—indicate comparable climates in the United States for which the plants were being sought.

The Department also introduced seed of the *Swedish oat* from Russia in 1899 and distributed them to the Federal experiment stations for trial. This new variety was an established crop by 1904, and twenty-five years later 5 million acres per year were being sown to the *Swedish Select* or selections from it. *Bavarian hops* introduced in 1900 promised to be superior to the ordinary varieties. Soybeans then received the attention which led to their cultivation and utilization by American agriculture and industry. Three varieties brought from Japan in 1900 began a series of introductions leading to the establishment of a major farm crop.

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Introductions of the Twentieth Century

DAVID G. FAIRCHILD took charge of the Office of Foreign Seed and Plant Introduction in 1897, and held that post, except for tours of exploration, for twenty-seven years. Under his leadership the Office set up an efficient system for disseminating plants, and experts in different parts of the country were employed to locate new plant materials. In 1902 Fairchild's division came under the jurisdiction of the new Bureau of Plant Industry. Three other divisions—the Arlington experimental fram, Congressional seed distributions, and tea investigations—were established at the same time.

When the Bureau of Plant Industry was organized in 1900, is was the first official agricultural organization of its kind devoted exclusively to plant introduction. In addition to the four branches listed above, there were divisions concerned with physiology and pathology, botany, grass and forage plants, pomology, and the experimental gardens and grounds. Under Beverly T. Galloway, the Department's leading plant pathologist, more than two hundred employees were engaged in plant work. The Bureau had several gardens and farms at its disposal, and experiment and field stations were established as they were needed for plant experiments. The Arlington Farms and Potomac Flats were located in Washington, D. C., and an eighty-acre garden at Chico, California. The South Texas Garden, established at Brownsville in 1907, contributed much to the development of the Winter Garden district in the Rio Grande Valley of South Texas.

THE SEARCH FOR NEW CROPS

At the turn of the century, the Department of Agriculture accelerated its search for new and better crop varieties. Secretary

Wilson encouraged the importation of date palms, Egyptian cotton, and superior varieties of barley for commercial purposes. He also was interested in macaroni wheats, and the culture of hops and prunes. The Department conducted experiments in 1903 with new varieties of cassava for feeding stock and for starch production. Mexican peaches and apricots were investigated as potential crops for the South, and the Department became interested in the problems of irrigation and crops for dry farming areas.

Growers asked for cover crops for fruit orchards and tobacco fields, and florists were searching for healthy varieties of Easter lilies. A soil improver was sought, along with disease-resistant cottons, and grains able to resist drouth, rust, and alkali. Fruit growers in Florida wanted some new, fancy varieties for the market. The northern states called for trees that could be used for shade and for windbreaks.

A Laboratory of Plant Life History was set up by W. T. Swingle in 1904 to study the soil, climatic, and cultural requirements of various plants. Previous work by Swingle on the Smyrna fig and the date palm had demonstrated the value of studying the life histories of plants before attempting to introduce them. Extensive research was done on the clovers and the alfalfas by the Laboratory.

The Office of Dry-Land Agriculture was established in 1906 to cope with the problem of utilizing the arid lands of the West for agriculture, and within three years experimental work was in progress at nine stations. Farmers became interested in the possibilities of dry farming after seeing the results of experiments with durum wheats.

New experimental gardens—By 1907 a new date palm garden had been established at Laredo, Texas, and *Peruvian alfalfa,* hardy citrus fruits, sorghum varieties, Egyptian cotton, and durum wheats were being given further study.

P. H. Dorsett, who was placed in charge of the plant introduction gardens in 1910, was instrumental in increasing the size and number of the gardens used for plant testing. Bamboos and dasheens were grown experimentally at Brooksville, Florida, and mangoes were tested at Miami. Two new gardens were located at Chico, California, and Rockville, Maryland. The station in southern Texas tested tropical and citrus fruits, and the *Chinese elm* and wild peaches were raised at Ames, Iowa.

Experiment stations set up in Puerto Rico, Hawaii, and the Philippines tested tropical plants before their introduction into the United States.

INTRODUCTIONS BY MEYER

One of America's outstanding plant explorers, Frank N. Meyer, made four trips to Asia over a period of twelve years, and sent back more than twenty-five hundred introductions. He was first sent to Asia in 1905 by the Office of Seed and Plant Introduction with instructions to secure plants of unusual vigor and hardiness. Meyer's first shipment contained varieties of the English walnut, the Chinese pistache, wild and cultivated apricots, wild peaches, hardy apples, Chinese grapes, and edible-fruited hawthorn, ornamental and shade trees, millets, field beans, and lawn sedge.

Two years later, Meyer sent more than a thousand seed and plant specimens from China, Siberia, and Manchuria.[1] In 1908, he shipped seedless Chinese persimmons, new spruces, elms, and pines. He returned to the United States with a wealth of information on dry-land farming, Chinese agriculture, forestry, and market gardening.

Meyer began his second tour of Asia in 1909 through the semidesert areas in the Crimea, the Caucasus, Bokhara, and the Chinese Turkestan. He sent varieties of the *Chinese lychee* to the United States about the same time that other varieties of this fruit were being secured from Java and the Philippines. By 1910, he had made promising discoveries of wild almonds, "Afghasian" apples, varieties of pears, *Erivan alfalfa,* cold-resistant Crimean olives, a good collection of table grapes, a drouth-resistant apple, a collection of edible, sweet-kernelled apricots, a collection of winter wheats from southern Russia, and many soil binding plants.

Meyer secured many different varieties of the *Chinese jujube* and citrus fruits. In 1913, he found chestnut trees which were resistant to the bark disease then attacking chestnut trees in the United States. Other trees Meyer obtained were the *Chinese early cherry* which came to be grown commercially in California;

[1] Of these, the Department was particularly interested in the northern Manchurian apples, blackberries and currants from Korea, twenty-four named pears of North China, bush cherries, plums and peaches from northern Siberia, drouth-resistant alfalfas, dry-land rices, and many ornamentals.

a Chinese poplar, and the *Chinese elm* which is now widely planted in the Great Plains and New England Areas.

The spinach industry of Virginia was saved from extinction by a disease-resistant variety brought back by Meyer, from which the *Virginia Savoy* was developed. Chinese cabbage (celery cabbage) and several kinds of bamboos also were considered as significant introductions.

On his last trip to China in 1918, Meyer disappeared from the deck of a steamer plying the Yangtze River. There is some indication that he may have committed suicide, for his letters reveal that the mental and physical hardships of his lonely existence may have broken his will to live. His last important "introduction," found in his luggage after his death, came to be one of the best-known lawn grasses in Florida—the *Centipede Grass.* In a will made before leaving Washington, Meyer had provided a thousand dollars for the staff of the Office of Plant Introduction, but the money was dedicated in honor of his memory for what became the Meyer Medal for meritorious work in plant introduction.

WORK OF BURBANK

Luther Burbank did much to awaken interest in the commercial possibilities of new plant forms through his many valuable plant "creations." The wide publicity his work received may be accounted for by the fact that his attitude towards plant breeding was as much commercial as scientific. He not only tested plants introduced by the Department of Agriculture, but also imported many varieties himself. However, he often failed to keep adequate scientific records of the elements that entered into his selections. In at least one instance, he claimed to have created a plant, the spineless cactus, which actually had been sent in by David Fairchild years before in introductions from South America and the Mediterranean region. He did add, however, an amazing number of new, superior varieties of stone fruits and other economic and ornamental plants to American agriculture.

INTRODUCTION BECOMES LESS IMPORTANT

When William A. Taylor succeeded Galloway in 1913, the Bureau's emphasis on plant introduction was superseded by work

on hybridization and selection. Disease control and cultivation methods became the main concerns of the Bureau. An appropriation of $100,000 was given the Bureau in 1915 for an annual broadcast of new field seeds. This work was distinct from the Congressional seed distributions, and did not include seeds of new foreign plants.

During the 1920's, the shift in interest from introduction to breeding as a means of improving crops became more pronounced. Plant introduction was no longer the most important service rendered by the Department of Agriculture as new breeding materials—genes—for barley, alfalfa, sugar cane, and Irish potatoes were sought. The Department looked for new, noncompetitive crops, and varieties resistant to disease, insects, and climatic conditions. Plant explorers searched for grasses and browse plants for range control as well as insecticide plants to replace the lead and arsenic compounds which were becoming less effective.

A further departure in the original objectives of the Department of Agriculture occurred in 1934 when the Bureau of Plant Industry became interested in ornamentals as such. In the past, introductions of ornamentals had been made in conjunction with some recognized economic function of the plant. The Department entered a new field of research in 1937 when a Vegetable Breeding Laboratory was established near Charleston, South Carolina.

DISTRIBUTION METHODS

Plant introduction gardens and field stations followed the practice of distributing materials in areas where they were likely to succeed. For example, the introduction garden at Brownsville assisted the citrus industry in that region. In 1909 the Chico gardens distributed more than five thousand plants—among which were the wild Chinese peach, the dry-land elm, a new Chinese poplar, edible hawthorns, and a Chinese jujube—all sent there by the plant explorer, Meyer. The Office of Seed and Plant Introduction was responsible for the distribution of over forty thousand "special rare foreign plants" in 1912. An appropriation in 1913 promoted the wider dissemination of alfalfa, clover, cowpeas, grasses, lespedeza, millet, soybeans, velvet beans, and cotton. Large appropriations for this work continued up to 1928.

Frank N. Meyer, agricultural explorer, brought more than twenty-five hundred plant varieties to America from China. (From *The World Was My Garden* by David Fairchild, Chas. Scribner's Sons).

In 1927, an unusually active year, approximately 370,000 plants, seeds, cuttings, roots, and bulbs were distributed to domestic experimenters, and about 7,000 were sent to foreign collaborators and others.

The general distribution of free seed by Congress, which included many imported seeds and bulbs, was discontinued in 1923. Seed distribution for serious experimental purposes was continued, however, under the control of the Department. This work spread many cotton, tobacco, and forage crop varieties into suitable, local regions. Congress doubled the appropriation of $20,000 for plant introduction work in 1905, and the allotment grew in succeeding years until it reached $182,300 in 1928.

SIGNIFICANT INTRODUCTIONS, 1901–13

The work of the Division of Plant Exploration and Introduction has encompassed a study of thousands of plants of possible economic value. Some individuals, unduly impressed by the special qualities of certain plants, have promoted them against the tide of popular taste. However, their efforts can be defended on the grounds that profitable and practical new crops may be developed by such experimentation.

WHEATS

The spectacular success of Carleton's wheat introductions from Russia proclaimed the value of searching for new varieties of wheat. Although many wheat introductions were made, no new wheats proved as highly successful as the *Kubanka* and *Kharkov* varieties. By 1903 the value of the durum wheats had been recognized, but further introductions of macaroni wheats were made, including two special lots—one a rust-resistant variety from Bombay, and the other the *Saragolla* from Italy. A drouth-resistant wild wheat found in Palestine aroused so much interest that an explorer was commissioned to procure seed for breeding. A hardy wild wheat found by Aaron Aaronsohn on the dry mountain slopes of Palestine created a flurry of excitement from 1910 to 1914 but did not prove as valuable as expected.

The famous *Marquis* was rapidly adopted in 1913 and 1914 from seed imported from Canada. This hard red spring wheat descended from a cross made by A. P. and William Saunders was the most extensively grown spring wheat from 1919 to 1935.

Three important varieties of Australian wheat adapted to the United States were brought in between 1914 and 1916. The *Florence,* obtained in 1914, and distributed to experiment stations in the western states, was grown on 150,000 acres in 1939, but its greatest contribution was as a parent of several new varieties. (1) The *Federation,* a spring wheat produced by the famous Australian wheat breeder, William Farrer, and brought to the United States in 1914, showed promise as early as 1916 at the Sherman Branch Experiment Station in Oregon. By 1944, 694,000 acres of Federation were grown in the West. The *White Federation* from Victoria in 1916 was first grown at the Sherman Branch Experiment Station. Because of its high yields, seed were grown in 1918 at Chico for distribution. By 1944, 244,000 acres of the White Federation were being grown, and several lesser varieties imported at the same time are still cultivated.

BARLEY

About 1900 the Department of Agriculture began a search for pure strains of barleys suited to the exact and elusive requirements of the brewing industry. American barleys were badly mixed and too nitrogenous and were not starchy enough for brewing. Two-rowed barleys were secured from Europe in 1901, as well as the *European Chevalier barley* and the *Beldi* from Algeria. *Club Mariot* from Egypt and the *Hancheen* from Sweden were brought in two years later. These last four varieties were planted to a combined 500,000 acres in 1927. Two thousand pounds of the *Hanna barley,* a famous pedigreed variety from Moravia, were obtained in 1904.

In 1905 the *Trebi barley* from Trebizond, Turkey, came to the Bureau of Entomology in a bulk lot of seed ordered through the Office of Seed and Plant Introduction. Trebi was widely grown in 1945 in the Northwest from a selection made by Harlan in 1909 in cooperative breeding work with the Minnesota Agricultural Experiment Station. On an exploring trip in 1923, Harlan secured thirty lots of barley in India, nineteen in Spain, Tunis, and Algeria, thirty-two in Egypt, and thirty-three in Abyssinia.

RICE

Other rices were obtained after Knapp's successful importations of the Japanese Kiushu. Forty-one varieties, mostly from

China and Japan, were tested in Florida in 1903. They produced thirty thousand pounds of seed for distribution. Wild rice from the Sudan, the 100-day rices from Japan, and eleven varieties from India—a total of forty-six new varieties—were introduced for other tests in 1907. *Patna* types of rice for soup making, brought from British India and Burma for tests in 1931, proved too slow maturing for the United States. The plants were killed by frost while in bloom.

SORGHUMS

When growers became convinced that they could not successfully refine sugar from the sorghums, they began experimenting with the plants for use as grain and forage crops for the West. *Feterita, hegari,* and *Sudan grass,* all from Africa, became valuable additions to the other grain and grass sorghums. After the first seed of feterita received in 1901 failed to secure any results, a second introduction was made for the Office of Forage Crops in November, 1906, from V. F. Naggiar, a merchant of Alexandria, Egypt. Seed from this lot, grown in 1907 at the Chillicothe (Texas) Experiment Station, spread the crop throughout the Southwest. Ten years later the annual value of the crop was estimated at $16 million.

Hegari, another important grain sorghum from the Sudan, was received from Khartoum in March, 1908, and planted that spring at Chillicothe. From these seed A. B. Connor of the Texas Agricultural Experiment Station made a selection in 1910 which was the forerunner of practically all the hegari grown in the United States. In the spring of 1916 the Bureau of Plant Industry distributed 17,000 pounds of seed.

Sudan grass arrived in the spring of 1909 from R. Hewison, Director of Agriculture and Land, for the Anglo-Egyptian Government at Khartoum. It came to the United States as the result of a search instituted through the Office of Seed and Plant Introduction by C. V. Piper, agrostologist. Seeds of many related forms intermediate between Johnson grass and sorghum were received, but only two—Sudan and Tunis grasses—proved of value. Sudan grass gained recognition immediately as a dryland hay crop for the South and Southwest. Within six years enough of it was being grown to meet all demands for seed. Sudan grass is now a familiar hay and grazing crop worth millons of dollars annually and is grown over almost the entire nation.

Tunis grass, received in 1909 from Dr. L. Trabut of Algiers, aroused some attention in the Department of Agriculture. Hundreds of sorghum introductions were made during the first two decades of the twentieth century. They came from Africa, India, China, and Australia for testing, breeding, and selection at a time when the vast ranch lands were giving way to farms and more intensive livestock raising in the Great Plains. The sorghums were indispensable in this transformation of the West.

NEW FORAGE PLANTS

An intensive search for varieties of alfalfa began with the organization of the Section of Seed and Plant Introduction and continued for over a decade. Hundreds of alfalfas were tried, and several unusual and distinctly valuable varieties such as the *Peruvian alfalfa* were discovered. Alfalfa exploration in Turkestan in 1901 discovered types with great resistance to cold and drouth.

Ernest A. Bessey explored in the Turkestan and adjacent regions in 1903 to find alfalfas, cereals, and fruits for the Northwest. He shipped the Department 5,000 pounds of four types of alfalfa adapted to extremes of cold, heat, and alkali. Contracts were made with growers to harvest seed for the Department. In 1903 two other explorers searched Algeria and Egypt for alkali-resistant plants, especially alfalfas.

Niels Ebbesen Hansen, commissioned by the Department in 1906 to explore in Russia, found the yellow-flowered *Siberian alfalfa.* That same year, a new, distinctive *Arabian alfalfa*—not hardy, but suited for the irrigated lands of the Southwest—was brought to public attention. Hansen returned to Siberia in 1908 and secured more seed and different types of the yellow-flowered alfalfa and other forage plants. Of more than six hundred varieties of alfalfa tested in 1927, the Peruvian proved the most valuable.

The *berseem clover,* now grown to some extent in the Southeast, was brought from Egypt by Lathrop and Fairchild for use as a soil reclaimer and enricher. On a visit in 1903 to the estate of Cecil Rhodes near Capetown, Lathrop and Fairchild also obtained seed of *Rhodes grass,* a valuable hay crop. Fifteen distinct varieties of velvet beans, most of them from Asia, had been planted in Florida by 1909. One of these, the *Lyon bean,*

very productive of seed pods, already was being grown throughout Florida.

Korean lespedeza, introduced in 1919 and again in 1921, proved useful in the South and Northeast because it was able to withstand unfavorable growing conditions. Its planting had been extended to 5 million acres by 1935. H. L. Westover explored through southwest Asia in 1929. Again the following year, with K. A. Ryerson, he searched North Africa and Spain for varieties of alfalfa resistant to bacterial wilt. This disease had appeared in the Midwest about 1926 and crop losses in many cases reached 25 per cent. In 1934, Westover also toured Russian Turkestan, Persia, and Afghanistan with C. R. Enlow, searching for plants that would prevent soil-erosion in the Great Plains. They returned with eighteen hundred lots of seeds from drouth-resistant plants, some of which, it was hoped, would yield suitable plant covers for wind-blown topsoil.

The expedition to Central Asia secured grasses and legumes from areas bordering the Gobi desert in 1935. More than a thousand grasses and forage items for soil control were collected by the Division of Foreign Plant Introduction in 1936, and the following year a similar collection was made.

COTTON

Various lots of seed of Egyptian cotton were secured prior to 1900, but selections from seed of the *Mit Afifi* procured by Fairchild about 1901 were the basis of successful Egyptian cotton production in Arizona. Alkali-resistant cottons and other types were secured at the same time in Egypt and Algeria to promote long-staple production in the United States. The Department hoped to extend cotton cultivation into alkali lands and produce the long-staple cotton which was being imported to the extent of $15 million annually. For several years growers were disappointed with Egyptian cotton due to its rank growth and other undesirable changes caused by the transfer from its original home. However, efforts at adaptation by selection brought a yield of two bales per acre in Arizona in 1908. Three superior varieties discovered were the *Egyptian, Durango,* and *Acala.* By 1913, 3,500 acres were being grown, and the value of the crop in 1920 was $20 million.

In 1905, Peruvian and East Indian varieties were being tried

to find cotton that could resist the boll-weevil attacks. The weevil was seriously reducing yields and destroying some crops completely as it spread from Mexico into the cotton South. Growers soon found that the weevil-resistant varieties from Mexico and Central America possessed other valuable characteristics such as long-staple lint and large bolls. From these varieties growers developed the Durango which extended the northern limits of cotton production in both Virginia and Texas. In California it was planted to 30,000 acres in 1914. The Acala, an upland cotton brought from Southern Mexico in 1906, also had shown many points of superiority by 1914. It entered into commercial production in 1916, and by 1924 had become widely acclaimed for its earliness, large bolls, and strong fiber. This had become the predominant crop in the irrigated valleys of the Southwest and the Imperial Valley in California by 1928, and its annual value exceeded $50 mllion.

TROPICAL PLANTS

Dates—Large collections of dates continued to be made in the search for varieties to extend the crop into other parts of the Southwest. In 1901 the best Egyptian varieties were procured. Lathrop sent in a large shipment of young date plants in 1902, and the Department of Agriculture had an eleven-acre cooperative orchard established in Arizona and planted to 580 imported trees. The first successful crop of the *Deglet Noor,* a widely marketed sort, was produced in 1904 in this cooperative garden with the help of the California Agricultural Experiment Station.

Thomas H. Kearney procured many valuable varieties in Tunis in 1905. At the same time, he spent several months investigating olives and discovered the *Barouni,* now a successful olive in California. In the same year, H. A. Rankin, an Englishman in Egypt, was commissioned to secure superior date varieties from Fayum, Egypt. The Rev. S. M. Zwemer, a writer on Arabia, made a journey into the oases of that country for other varieties.

The date garden at Tempe, Arizona, established in 1900, had 143 varieties in 1912, and other experiments were being conducted in cooperation with private growers in California, Arizona, and Texas. Further date importations from Egypt were made in 1912 in the form of offshoots. The policy established in 1921 stressed the importation of proven Old World dates to extend the industry and replace poor varieties. Galloway esti-

mated the value of the expanding date industry in 1928 at $500,000. From these studies, more scientific information on the date accumulated in the Southwest than in all the date growing regions of the Old World combined.

The acquisition by the United States of tropical island colonies after the Spanish-American War provided climates suited to the production of crops that had been suggested for Florida. Experiment stations were set up in the colonies to determine what varieties of coffee, cacao, bananas, avocadoes, fiber plants, and rubber plants were most desirable, before introducing these plants into the United States.

Mangoes—After a tree of the East Indian mulgoba mango survived a severe freeze in Florida in 1895, the Bureau of Plant Industry sought other mangoes with resistance to frost. Fifty of the best varieties from India also were procured in 1903 to satisfy a mango enthusiasm among growers in the South. The Department had the largest mango collection in the western hemisphere in 1905 with more than a hundred varieties. Collections were sent to Florida, Puerto Rico, and Hawaii for fruiting trials. Fiberless East Indian mangoes had fruited in Florida by 1909. Mangoes were looked upon as a coming crop in the South and there was a great demand for grafted varieties. Florida mangoes are now marketed to a limited extent at high prices.

Avocadoes—Hundreds of introductions of avocadoes were made in early efforts to establish them in California and Florida. After Guatemalan varieties introduced in 1914 had been propagated for distribution, the plant's value became recognized. The most important contribution to this crop was the collection of twenty-three varieties sent from Guatemala by Wilson Popenoe in 1916. After distribution of these, many avocadoes came into commercial production. A search for cold-resistant varieties brought more valuable plants from Ecuador and Mexico in 1922.

The *mangosteen,* a tropical fruit promoted by Fairchild after he had been attracted by it in the East Indies, failed to prosper for lack of a good root system. To increase its chances of success, a related plant was found in 1909 for use as a rootstock. Pineapple plants were secured in 1903 from Natal, South Africa, to improve this established crop.

Cassavas and *dasheens* were considered desirable for their fleshy, edible rootstocks. P. H. Rolfs, an agent of the Depart-

ment sent to Jamaica in 1903, purchased a collection of cassavas there including many varieties high in starch content. These were tested and grown for use as stock feed. Many new tropical yams and dasheens were introduced in 1920. The Department made 1,600 distributions of dasheens in the South that same year. They were considered as a possible cheap substitute for potatoes, and with promotion by the Department are still grown to some extent in the southern states.

Bamboo—The many uses of bamboos in the Far East suggested to the explorers, especially Fairchild, that these might be grown in the southern and western United States. An agent in Japan in 1908 returned several thousand plants, including types grown for edible shoots. Of 3,000 bamboo plants of hardy timber kinds imported in 1909, a large number were planted at the Chico Introduction Garden in California. Successful growths in 1916 showed that United States growers could produce canes comparable to those grown in the Far East. In these tests a ten-acre planting of bamboos was made at Brooksville, Florida, and a smaller planting made at Avery Island, Louisiana. In 1919 two more edible types were secured for experiment.

Investigations in the production of rubber in the United States have been concentrated on the use of native wild plants, but in 1927 two kinds of African rubber-producing trees and two ornamental rubber-producing vines from Madagascar were planted in Florida for trial.

MISCELLANEOUS INTRODUCTIONS

Thousands of fruit introductions suitable to temperate and northerly climates have been made by the Office of Seed and Plant Introduction. Only a few specific collections can be named, but many of the items brought in for use by breeders and experimenters contributed desirable qualities to the familiar fruits. The prune industry in the Pacific Northwest is indebted to an agent sent to France whose studies of the prune industry there led to the importation of several worthy varieties. Peaches, apricots, and cherries were secured from Mexico in 1903 by Onderdonk.

Over a hundred varieties of French phylloxera-resistant grapevines were secured in 1904 for trial in the infected vineyards of California, and a number of resistant South African grapevines were sent in by Lathrop. In 1904 two hundred hardy *Vladimir*

Sib pollination of a squash flower. One of the methods used at the Regional Primary Introduction Stations to prevent cross-fertilization of the various species. Taken at the Ames, Iowa, station.

cherry trees were brought from Russia for the Northwest, and an entirely new fruit-producing vine, the *yang-taw* from central China, was presented to the Department by Consul Wilcox of Hankow. About two hundred peach varieties with unusual cold resistance were received from the Caucasus in 1944.

The *Jordan Almond* was successfully introduced in 1903 in California. Although almond crops of several million pounds were then being produced in California, the quality was so inferior to the Jordan of Spain that large quantities of nuts were imported annually. In 1906, 6,000 trees of the *pistache,* a green-fleshed nut used in coloring and flavoring confections, were sent to experimenters, and new varieties from the Turkestan and North China were introduced. Hardy wild stocks were being secured and studied for use as rootstocks at the same time, and Kearney secured the best almonds from Italy. Later Meyer was to find many types in Asia, but progress has been slow for this crop in America.

Potatoes—L. R. Jones, an explorer commissioned to go to Europe in 1905, collected ninety potato varieties on the Continent. In the same year, four varieties from the higher altitudes of Ecuador were sent to the United States by the Minister of Commerce and Agriculture of Ecuador, and an Uruguayan variety also was brought in. The Department received seventy-two varieties from Chile in 1909 to be used in breeding blight-resistance and potatoes for dry-land farming. Explorations in the Andes of Peru and Bolivia in 1913 secured over 250 sorts of wild and cultivated potatoes and proved this region to be the native home of the Irish potato. Four explorers, Donald Reddick, C. O. Erlanson, Paul Russell, and M. J. Souviron, searching for wild and cultivated potatoes in 1930 in Mexico, made collections for breeding resistance to blight and cold. Corn from Central America secured for acclimitization in 1906 behaved very erratically in the new, northerly environment.

Matting—Agriculturists were concerned at the turn of the century with the fact that $4 million worth of matting materials had to be imported yearly because there was no competitive native crop. Growers in South Carolina wanted a substitute crop for their rice fields which could no longer compete with the rice fields in Texas and Louisiana. The Department of Agriculture sent John H. Tull to Japan in 1906 to study the industry and secure plants. Attempts to introduce rushes two years earlier

had not been successful. Tull encountered opposition from the Japanese matting industry similar to that experienced by other explorers—the communities feared they might be deprived of a market for their commodity if they permitted plants to leave the country.

However, the final abandonment of the matting industry in America was not due to the difficulty in securing plants, but the economic aspects of its cultivation. Upon Tull's return, the Japanese rushes were distributed and a machine invented for mat-weaving. Many other varieties of rushes and reeds also were collected in Asia. Agriculturists hoped these crops might utilize abandoned rice fields, cheap swampy lands, and parts of the Mississippi delta. Although large collections of the plants had been established by 1908, the problem of securing enough cheap labor brought the work to a standstill, and attempts to promote a matting industry were abandoned the following year.

Experiments in the use of reeds for lathing in building construction were abandoned due to the cost of preparation and other findings of the experiments. The mitsumata paper plant, from which a very superior quality of paper was manufactured in Japan, was used in experiments, but failed to win notice after a few years.

Work over a period of many years by the Bureau of Plant Industry has resulted in a thriving bulb industry in the state of Washington. Introductions of quantities of bulbs for breeding from Bermuda, Japan, and other countries contributed to this success.

The Bureau also assisted tobacco cultivation by making introductions until varieties were found which would meet the exacting requirements of that industry. In 1901 Cuban and Sumatran varieties were introduced. Other varieties from Cuba were secured in 1904 for use as wrapper-leaf tobaccos, and in 1936, 655 tobacco items were imported for breeding purposes.

SOYBEANS

Soybeans from Asia are probably the most outstanding plant introductions since the Kharkov and durum wheats. Economic products of the soybean plant, now a major field crop, include hay, forage, food and feed products, and oil for many industrial uses. Recent introductions of the soybean have been merged

by breeding, into new, superior plants with little resemblance of the original.

Interest in the soybean as a commercial crop began with the introduction of three varieties from Japan in 1900. Nearly three hundred varieties were obtained in China, Japan, and India in 1909. The Department recommended soybeans as a crop that could be substituted for cotton in the South.

In 1910, twenty soybeans from a group of 350 under test were selected for wide distribution. Three hundred varieties received from Korea and northern Manchuria in 1914 were expected to extend soybean cultivation northward in America. An increased acreage was planted in 1916 for oil production and stock feed. Four years later there was a rapid expansion in the cultivation of eight selections made by the Department from over a thousand varieties collected up to that time.

Further selection progressed as soybean acreage was expanded. The distribution of soybeans was a prominent feature of field crop seed distribution after 1914. Estimated value of the crop of 2,500,000 acres in 1924 was $23,917,500. Because of its contributions to the new industry, the Bureau of Plant Industry claimed credit for half this value. Ryerson, in 1933, stated that all but three of the twenty varieties of soybeans then in cultivation were found by the Office of Plant Introduction.

When it became clear that the soybean would be a major crop, the Department decided to send two explorers to search the soybean areas of Japan, Sakhalin, Manchuria, Korea, and China to make sure our farmers would have the best varieties. After two years of work, P. H. Dorsett, of the Division of Plant Exploration and Introduction, and W. J. Morse, of the Division of Forage Crops and Diseases, returned with almost three thousand varieties.

The expedition also collected seeds of mung beans, lespedeza, alfalfas, barleys, wheats, grasses, and other agricultural plants. More soybean varieties were obtained, especially from Manchuria, in order to extend their cultivation to new areas. The acreage in soybeans continued to increase to meet the demands for the crop as food and feed, and for industry in the manufacture of paint, varnish, and glue.

Tung trees, identical with the varnish trees referred to by early plant explorers, were fruiting in 1910 from introductions

made by the Bureau of Plant Industry. Subsequently, small test plantings were made in the South. The crop was publicized widely as one that could be grown on poor lands. While the crop has not been grown on a large scale in this country because of the winter-killing, its production serves as a stimulus to the Chinese growers to export a good quality of unadulterated oil.

SUGAR CANE

The importance of a continuing supply of fresh sugar cane stocks has not diminished since Charles Mason first secured the assistance of the Navy in procuring East Indian varieties. Mosaic disease, a great enemy of Louisiana cane growers, has necessitated the breeding of new, resistant types. Javanese varieties restored the industry in Louisiana in the 1920's. But explorers in 1928 had to secure further cuttings for breeding stocks. Over a hundred varieties were found in New Guinea and Papua. In 1935 the Department claimed that the introduction of the mosaic-resistant varieties had maintained the sugar industry of Louisiana at an annual value of $20 million, and had saved investments of $100 million. New threats of mosaic among the resistant varieties developed in 1935, indicating that further work had to be done.

Beans were imported from Mexico in 1903 and again in 1945 from Chile, Columbia, Peru, and Mexico to supplement a breeding program. The spineless cacti of Tunis were brought to America in 1905 to test their utility as a feed crop. Thousands of plants of the Japanese blanched salad vegetable udo, similar to asparagus, were distributed about the same time. Hemp seed from Manchuria and China was tried in Kentucky, Nebraska, and California.

America began exchanging large numbers of plants with Latin American countries during the 1930's, and continued the practice during World War II when plant imports from other lands were shut off. As an example, cultivation of the *Derris elliptica*—the roots of which constitute a source of rotenone—has been extended by distribution of over 2 million cuttings to Latin American countries.

THE WAR YEARS

When the Japanese invasion spread over plantations of vital tropical crops in 1942, the Bureau adopted a new program of self-sufficiency in the Americas. From seed flown in from the

Philippines, several million young cinchona trees were raised at Glenn Dale, Maryland, and later flown to Latin America. Thus the cinchona returned to the western hemisphere. It had been discovered in 1852 in Peru by the Dutch botanist Hasskarl and sent to tropical Asia for cultivation.

The abaca, a banana-like Manila fiber plant, was planted in the Americas on a commercial scale for the first time during World War II. Corn strains came from Argentina, oat species from Uruguay, and a number of grasses, legumes, and varieties of opium poppy came from below the equator.

Dissemination of new plants was effected through field stations and by correspondence with individuals as well as by special agreements with experiment stations, superintendents of city parks, and private experimenters. Plant quarantines were tightened, and laboratory facilities increased to handle specimens.

Facilities for receiving introductions in 1944 consisted of the original stations at Glenn Dale, Maryland, the station at Savannah, Georgia, devoted to oriental crops including bamboos and chestnuts, and another at Coconut Grove, Florida. The Florida station has one of the largest permanent collections of living subtropical and tropical species and varieties in the western hemisphere. A fourth station at Chico, California, maintains collections of deciduous fruits, and such trees and shrubs as prefer the warm-arid climate of the west coast.

INVENTORY OF INTRODUCTIONS

In recent years, between three and four thousand items have been inventoried annually by the Office of Seed and Plant Introduction. Approximately 180,000 introductions have been recorded since the establishment of the Office. Table 8 shows an estimate made by Galloway in 1928 of the number of varieties of fruit crops inventoried by the Office.

The Department of Agriculture also maintains a large collection of important crop seeds to meet the demands for breeding materials. In 1945 this collection included 8,500 strains or varieties of wheat, 4,000 of barley, 1,000 rice, 400 flax, and sorghum and corn about 300 each.

The Research and Marketing Act of 1946 represented a significant development in plant work. It provided funds for a federal-state cooperative program of exploration, introduction, and test-

ing of plant materials for both crop and industrial uses, as well as the cataloging of present genetic stocks, and the preservation of basic germ-plasm for future breeding programs.

Regional activities have been centralized around four primary introduction stations at Pullman, Washington for the Western Region; Ames, Iowa, for the North-Central Region; Glenn Dale, Maryland, for the Northeastern Region; and Experiment, Georgia, for the Southern Region.

Foreign seeds received by the Division of Plant Exploration and Introduction are sent to these primary introduction stations for repropagation and distribution to state experiment stations. The growing plants are given a preliminary check for growth and disease factors at the primary stations, but detailed evalua-

TABLE 8

FRUIT CROP VARIETIES INTRODUCED BY OFFICE OF SEED AND PLANT INTRODUCTION

Crop	No. of Varieties Introduced
Apples	600
Avocadoes	353
Blackberries	100
Jujubes	225
Mangoes	498
Nectarines	50
Peaches	500
Pears	700
Oriental persimmons	600
Plums	450

Based upon an estimate made in 1928 by B. T. Galloway, Department pathologist.

tion of the plants and work on breeding programs is left to the experiment stations.

To insure the passing on of the "pure" strains as they are received, the primary introduction stations frequently resort to hand pollination of certain species that would otherwise cross freely by insects or windborne pollen. (See Fig. 3). In hand pollination it is necessary to keep both the male and female flowers covered to insure the desired parentage.

Where it is impractical either to isolate or hand pollinate large numbers of normally insect or wind-pollinated species, the plants are increased by vegetative cuttings. For growing areas

other than those directly served by the primary stations, secondary regional introduction stations have been planned. At these secondary stations, crops which have shown themselves adaptable to that area will be grown. This will relieve the primary stations of part of their repropagating burden and place the plants where they can thrive best.

Under the provisions of the Research and Marketing Act, five exploring expeditions were sent into the field between 1946 and 1948. Disease-resistant potatoes were secured from Mexico by D. S. Correll. Varieties of Mexican and Guatemalan cotton were found which have plant and fiber characteristics that may prove helpful in improving American upland cotton. Forage plants and wild and cultivated strains of peanuts came from South America. J. R. Harlan went to Turkey to find vegetables, forage plants, oil plants, and cereals for a domestic breeding program. In 1949, W. N. Kelz, was searching India for cereals for winter forage and plants with potential industrial uses. From these expeditions more than 4,500 introductions had been obtained and distributed to thirty-eight states by 1948.

LOOKING TO THE FUTURE

It seems certain that plant research and introductions of the future not only will contribute new food crops, but will aid as well the progress of mechanical and chemical technology. Often when experimenters develop disease-resistant plant varieties, the disease organisms in turn adjust themselves by developing new virulent strains. Redesigning plants with the desirable characteristics of many species fused into a single new variety offers a limitless challenge to plant workers. Like the introductions of Colonial days, the plants of tomorrow become America's crop heritage for future generations.

Appendix

SECTION I

TREASURY DEPARTMENT CIRCULAR REGARDING PLANT INTRODUCTION, SEPTEMBER 6, 1827

"The President is desirous of causing to be introduced into the United States all such trees and plants from other countries, not heretofore known in the United States, as may give promise, under proper cultivation, of flourishing and becoming useful, as well as superior varieties of such as are already cultivated here. To this end I have his directions to address myself to you, invoking your aid to give effect to the plan that he has in view. Forest trees useful for timber; grain of any description; fruit trees; vegetables for the table; esculent roots; and, in short, plants of whatever nature, whether useful as food for man or the domestic animals, or for purposes connected with manufactures or any of the useful arts, fall within the scope of the plan proposed. A specification of some of them, to be had in the country where you reside, and believed to fall under one or other of the above heads, is given at the foot of this letter, as samples merely, it not being intended to exclude others, of which you may yourself have knowledge, or be able on inquiry to obtain knowledge. With any that you may have it in your power to send, it will be desirable to send such notices of their cultivation and natural history as may be attainable in the country to which they are indigenous; and the following questions are amongst those that will indicate the particulars concerning which information may be sought:

1. The latitude and soil in which the plant most flourishes.
2. What are the seasons of its bloom and maturity, and what the term of its duration?
3. In what manner is it propagated? by roots, seeds, buds, grafts, layers, or how? and how cultivated? and are there any unusual circumstances attending its cultivation?
4. Is it affected by frost, in countries where frost prevails?
5. The native or popular name of the plant, and (where known) its botanical name and character.
6. The elevation of the place of its growth above the level of the sea.
7. Is there in the agricultural literature of the country, any special treatise or dissertation upon its culture? If so, let it be stated.
8. Is there any insect particularly habituated to it?

9. Lastly—its use, whether for food, medicine, or the arts.

In removing seeds or plants from remote places across the ocean, or otherwise, great care is often necessary to be observed in the manner of putting them up and covering them. To aid your efforts in this respect, upon the present occasion, a paper of directions has been prepared, and is herewith transmitted.

"The President will hope for your attention to the objects of this communication as far as circumstances will allow; and it is not doubted but that your own public feelings will impart to your endeavours under it, a zeal proportioned to the beneficial results to which the communication looks. It is proper to add, that no expense can at present be authorized in relation to it. It is possible, however, that Congress may not be indisposed to provide a small fund for it. The seeds, plants, cuttings, or whatever other germinating substance you may transmit, must be addressed to the Treasury Department, and sent to the collector of the port to which the vessel conveying them is destined, or where she may arrive, accompanied by a letter of advice to the Department. The Secretary of the Navy has instructed the commanders of such of the public vessels of the United States as may ever touch at your port, to lend you their assistance towards giving effect to the objects of this communication; as you will perceive by the copy of his letter of instructions, which is herewith enclosed for your information. It is believed also that the masters of the merchant vessels of the United States will generally be willing—such is their well known public spirit—to lend their gratuitous co-operation towards effecting the objects proposed. I remain, respectfully, your most obedient servant."

RICHARD RUSH

From the *American Farmer,* IX, (November 30, 1827), 292–93.

SECTION II

DIRECTIONS FOR PUTTING UP AND TRANSMITTING SEEDS AND PLANTS, ACCOMPANYING THE LETTER OF THE SECRETARY OF THE TREASURY OF SEPTEMBER 6, 1827

"With a view to the transmission of seeds from distant countries, the first object of care is to obtain seeds that are fully ripe, and in a sound and healthy state. To this the strictest attention should be paid; otherwise, all the care and trouble that may be bestowed on them, will have been wasted on objects utterly useless.

"Those seeds that are not dry when gathered, should be rendered so by exposure to the air in the shade.

"When dry, the seeds should be put into paper bags. Common brown paper has been found to answer well for making such bags. But, as the mode of manufacturing that paper varies in different countries, the precaution should be used of putting a portion of the seeds in other kinds of paper. Those that most effectually exclude air and moisture are believed to be the best for that purpose. It would be proper, also, to enclose some of the seeds in paper or cloth that has been steeped in melted bees' wax. It has been recommended that seeds collected in a moist country, or season, be packed in charcoal.

"After being put up according to any of these modes, the seeds should be enclosed in a box; which should be covered with pitch to protect them from damp, insects and mice. During the voyage they should be kept in a cool, airy and dry situation; not in the hold of the ship.

"The oily seeds soonest lose their germinating faculty. They should be put in a box with sandy earth in the following manner: first, about two inches of earth at the bottom; into this the seeds should be placed at distances proportionate to their size; on these another layer of seeds; and so on with alternate layers of earth and seeds, until the box is filled within about a foot of the top, which space should be filled with sand, taking care that the earth and sand be well put in, that the seeds may not get out of place. The box should then be covered with a close net work of cord, well pitched, or with split hoops or laths, also pitched, so as to admit the air without exposing the contents of the box to be disturbed by mice or accident. The seeds thus put up will germinate during their passage, and will be in a state to be planted immediately on their arrival.

"Although some seeds, with a hard shell, such as nuts, peaches, plums, &c. do not come up until a long time after they are sown, it would be proper, when the kernel is oily, to follow the method just pointed out, that they may not turn rancid on the passage. This precaution is also useful for the family of laurels, (*laurinae,*) and that of myrtles, (*myrti,*) especially when they have to cross the equatorial seas.

"To guard against the casualties to which seeds in a germinating state may be exposed during a long voyage, and, as another means of insuring the success of seeds of the kinds here recommended to be put into boxes with earth, it would be well also to enclose some of them (each seed separately,) in a coat of bee's wax, and afterwards pack them in a box covered with pitch.

"In many cases it will be necessary to transmit roots. Where roots are to be transmitted, fibrous roots should be dealt with in the manner herein recommended for young plants. Bulbous and tuberous roots should be put into boxes in the same manner as has already been recommended for oleaginous seeds; except, that, instead of earth, dry sand, as free as possible from earthy particles, should be used. Some of the bulbous and tuberous roots, instead of being packed in sand, may be wrapped in paper, and put in boxes covered with net work or laths. Roots should not be put in the same box with seeds.

"Where the seeds of plants cannot be successfully transmitted, they may be sown in boxes, and sent in a vegetating state. Where more than one kind is sown in the same box, they should be kept distinct by laths, fastened in it crosswise on a level with the surface of the ground in which they were sown: and when different soils are required, it will be necessary to make separate compartments, in the box. In either case they should be properly marked, and referred to in descriptive notes which accompany them.

"When plants cannot be propagated from seeds with a certainty of their possessing the same qualities which long culture or other causes may have given them, they may be sent in a growing state. For this purpose, they should be taken up when young. Those, however, who are acquainted with their cultivation in the countries where they grow, will know at what age they may be safely and advantageously removed. They may be transplanted direct into the boxes in which they are to be conveyed; or, where that cannot be con-

veniently done, they may be taken up with a ball of earth about the roots, and the roots of each surrounded with wet moss, carefully tied about it to keep the earth moist. They may afterwards be put into a box, and each plant secured by laths fastened crosswise above the roots, and the interstices between the roots filled with wet moss. The same methods may be observed with young grafted or budded fruit trees.

"Where the time will permit it is desirable that the roots of the plants be well established in the boxes in which they are transplanted. Herbaceous plants require only a short time for this; but, for plants of a woody texture, two or three months is sometimes necessary.

"Boxes for the conveyance of plants, or of seeds that are sown, may be made about two feet broad, two feet deep and four feet long, with small holes in the bottom, covered with a shell, or piece of tile, or other similar substance, for letting off any superfluous water. There should be a layer of wet moss of two or three inches deep at the bottom, or, if they cannot be had, some very rotten wood or decayed leaves, and upon that about twelve inches depth of fresh loamy earth, into which the plants that are to be transplanted should be set. The surface of the earth should be covered with a thin layer of moss, cut small, which should be occasionally washed in fresh water during the voyage, both to keep the surface moist, and to wash off mouldiness, or any saline particles that may be on it.

"When the boxes are about to be put on board the ship, hoops of wood should be fastened to the sides, in such a manner that arching over the box, they may cover the highest of the plants; and over these should be stretched a net work of pitched cord, so as to protect the plants from external injury, and prevent the earth from being disturbed by mice or other vermin.

"To each box should be fastened a canvass cover, made to go entirely over it, but so constructed as to be easily put on or off, as may be necessary to protect the plants from the salt water or winds, and sometimes from the sunshine. Strong handles should be fixed to the boxes that they may be conveniently moved.

"During the voyage, the plants should be kept in a light airy situation; without which they will perish. They should not be exposed to severe winds, nor to cold, nor for a long time to too hot a sunshine, nor to the spray of the salt water. To prevent injury from the saline particles with which the air is oftentimes charged at sea, (especially when the waves have white frothy curls upon them) and which, on evaporation, close up the pores of the plants, and destroy them, it will be proper, when they have been exposed to them, to wash off the salt particles, by sprinkling the leaves with fresh water.

"The plants and seeds that are sown, will occasionally require watering on the voyage; for which purpose rain water is best. If, in any special case, particular instructions upon this point, or upon any other connected with the management of the plants during the voyage, be necessary, they should be made known to those having charge of the plants. But after all, much will depend upon the judicious care of those to whom the plants may be confided during the voyage.

"Plants of the succulent kind, and particularly of the bulbous family should not be planted in earth, but in a mixture of dry sand, old lime,

rubbish, and vegetable mould, in about equal parts, and should not be watered.

"It may not be necessary, in every case, to observe all the precautions here recommended in regard to the putting up and transmission of seeds; but it is believed that there will be the risk in departing from them, in proportion to the distance of the country from which the seeds are to be brought, and to the difference of its latitude, or of the latitudes through which they will pass on the voyage. It is not intended, however, by these instructions, to exclude the adoption of any other modes of putting up and transmitting seeds and plants, which are in use in any particular place, and which have been found successful, especially if more simple. And it is recommended, not only that the aid of competent persons be acceptd in procuring and putting up the seeds and plants, but that they be invited to offer any suggestion in regard to the treatment of the plants during the voyage, and their cultivation and use afterwards."

From the *American Farmer,* IX, (November 30, 1827), 293.

SECTION III

NAVY DEPARTMENT ENDORSEMENT OF TREASURY DEPARTMENT CIRCULAR REGARDING PLANT INTRODUCTION, SEPTEMBER 6, 1827

"Navy Department

"*Sir*—I have to call your attention to the enclosed copy of a communication from the Treasury Department to the consuls of the United States at various ports; and to desire that the objects of that communication may be promoted by you, on all occasions, as far as may be in your power.

"The Executive takes a deep interest in this matter, and, by particular attention to it, you will probably confer a lasting benefit to the country.

"The letter of the Secretary to the Treasury is so full and satisfactory, that no further explanation seems necessary on my part.

"You will be pleased to report to the Department what you do in execution of this object, and return the papers to the Department when you are detached from the vessel which you now command.

"I am, respectfully, &c..
SAM. L. SOUTHARD

From the *American Farmer,* IX, (November 30, 1827), 293–294.

SECTION IV

COPY OF THE LETTER OF INSTRUCTIONS, FROM THE DEPARTMENT OF STATE

"To Dr. James Morrow,

"Sir;

"You having been detailed by orders from the Navy Department, for service in the Squadron under the command of Commodore Perry, for the performance of such duty as may be assigned you in reference to the care

and distribution of seeds and the use of Agricultural Implements, you are hereby instructed and authorized, under the direction of the Commodore and subject to his orders, to take charge of the seeds and Agricultural Implements procured for the Expedition.

"Should any agricultural operations be ordered by the Commodore, at any place of rendezvous, you will superintend the same. You will endeavor to introduce those vegetable productions not indigenous at such place of rendezvous, as you may be able, by the use of the seeds furnished you, and you will carefully note and collect all indigenous vegetable products, within your sphere of operation, with a view to their introduction into the United States, preserving seeds and dried specimens of as many plants as possible.

"You will keep a full and accurate Journal of your proceedings and operations, which on your return, will be delivered by you to this Department."

I am, Sir respectfully
Your obedient Servant,
EDWARD EVERETT

From Morrow *Journal* of journey in Japan, 1853–1854, p. 1.

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