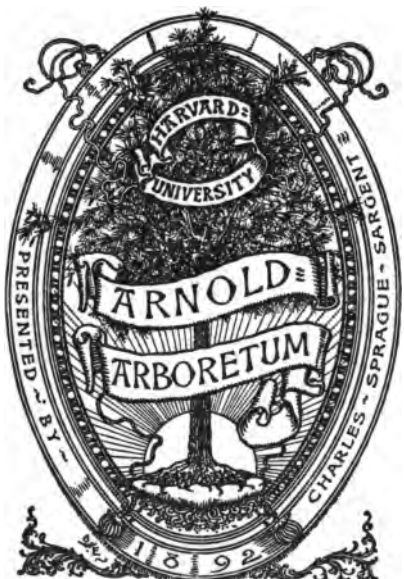

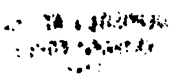

UNITED STATES DEPARTMENT OF AGRICULTURE.
BUREAU OF PLANT INDUSTRY.
B. T. GALLOWAY, *Chief of Bureau.*

VISITORS' GUIDE

TO THE

EXHIBITS OF THE BUREAU OF PLANT INDUSTRY

AT THE

LOUISIANA PURCHASE EXPOSITION, ST. LOUIS, 1904.

COMPILED BY
J. E. ROCKWELL,
EDITOR OF BUREAU IN CHARGE OF INDOOR EXHIBIT.

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VISITORS' GUIDE.

INDOOR EXHIBIT OF THE BUREAU OF PLANT INDUSTRY—IN THE UNITED STATES GOVERNMENT BUILDING.

J. E. Rockwell, *in General Charge.*

The indoor exhibit of the Bureau of Plant Industry is located in the northwest end of the United States Government Building, between the exhibits of the Department of State and of the International Bureau of the American Republics on the west and those of the Bureau of Animal Industry and of the Bureau of Chemistry of the Department of Agriculture on the east and south, respectively. (Fig. 1.)

The space assigned covers 4,874.5 square feet, its greatest length being 105 feet 6 inches and its width 52 feet 9 inches.

The exhibits of Pomological Investigations and of Grass and Forage Plant Investigations are upon

the main (20-foot) aisle, while those of the Office of Seed and Plant Introduction and Distribution and of Cereal Investigations, of Drug and Medicinal Plant Investigations, and of Vegetable Pathological and Physiological Investigations are located upon the 16-foot aisle leading to the northwest entrance to the building. The exhibits of Fiber-Plant Investigations occupy a central position in the space, while those of the Seed Laboratory and of Poisonous Plant Investigations are placed upon the 7-foot aisle immediately opposite the installation of the Bureau of Animal Industry. (Fig. 2.)

Prof. F. Lamson-Scribner, Special Agent representing the Bureau of Plant Industry at the Exposition, has a desk at the end of this aisle and is prepared to answer the questions of visitors and give detailed information as to the several exhibits.

VEGETABLE PATHOLOGICAL AND PHYSIOLOGICAL INVESTIGATIONS.

ALBERT F. WOODS, *Pathologist and Physiologist, in Charge.*

Pathological laboratory.—The portion of the exhibit of the Bureau of Plant Industry devoted to pathology and physiology consists, first, of a small working laboratory in charge of Dr. Hermann von Schrenk and his assistants, Perley Spaulding and Caroline Rumbold. This laboratory, in which diseased plants are shown in their fresh condition from day to day, has a complete equipment of culture materials, sterilizers, culture apparatus, microscopes, etc.; and a representative of the Department of Agriculture is present daily to show the manner in which fungous diseases are studied and to explain the different structures and forms of diseases, as well as methods of combating them.

On the walls surrounding this laboratory are exhibited charts, photographs, and colored illustrations of various plant and fruit diseases and

the methods of their treatment. In connection with this laboratory are six cases containing special exhibits.

Diseases of cultivated crops.—One case is devoted to the principal maladies of cultivated crops, showing preserved specimens of various diseases. A complete series of the various stages of growth of the bitter-rot fungus is shown; also various forms of the smut diseases of grasses, the leaf-spot on the sugar beet, and the black-knot of plum.

On a separate rack next to this case are about forty different forms of leaf diseases of agricultural crops. In each instance a brief description of the particular disease accompanies the specimen, and recommendations as to how such disease may best be combated are given in most instances. Growing cultures of various fungi are shown.

Timber diseases.—The case devoted to timber diseases contains a varied collection of diseased woods, showing the manner in which various timber-destroying fungi bring about the decay of living trees. Several large punks or fruiting organs of these fungi are shown growing on living trunks. Among the diseased trees in the exhibit are the white ash, redwood, various species of pine, beech, oak, cypress, and catalpa.

A certain portion of the case is devoted to an exhibit of the fungous diseases of structural timber, notably the "blue" disease of coniferous wood, while several sections of railway ties, showing the manner in which they decay, are also displayed.

Sugar beets.—A third case is devoted to an exhibit of sugar beets prepared by Dr. C. O. Townsend. The various stages in the development of the sugar beet, from the seed to the mature beet, are shown; also the various steps in the preparation of the products and by-products of the sugar beet.

Over 200 samples of seed, including American and foreign grown seeds, are exhibited for comparison. Among these is one bottle containing 10,000 single-germ seed balls, and another bottle of the same size containing 1,600 multiple-germ seed balls. The various objects shown are explained in detail on the labels.

Nitrogen-fixing bacteria.—A fourth case, prepared by Dr. George T. Moore, illustrates the relation of bacteria to the fixation of atmospheric nitrogen. In the lower part of the case, on one side, is shown the method of isolating the bacteria from nodules on leguminous plants and making poured plates; transferring the organisms to nitrogen-free silica jelly and to nitrogen-free liquid media; saturating

sterilized cotton with this culture; drying and packing the cotton; together with packages of nutrient salts for making up the fresh culture liquid, and wrapped packages ready to mail to applicants, thus illustrating the preparation and distribution of these organisms in general farming by the Department of Agriculture.

On the opposite side of the case are illustrated the process of preparing the culture, the inoculation and drying of the seed, and all steps necessary previous to sowing or storing the seed. Herbarium specimens of some of the various leguminous crops are exhibited, with special comparison of inoculated and uninoculated plants, to demonstrate the benefit of nodule-forming bacteria. Some photographs are also included in this exhibit.

Mushrooms.—The mushroom case, prepared by Dr. B. M. Duggar, is illustrative of the work in mushroom growing, and has been designed with the view of giving a general exposition of the mushroom industry and of the scientific work which is being done rationally to stimulate this industry.

On the lowest shelf are shown the two types of mushroom beds (the flat bed and the ridge bed) in common use for the cultivation of *Agaricus campestris*. The habit of the mushroom is shown

by means of plaster casts, each of these being a reproduction of a mushroom or a cluster of mushrooms grown in the experimental beds at Columbia, Mo.

Three shelves are devoted to commercial spawns, edible commercial mushroom products—which, at present, are largely foreign—and views of the mushroom industry in France and in America. Among the spawns are to be found the English, the French, and the new American article.

The products include nearly all species and grades of preserved mushrooms which are to be found on the market, the most highly prized being the morels and the truffles.

Three remaining shelves indicate some phases of the scientific work. In the large test tubes are new cultures of the spawn of many species of mushrooms, and these are supplemented by photographs showing the methods of making cultures.

There are also shown preserved specimens and photographs of interesting edible mushrooms, which may be found in pastures, in lawns, and on decaying trees.

Plant breeding.—A sixth case, containing an exhibit prepared by Dr. H. J. Webber, shows some of the work that has been accomplished in the improvement of plants by breeding. Various

improved types of cotton are exhibited by means of photographs and specimens illustrating the processes used in producing hybrids and new fixed types, and in the selection and improvement of imported types, such as Egyptian cottons.

Here is also illustrated the advance that has been made in the production of hardy oranges by crossing the hardy Trifoliate orange with the tender and edible sweet orange, and in the production of improved and earlier varieties of the "kid glove," or Tangerine, orange, as well as other new and improved types. The improvements secured in pineapples are illustrated by a series of photographs showing types of new varieties.

The methods of improving corn are illustrated by sample ears and photographs. The peculiar phenomenon known as "xenia," or the immediate effect of pollen, is demonstrated conclusively by the specimens exhibited.

BOTANICAL INVESTIGATIONS AND EXPERIMENTS.

FREDERICK V. COVILLE, *Botanist.*

EDGAR BROWN, *Botanist, in General Charge of Botanical Exhibits.*

FIBER-PLANT INVESTIGATIONS.

LYSTER H. DEWEY, *Botanist in Charge.*

The exhibit of plant fibers occupies the central portion of the space assigned to the Bureau of Plant Industry in the Government Building.

The principal plant fibers used in the textile industries of this country—in twines, cordage, rope, thread, yarn, and woven goods—are shown in the forms in which they are found in commerce as they pass from the producer to the manufacturer.

Living plants, with bales of fibers.—The exhibit is outlined by commercial bales of hemp, flax, cotton, jute, manila, and sisal as these are found on the market, and in most instances these bales are accompanied by growing plants showing the source of the fiber. Since cotton, hemp, and flax are the only fiber plants cultivated commercially in this

country, most of the others had to be imported—manila from the Philippines, sisal from Yucatan, jute from India, and the various istle or Tampico fiber plants from Mexico.

Hard and soft fibers.—In the center of the fiber group are two glass cases, one containing samples of hard fibers—manila, sisal, New Zealand, Mauritius, and istle—used chiefly for binder twine, rope, and cordage, and the other containing samples of typical cottons, such as American Upland, Sea Island, Egyptian, and Indian, and the soft fibers or bast fibers—hemp, flax, jute, and ramie—used more largely in woven goods and for small twines.

Ropes and twines.—Samples of manila and sisal rope and binder twines, and also flax, hemp, and jute twines, accompany the specimens of raw fiber, but no attempt has been made to exhibit many forms of articles or to show the different stages in the processes of manufacture.

SEED LABORATORY.

EDGAR BROWN, *Botanist in Charge.*

The exhibit of the Seed Laboratory is arranged to show the methods used in seed testing and its practical value to the farmer.

Seed-testing apparatus.—The apparatus used in making tests of seeds for mechanical purity and for germination, including special cleaning devices, forceps, and lenses for purity testing, and including also the Improved Standard Germinating Chamber, is exhibited.

Weed seeds.—Under magnifiers and in bulk are shown the weed seeds most commonly found mixed with the seeds of grass and clover offered for sale. Accompanying these are live plants of each kind of weed so introduced. While most of these weed plants are commonly known, the seeds are not often recognized. The exhibit affords an opportunity to compare the weed seeds with the plants themselves, and emphasizes the importance of securing seed free from impurities in the form of weeds which may prove a pest upon the farm.

Impurities.—In open bowls and under magnifiers are shown samples of different grades of the more common grass and clover seeds. These are so arranged that seeds of the same kind but of different qualities may be easily compared. In tubes in frames on a nearby screen are exhibited the results of purity and germination tests of the same seed samples shown under the magnifiers. Here can be seen in connection with each sample the actual quantity present of dirt, chaff, weed seeds, and

adulterants, as compared with the quantity of seed that will grow. The price at which these seeds were sold to the public is stated in each case, as well as the actual cost of the pure seed that will germinate and grow.

Cheap adulterants.—Several of the samples illustrate the use of the seed of Canada bluegrass, meadow fescue, and yellow trefoil as cheap adulterants. In most cases the adulterants so closely resemble the seeds with which they are mixed that they can not be distinguished except by careful examination with the aid of a magnifying glass.

Comparative cost of pure seed.—An examination of the results of the tests of the samples of seeds obtained from the stock of seedsmen as offered for sale emphasizes the well-established fact that the best quality is always the most economical, as the pure seed that will grow actually costs less when a good grade is purchased than when a medium or poor grade is bought.

DRUG AND MEDICINAL PLANT INVESTIGATIONS.

R. H. TRUE, *Physiologist in Charge.*

The exhibit of Drug and Medicinal Plant Investigations consists of crude drugs, shown in some cases in bags in large quantities and in other cases in small samples in glass jars.

Native crude drugs.—Twelve specimens exhibited in quantity represent drugs either at present grown in this country or considered well adapted for growth in the United States or its dependencies. A growing plant in a tub accompanies each of these bags and shows the living plant concerned. In the cases of cinchona, eucalyptus, and cascara sagrada, where mature trees furnish the products exhibited, young trees are shown in the tubs.

Cultivated drug plants.—Golden seal and cascara sagrada are plants native to and growing wild in the United States which are now beginning to be brought under cultivation, owing to the fact that the great demand for their products seems to be pointing toward their gradual disappearance in a wild state. Castor beans are easily produced in the United States and should be cultivated more extensively in order to supply the demand fully; they are now imported in large quantities.

Native commercial drugs.—In a case at the end of the exhibit are shown about a hundred kinds of commercial drugs, all of which have been produced in the United States and nearly all from wild plants, though in a few instances samples from cultivated as well as from wild stock are shown.

POISONOUS PLANT INVESTIGATIONS.

R. H. TRUE, *Physiologist in Charge.*

The poisonous plant exhibit consists of two parts:

Plants poisonous to man and to live stock.—First, water-color illustrations of over fifty plants poisonous to mankind and to stock, in two groups, one representing those chiefly poisonous to man, and the other those poisonous to stock. In some cases, especially in the former class, plants which are sought and for which poisonous plants are sometimes mistaken are also exhibited, the grouping bringing together, for comparison, the species confused. Nearly all the water colors are the work of Mr. Walpole, of the Department of Agriculture, who painted the various subjects from the living plants.

Methods used in counteracting the effects of poisons.—The second part of the exhibit is shown in a case, on one side of which will be found apparatus made use of in connection with poisonous plant investigations, materials used as antidotes, and instruments employed in administering antidotes to live stock which have eaten poisonous plants. Instruments used in autopsies and in the laboratory are also included.

Active principles of plant poisons.—On the other side of the case, dried material of a number of species and small quantities of active principles isolated from American poisonous plants are shown.

Potted plants.—Potted specimens of some of the most important poisonous plants are exhibited.

GRASS AND FORAGE PLANT INVESTIGATIONS.

W. J. SPILLMAN, *Agrostologist.*

CARLETON R. BALL and A. S. HITCHCOCK, *in Charge of Exhibit.*

The exhibit of the Office of Grass and Forage Plant Investigations is composed chiefly of the following groups of material:

Models of haying machinery.—Models of hay balers, stackers, rakes, and other types of machinery used in haying operations; photographs of machinery; samples of smaller articles, such as baling ties and soft-ground horseshoes.

Baled hay.—Samples of ordinary hay of a few standard varieties; double compressed bales used for export; a wireless bale; and several bales illustrating the miscellaneous hays of the country.

Mower parts.—The pitman attachments of several makes of mowing machines, showing the connection with the crank wheel and sickle—one of the most important parts of a mower.

Model of sand dune.—A miniature sand dune, illustrating methods used to control drifting sand,

such as plantations of beach grass, covering with sand hedges, and the foundation of a barrier dune.

Seeds of forage plants.—Seeds of about forty of the leading forage crops are displayed in half-gallon glass vials, while many distinct varieties of cowpeas, soy beans, sorghums, and millets are shown in smaller vials.

Publications.—Title pages and sample illustrations and pages of texts selected from the more important circulars and bulletins on forage crops, meadows, pastures, range problems, silos, lawns, and the reclamation of sand-dune areas are exhibited.

Silo construction.—The central pavilion in this exhibit is a cylinder 13 feet in diameter and 12 feet high. The interior is reached through four doorways, in the sides or jambs of which are built cross sections showing actual silo construction. Four types of silos are thus illustrated; namely, a stave silo, two kinds of round wood silo (one merely sheathed, while the other is lathed and covered with cement plaster), and a round brick silo.

Dried grasses and forage plants.—Upon the walls of the central pavilion or silo are placed sheaves and dried specimens of native and cultivated grasses, alfalfa, and other forage plants from all parts of the United States.

Transparencies.—In the center of the silo is a frame containing a series of transparencies showing forage crops, hay making, range scenes, lawns and related subjects.

POMOLOGICAL INVESTIGATIONS.

G. B. BRACKETT, *Pomologist.*

WM. A. TAYLOR, *Pomologist in Charge of Field Investigations, in Charge of Exhibit.*

The pomological exhibit comprises the following distinct features:

A.—COLLECTIONS OF FACSIMILE MODELS ILLUSTRATING FRUIT VARIETIES.

Classified and arranged by G. B. Brackett, Pomologist, and W. N. Irwin, Assistant Pomologist.

1. Commercial apples of the Mississippi Valley.—A collection of models of the leading commercial varieties of apples grown in the Mississippi Valley and Upper Lake regions occupies two case fronts. This collection consists exclusively of such varieties as have demonstrated their adaptability to commercial culture in various sections of the region extending from the Great Lakes to the Gulf. It comprises varieties ripening throughout the season from early June in Texas, Louisiana, and

Mississippi, until late October in the more northern States.

Many of the winter varieties grown in the central and northern portions of this region are easily kept in common cellar storage until April or May. Through the agency of refrigerated storage these staple varieties are held in the larger cities in excellent condition until the early varieties of the new crop from the South reach the market, thus providing a continuous supply of wholesome apples throughout the year.

In some instances several models of a single variety are shown, the modification of the fruit of a variety by soil and climatic conditions being illustrated in this way. Most of the varieties shown are of American origin, and as the region represented contains a wide range of soil and climatic conditions this collection comprises a large proportion of the important commercial apples of North America.

2. New or little-known apples of the Mississippi Valley.—A collection of new or little-known varieties of apples that are considered worthy of testing in the Mississippi Valley and Upper Lake regions either for commercial or amateur planting occupies one case front. It consists chiefly of varieties that have been introduced by nursery-

men since the World's Columbian Exposition in 1893, although it includes also certain older sorts that have not heretofore been known outside the localities of their origin.

Practically all the varieties in this collection are of American origin, and except in the localities of their nativity they must be considered as in the experimental stage.

3. General collection of fruits grown in the United States.—A general collection of the fruits grown in the various portions of the United States occupies fifteen case fronts. This comprises the more important varieties of apples, crab apples, pears, quinces, peaches, plums, apriçots, nectarines, cherries, cranberries, strawberries, oranges, lemons, pomelos, limes, citrons, kakis, loquats, avocados, mangoes, sapodillos, persimmons, and miscellaneous tropical and subtropical fruits. Small maps in these cases indicate the general regions within which each species is grown.

Many of the varieties are represented by two or more models to illustrate the modification of fruit by different conditions of soil, climate, or other features of plant environment.

The facsimile models in the above collections are by G. B. Brackett, Pomologist, the late J. W. Hendley, and Miss A. A. Newton, modelers.

B.—Package Exhibits Illustrating Investigations in Fruit Marketing and Storage.

Prepared by Wm. A. Taylor and G. Harold Powell, Pomologists, assisted by S. H. Fulton, Assistant Pomologist.

4. Standard grades of apples.—The standard commercial grades of winter apples, as adopted by the International Apple Shippers' Association, are illustrated by models of certain leading commercial varieties displayed in sections of apple barrels of standard size in one exhibition case. Both "No. 1" and "No. 2" grades of several varieties are shown, the smallest specimens in each package representing the minimum size of fruit of that variety which is permitted in that grade.

The specifications regarding the standard grades and the standard size of an apple barrel are given in detail on large descriptive labels in the case.

5. Summer apples, pears, and peaches packed for export.—The methods of packing and forwarding experimental export shipments of the perishable summer fruits by the Department of Agriculture are illustrated by two exhibition cases of summer apples, pears, and peaches packed in the kinds of packages that have been found best adapted to their particular requirements. These shipments are made by the Department in cooperation with fruit growers in different parts of the country for

the purpose of determining the best methods of packing these fruits for shipment to foreign countries. Many radical changes in the methods of packing practiced with these fruits in our domestic markets have been found necessary to insure their delivery in sound and wholesome condition in European markets. Certain varieties of delicate texture that were until recently considered impossible of successful trans-Atlantic shipment have been found exceedingly profitable to export when properly handled.

Details regarding the shipments, packages, and methods of packing recommended are shown on the display labels in the cases with these exhibits.

6. Studies in fruit storage.—The influence of the cultural and climatic conditions that affect the growth of the tree and fruit and of the methods of harvesting and storing to which the fruit is subjected upon its ultimate keeping quality in cold storage is illustrated by four exhibition cases of facsimile models displayed in sections of commercial packages.

In one exhibition case, the close relation that has been discovered to exist between the degree of maturity at which certain winter apples are picked and the development of "scald" upon them while in storage is illustrated by commercial pack-

ages showing immature and mature fruit of the Rhode Island Greening, Winesap, York Imperial, and Baldwin varieties after apples of both degrees of maturity have been subjected to identical storage conditions throughout the winter. Immature and poorly colored specimens of a variety scald soonest; hence, the fruit should be allowed to reach good maturity and color before being picked, to insure greatest freedom from scald.

In another exhibition case, the influence of the age of the tree upon the keeping quality of its fruit is illustrated by sections of commercial packages of Tompkins King and York Imperial apples, while the relative influence of sandy and clayey soils upon the keeping quality of the fruit of Rhode Island Greening and Baldwin apples in cold storage is also shown.

In general, the keeping quality of apples from young trees that are making luxuriant wood growth is inferior to that of older trees which have attained a more stable equilibrium of their functions. In general, also, winter apples grown upon light soils ripen earlier and pass through their life history sooner than the same varieties grown upon clayey soils in the same climate. In either instance the keeping quality can be somewhat controlled by picking the fruit according to its stage of develop-

ment rather than on arbitrary dates, regardless of the seasonal conditions, as is often done.

Delay in storing fruit after it is picked has been found one of the most serious causes of decay in storage. When such delay occurs in warm weather the ripening is usually much more rapid than if the fruit were left upon the tree; hence, the importance of prompt storing after the fruit is picked. The effect of such delay in storing upon the keeping quality of Sutton and Rhode Island Greening apples and of Bartlett and Kieffer pears is shown by packages of these varieties, which occupy one exhibition case.

The effect of the size and type of package upon the keeping quality of Bartlett pears in cold storage and the effect of different temperatures and of paper wrappers on the keeping quality of Bartlett and Kieffer pears are illustrated by packages of these fruits, occupying one exhibition case.

The facsimile models in the above exhibit are by Miss A. A. Newton and Miss Ellen Isham Schutt, modelers.

C.—Collections of Named Varieties of Pecans.

Prepared by Wm. A. Taylor, Pomologist.

7. Standard varieties of pecans.—A collection of samples of the ten varieties of pecans that have

been disseminated by budding and grafting for a sufficient time to entitle them to recognition as standard varieties occupies one exhibition table. Several samples of most of the varieties in this collection are shown, thus illustrating the modification of the nuts of varieties of this species by differing environmental conditions.

Upon this table is also displayed a large jar of specimen pecans, illustrating the general range of unnamed commercial pecans as they reach the New Orleans market from the seedling trees of Louisiana.

8. Promising new varieties of pecans.—The remaining exhibition table contains a collection of promising new varieties of pecans that have been recently introduced by commercial nurserymen. In many instances the specimens shown are from the original trees of the respective varieties. The climatic and cultural range of these new varieties is not yet determined.

Upon this table are also shown a large jar of specimens illustrating the commercial types of the pecan as they reach the markets in Texas, and a series of samples illustrating the methods of cleaning and grading these nuts for market.

D.—Fruit Illustration.

9. Water-color paintings of fruits.—A representative collection of water-color paintings of fruits is displayed upon the partition at the rear of the collections of pecans. These paintings are accurate delineations of the varieties they represent, and illustrate the effectiveness of this important method of recording varietal characters. They are specimens from the collection of fruit illustrations in the Office of the Pomologist, from which are taken such original paintings for reproduction as plates as are used in the Yearbook and other publications of the Department of Agriculture.

The paintings in this collection are by Miss D. G. Passmore and Miss Bertha Heiges, artists.

SEED AND PLANT INTRODUCTION AND DISTRIBUTION.

A. J. PIETERS, *Botanist in Charge.*

D. G. FAIRCHILD, *Agricultural Explorer, in Charge of Exhibit.*

Foreign plants.—The exhibit of the Office of Seed and Plant Introduction and Distribution consists of specimens, photographs, and models of some of the foreign plant cultures which have either been successfully introduced into America by the Department of Agriculture and have added materially to the agricultural wealth of the country, or are now being studied by the experts in this Office with a view to the growing of these crops in the various portions of the United States where they are most likely to be financially successful. These specimens, photographs, and models represent only a very small percentage of the thousands of seeds and plants which have been introduced since the establishment of the Office in 1897. They are such, from the preliminary examination which has been made of them, as are deemed worthy of a prominent place in the estimation of American agriculturists.

Agricultural explorations.—Many of the articles exhibited have been secured in foreign countries by the agricultural explorers of the Office; some of the most important have been presented by the Hon. Barbour Lathrop, of Chicago, while others have been obtained through correspondents in various parts of the world. The wide range of fruits, vegetables, and grains exhibited illustrates the possible benefit to the country of this branch of the work of the Department, which has been systematically carried on for less than seven years.

Promising introductions.—The exhibits include the famous Kiushu rices of Japan, which have been so remarkably successful in the newly irrigated regions of Louisiana and Texas; macaroni wheats gathered by agricultural explorers in Russia, on the northern coast of Africa, and in Italy, which have shown their remarkable ability to thrive in the arid belt of farming country of western Kansas, Nebraska, and the Dakotas; fodder crops from Egypt and Algiers, including the remarkable Egyptian clover called Berseem, which is without doubt the best annual winter fodder plant for irrigated regions having a mild winter climate; timber bamboos from Japan, which are among the most profitable plant cultures of that country; the Japanese paper plant, from which

the most delicate paper in the world is made and which it is hoped can be grown economically enough to lead to the creation of a new plant industry in the Gulf States; the famous wrapper tobacco from Sumatra, of which there is a large export from that country to America; the date palm from the Sahara and the banks of the Tigris, whose successful cultivation in Arizona and California has been practically assured by the experiments already made; the pistache nut from the Levant, a delicious table nut as common in Greece as are salted peanuts in this country; the mango from the oriental tropics, a fruit which will some day be as common on American tables as the grape fruit, and which can be successfully grown in southern Florida and in Porto Rico; the famous Smyrna fig, the successful introduction of which was due in part to the work of the Department of Agriculture and which has led to the establishment of a profitable industry in California; a new Japanese salad plant called Udo, which may some day rival our well-known salads in importance; the hard-shelled almond from Spain, the kernels of which bring the highest prices paid by confectioners and whose delicate flavors are not equaled by any of the almonds hitherto cultivated in California; a superlative variety of horse-radish from

Moravia, called Maliner Kren, which is considered by Viennese gourmets the finest flavored variety in the world; a brewing barley from Austro-Hungary called Hanna, which is recognized throughout southern Europe as the best brewing barley on the Continent; and the long-staple silky cotton from Egypt, of which our manufacturers import every year many thousand dollars' worth from the Nile Valley, and which has been crossed successfully with the short-staple Upland cotton of our Southern States.

Since the establishment of the Office of Seed and Plant Introduction and Distribution, over ten thousand kinds of seeds and plants have been introduced and distributed to the State agricultural experiment stations and to private experimenters throughout the country. Records of the distribution of these thousands of plants are on file for future reference, and it is believed that this is the first instance in the history of any country where the work of introducing and establishing new plant industries has been systematically carried out on such a comprehensive scale.

CEREAL INVESTIGATIONS.

M. A. CARLETON, *Cerealist, in Charge.*

Introduced grains.—The exhibit of introduced grains consists of a number of specimens in different stages, both before and after thrashing and when manufactured into meal and flour, showing the most important varieties that have so far been obtained by the Department of Agriculture in foreign countries and brought to the United States for growing by our farmers. Several varieties of durum (macaroni) wheat, Japanese rice, Swedish Select oat, emmer, and three important varieties of Russian proso (broom-corn millet) are given special prominence, while several kinds of oats, barley, and buckwheat are less conspicuously shown.

Durum wheat.—Because of its relative importance a large part of the space assigned to cereals is devoted to durum wheat and special attention is directed to a number of important products which can be made from that grain, thus emphasizing its commercial value. Bromide pictures illustrate

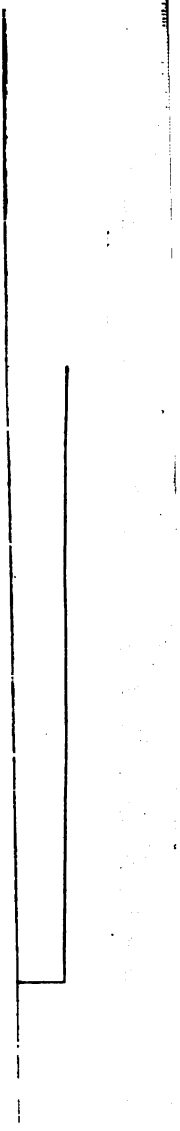
many interesting features in the grain industry and show the various cereals in cultivation.

Of the considerable number of different varieties of durum wheat which have been introduced from Russia, North Africa, and portions of Asia, the most important so far seem to be Kubanka, Pelissier, Yellow Garnovka, Velvet Don, and Black Don. As a result of the introduction of these new varieties the production of durum wheat in the United States during the season of 1903 was about 6,000,000 bushels, while the output for the coming season will probably reach 15,000,000 bushels. A sufficient number of experiments have been made by the Department of Agriculture and by commercial laboratories, as well as baking trials by private families, to demonstrate the fact that this class of wheat is eminently successful for producing bread, as well as for the manufacture of macaroni. Photographs of loaves of bread made from durum wheat form a part of this exhibit.

Swedish Select and Sixty Day oats.—Two other specially valuable grains introduced into this country by the Department of Agriculture are the Swedish Select and Sixty Day oats, the former being particularly adapted to the northernmost districts of the United States and the Sixty Day oat to the middle latitudes.

The comparative resistance to drought of the Swedish Select oat makes this an especially promising variety for some sections, and that it is already considered the most valuable of all varieties in a large portion of the northern Great Plains is attested by the fact that though only introduced in 1899 the crop of 1904 will consist of several million bushels. The Sixty Day oat is very early in ripening and is particularly valuable for that reason. A large part of the exhibit of oats is made up of samples of these two varieties, both thrashed and in the straw.

Miscellaneous grain introductions.—Among other foreign varieties of grains that have proved to be well adapted for growing in this country are the Hanna barley (a particularly good brewing variety), the Beldi and Telli barleys from Algeria, the Tobolsk and North Finnish Black oats, the Malakhov sugar corn (a very early variety and quite resistant to drought), the Orenburg buckwheat (maturing even in Alaska), and the Ivanov, Abruzzes, and Giant Winter varieties of rye.



OUTDOOR EXHIBIT OF THE BUREAU OF PLANT INDUSTRY.

W. J. SPILLMAN, *Agrostologist, in General Charge;* assisted by D. A. BRODIE and CHAS. F. WHEELER.

The outdoor exhibit of the Bureau of Plant Industry occupies about 7½ acres of land on the sloping hillside facing the Palace of Agriculture. This area is nearly square. In the center of it is laid out a large map of the United States, more than 550 feet in length. State boundaries are indicated by paths, from which visitors may study the exhibit. In each State are planted the leading field crops it produces, on areas proportional to the areas these crops actually occupy in the State. This gives, in effect, a bird's-eye view of the chief crop productions of the entire country.

The land lying outside the boundaries of the map of the United States is occupied by exhibits illustrating the special lines of investigation of the different offices composing the Bureau. (Fig. 3.)

PLANT DISEASES.

M. B. WAITE, *Pathologist, in Charge.*

This exhibit is designed to show some of the more important diseases of the principal orchard and truck crops and the methods of their treatment. Plats of young fruit trees, vegetables, and other crops, one-half of which have been treated by spraying for the prevention of diseases, demonstrate the beneficial effects of such treatment.

NITROGEN-FIXING BACTERIA.

GEORGE T. MOORE, *Physiologist, in Charge.*

Certain plats are devoted to the growth of leguminous crops, with a view to showing the effect of inoculating such crops with bacteria, in order to enable them to secure atmospheric nitrogen. In a small structure erected on one of the plats are grown various legumes and other plants in pots containing known quantities of nutrient salts to demonstrate the importance in crop production of an adequate nitrogen supply, and also to show the relation between bacteria securing nitrogen from the air and the use of nitrogenous fertilizers.

PLANT-BREEDING INVESTIGATIONS.

HERBERT J. WEBBER, *Physiologist, in Charge;* assisted by C. P. HARTLEY, *Assistant in Physiology.*

The exhibit of the Plant-Breeding Laboratory consists of a demonstration by means of cotton and corn plants of some of the results obtained by the practice of plant-breeding methods.

Rows of Sea Island and ordinary Upland short-staple cotton plants illustrate the parent types. Following these is a row each of first, second, third, and fourth generation plants. The first generation plants exhibit characters intermediate between the parents. The second generation plants show the great degree of variation that is common in this generation, while later generations show the gradual progress to a fixed type due to strict selection of type. A row of select Ashmouni Egyptian cotton and another of a fifth generation hybrid of Sea Island × Ashmouni Egyptian cotton are grown.

Dissimilar types of corn that have been used in hybridization work are grown in rows by the side of first and later generations of the hybrids. Increased vigor of stalk and the blending of stalk characters of sweet and starch corn can be noticed

as the results of hybridization. Peculiar strains of dwarf corn, broad-leaved corn, etc., produced by selection, are growing side by side with the original types from which the selections were first made. One row of Blount Prolific corn presents the effect of one year's breeding for increased number of ears per stalk; another, one year's breeding for increased number of suckers; and a third row, one year's breeding for decreased number of suckers.

Rows of pod corn, teosinte, and mais de coyote (a hybrid of teosinte and ordinary corn) are also grown.

CEREAL INVESTIGATIONS.

M. A. CARLETON, *Cerealist, in Charge.*

The cereal exhibit is a living representation of the different groups of cultivated grains arranged in logical order, showing the actual characteristics and manner of growth of a number of the principal varieties of each group. Within each group there is also, so far as possible, a secondary arrangement of varieties according to the country in which they are most commonly grown. Under cereals are included all agricultural plants of which chiefly the seeds are used as food either for man or for animals. The different grains actually shown are corn, wheat, oats, rye, barley, buckwheat, rice,

kafir corn, milo maize, and proso or broom-corn millet.

Almost the entire exhibit contributes simply to one's practical knowledge of different varieties and their behavior in the field. The observer is thus enabled to become acquainted not only with many grains grown in this country hitherto unknown to him, but with a large number of varieties of the different groups entirely foreign to this country, and at the same time can see how they compare with each other in hardiness, earliness, resistance to disease, etc.

In four of the plats there is a special experiment showing the effects of the treatment of oats and wheat for the prevention of smut. In such case one plat is grown from seed badly smutted without being treated and another from seed just as badly smutted but which was treated with formalin for the prevention of smut, and the results show the value of this treatment. In a few cases some ornamental arrangement is also made of certain varieties.

SEED INVESTIGATIONS.

EDGAR BROWN, *Botanist in Charge.*

The large plats in this exhibit are sown with different grades of commercial grass and clover

seeds to show the difference in crop return when high-grade seeds and when low-grade seeds are used. The small plats contain weed plants whose seeds are most frequently found among commercial seeds.

FIBER-PLANT INVESTIGATIONS.

LYSTER H. DEWEY, *Botanist in Charge.*

In the space assigned to fiber-plant investigations are growing all of the plants used in the production of fibers now found in commercial quantities on the market in this country. There are specimens of abaca from the Philippines, henequen from Yucatan, palma istle and lechuguilla from Mexico, fiber plants from New Zealand and Mauritius; also flax, hemp, jute, and ramie, and the typical kinds of cotton grown in this country, in Egypt, and in India.

DRUG AND MEDICINAL PLANT INVESTIGATIONS.

R. H. TRUE, *Physiologist in Charge.*

About forty-five representative drug plants are arranged in a natural sequence, beginning with the lowest orders and running through the flowering plants to the highest types. The order is that of Engler and Prantl. Not only the common and

botanical names but also the physiological properties are indicated on the labels.

Among the specimens shown are some of the common weeds which have a medicinal value, as burdock, couch grass, and yellow dock. Other kinds are cultivated in Europe and imported in large quantities into the United States, as digitalis and belladonna. Some are wild native plants which are collected in various parts of the United States, as golden seal and cascara sagrada.

POISONOUS PLANT INVESTIGATIONS.

R. H. TRUE, *Physiologist in Charge.*

This exhibit includes plants known to have a poisonous action on live stock and on human beings, the labels indicating the noxious characters of the plant. Common poisonous weeds, some ornamental plants, and the principal stock-poisoning plants of the cattle ranges are represented. Among the number may be found one of the most feared loco weeds of the western stock ranges; a kind of larkspur which causes great losses of cattle and sheep; the cocklebur, said to be the cause of death in the case of cattle and hogs; the laurel of the eastern mountains, known to be fatal to stock, and the cherry, the wilted foliage of which causes death.

SCHOOL GARDENS.

CHARLES F. WHEELER, *Botanist, in Charge.*

The school-garden exhibit, which is located in the northeast corner of the grounds occupied by the Bureau of Plant Industry, has for its object the carrying on of children's gardens, which it is hoped will help forward the movement looking toward the teaching of agriculture in schools.

Thirty model gardens are cared for by some of the children from the schools of St. Louis under the direction of an experienced teacher, and daily exhibitions throughout the Exposition will be given.

Teachers interested in nature study can learn practical methods here which they can introduce into their own schools, thus helping to make primary education more practical and helpful.

Observation plats comprising the principal agricultural crops are planted on the grounds. Wild plants, showing their appropriateness for ornamenting school grounds, are used for decorative purposes.

GRASS GARDEN.

W. J. SPILLMAN, *Agrostologist, in Charge.*

The grass garden is located at the southeast corner of the exhibit, extending from Maine around Florida on the central map. Adjacent to the New England States on the map is shown a sand dune upon which have been set out several plants which are characteristic of areas of drifting sand. South of this, along the eastern border of the exhibit, are shown a number of coarse fodder plants, such as kafir corn, sorghum, milo maize, etc. Lying between this row of coarse fodders and the map are a number of our native wild grasses, those chosen for exhibition being among the more valuable of these grasses. Opposite the angle between Florida and Georgia is a circle in which the lawn grasses are exhibited. Below this are found the standard grasses and legumes of America and of Europe. In the extreme southeast corner of the exhibit are some ornamental grasses. To the west of Florida is shown a large number of miscellaneous grasses and forage plants, all of which are of more or less importance to American agriculture. In the portion of the exhibit devoted to standard grasses, particular attention is called to the several varieties of timothy exhibited. These

were originated by Dr. A. D. Hopkins, formerly of the West Virginia Agricultural Experiment Station, now of the Department of Agriculture, and show what possibilities exist in the way of securing new varieties of the standard crops.

CROP ROTATION.

At the request of the Bureau of Forestry of the Department of Agriculture, a system of crop rotation was devised in conjunction with its outdoor exhibit adjoining that of the Bureau of Plant Industry. As the forestry exhibit is intended to illustrate the use of trees as windbreaks upon a prairie farm, a system of crop rotation has been worked out for a general stock and grain farm in the prairie sections of the Middle West. On account of the fact that alfalfa is one of the crops adapted to that section and is also a crop that remains productive for many years, the rotation has been planned with a view to leaving one of the fields in alfalfa for as long a time as may be desired, devoting the remaining five fields to the following rotation: Wheat, meadow, pasture, corn, oats. The alfalfa may be transferred from one field to another, following the oats. The transfer should, therefore, be made during the year the

oat crop occupies the field to which it is desired to transfer the alfalfa.

Some advantages of the particular rotation outlined are: The meadow grasses may either be sown with the wheat or put down in the summer after the wheat crop is removed; the meadow may be used for pasture the second year and affords a good place for manure for the corn crop following. In such a system most of the manure would naturally be put upon the grass land before plowing for corn.

August 13, 1904.