

## PRODUCTION OF DRUG-PLANT CROPS IN THE UNITED STATES.

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**M**EDICINAL plants have been cultivated in the United States for more than two centuries. Only a few decades have elapsed since healing herbs shared with small fruits and vegetables a place in every kitchen garden, and in certain localities their production and sale at one time formed the basis of small industries. In time, however, the numerous convenient preparations obtainable at every drug store rendered the domestic herb garden no longer necessary, and the great development of foreign commerce made it possible to obtain supplies of most crude drugs from sources where the cost of production was less than in this country. As a result, drug cultivation has never become an important branch of agriculture in the United States, and in recent years it has been confined chiefly to the production of relatively small crops of plants yielding volatile oils which are in demand for industrial purposes as well as for medicinal use.

### DRUG CRISIS PRECIPITATED BY THE WAR.

The extent to which this country had become dependent upon foreign sources for its supply of crude drugs was not generally realized until 1914, when the war in Europe abruptly severed long-established trade connections and either greatly reduced or cut off entirely our supplies of many drugs. Prices rose to almost unheard-of figures, and the fear of a drug famine occasioned grave concern in business circles interested in maintaining the supply of medicinal products. The crude-drug situation soon became a popular subject for feature stories in numerous magazines and newspapers, and many people have been led to believe that the cultivation of medicinal plants offers unusual opportunities for large profits.

## DRUG PLANTS CULTIVATED IN THE UNITED STATES.

Although the list of plants which yield useful drugs is large, the number at all suitable for cultivation in this country is relatively small. Many crude drugs are derived from plants which thrive only in the Tropics and therefore can not be successfully grown in the United States. Many other drugs are obtained from native trees and shrubs, and from wild herbs, some of which grow naturally on sandy or stony soil in the woodland shade, some in swamps and marshy places, while others occur as familiar weeds along roadsides, in meadows, and in open woods. When these wild plants are taken from their natural surroundings and placed under the conditions which exist in cultivated fields, they very frequently fail to make a satisfactory growth and often become the prey of insects or diseases from which they are practically free when in their native haunts. To domesticate these wild plants is by no means a simple task; it requires much time and patience, as well as unusual skill both in handling the plants and in supplying the conditions necessary for their favorable growth and development.

Many of the common medicinal plants are still grown in gardens in this country, either as decorative plants or for domestic use in cookery and as home remedies. For the most part, however, the consumption of salable products prepared from these plants is so small that their commercial cultivation would be impracticable, since their production in any considerable quantity would result in overstocking the market. A few medicinal plants, such as peppermint, spearmint, wormwood, wormseed, and tansy, are now grown commercially, chiefly as a source of volatile oils, but the relatively small acreage devoted to these crops is restricted to certain localities which have been found to be especially suitable for their production. Sage is a well-known market-garden product, but there is a small acreage of this crop grown exclusively for the production of the dry-leaf sage, much in demand by sausage makers and spice grinders. (See Pl. XVIII, fig. 2.)

The growing of ginseng and goldenseal is a small but well-established industry in several States, but it is well recognized that each of these crops requires a heavy initial outlay

and that five or more years must elapse after the germination of the seeds before any returns can be expected.

#### CANNABIS AND PEPPERS IN THE SOUTH.

Cannabis is now grown commercially as a side line by a few farmers in South Carolina and by occasional individuals in some other States. Two large drug manufacturers also grow sufficient cannabis for their own needs. Considerable technical skill is required to produce cannabis of a quality that will meet the standard requirements for this drug. Cannabis grown in some localities is deficient in the active principles upon which its value depends, and preliminary tests to determine the quality of the product are therefore always advisable before planting this crop on a commercial scale.

The commercial production of peppers for the drug and spice markets receives some attention in South Carolina, Louisiana, and some of the States of the Southwest. A market has been found for the small species used by pharmacists and for the larger species employed in manufacturing the ground red pepper, such as paprika, which is extensively used as a condiment. In Florence County, S. C., a pepper growers' association has been formed among the farmers growing this crop. The chief objects of this organization are to maintain a pure seed supply and to facilitate the marketing of the product. Through the cooperation thus secured it has been possible to overcome many of the marketing difficulties which were encountered when the crop from this locality was first introduced to the trade.

#### EXPERIMENTS WITH CAMPHOR.

The experiments with the camphor tree begun in Florida about 12 years ago by the Bureau of Plant Industry have led to the recent planting of this tree on an extensive scale for the commercial production of camphor gum. This tree has long been grown as an ornamental in various parts of the South, and in several localities in Florida there are small plantings, now well grown, which were made with a view to the production of camphor gum in marketable quantities. The experience thus far gained indicates that the cost of producing camphor gum from small plantings is prohibitive,

owing to the necessarily heavy overhead charges, and particularly the outlay required for the indispensable distilling plant. The smallest practicable commercial planting has been estimated at 500 acres, while it is believed that a plantation must cover several thousand acres in order to afford the best opportunity for reducing the cost of production to the minimum.

#### DIGITALIS.

Digitalis is one of the important drugs the normal supply of which has been seriously curtailed by the war in Europe. Attracted by the high market prices of these drugs, which include belladonna and henbane, many persons have recently attempted to cultivate them as a source of profit. The number of failures, however, has been relatively very large, either on account of inexperience or because of inability to provide the soil, climatic, and cultural conditions necessary for the successful growth of these plants.

Although very little digitalis is now cultivated as a drug crop, no serious market shortage need necessarily occur, since this plant, escaped from cultivation, grows wild over extensive areas in western Oregon and Washington, where, with proper encouragement, a supply sufficient to meet all domestic needs could be readily collected. For this reason it is doubtful whether present conditions warrant the growing of digitalis on land which might otherwise be devoted to the production of food crops.

#### BELLADONNA.

The continued high price of belladonna since the beginning of the present war has greatly stimulated interest in the production of this crop, but the acreage planted has been greatly restricted on account of inability to secure reliable seed at reasonable prices and because of the high cost of labor and the outlay required to provide the greenhouse facilities desirable for the successful propagation of thrifty plants. Information obtained from the best sources available indicates that approximately 100 acres of belladonna were harvested in this country in 1917. Although it is desirable that the acreage should be increased sufficiently to provide an adequate supply of this drug, it must be borne



FIG. 1.—FIELD OF BELLADONNA.



FIG. 2.—FIELD OF SAGE.

DRUG CROPS UNDER CULTIVATION ON A COMMERCIAL SCALE IN WISCONSIN.

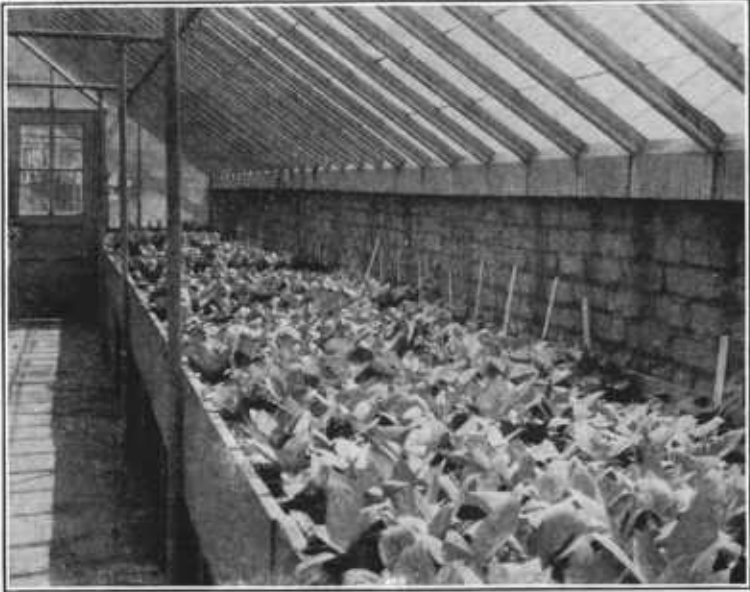


FIG. 1.—BELLADONNA SEEDLINGS IN A GREENHOUSE READY FOR TRANSPLANTING.

Belladonna is grown most readily from seeds sown in flats in the greenhouse in midwinter and transplanted to small pots in which they are handled like tomato plants, so that they may be ready for transplanting in the field as soon as danger of frost is over in the spring. Sowing belladonna seeds in the field or transplanting directly from the seed bed to the field has rarely given good results in this country.

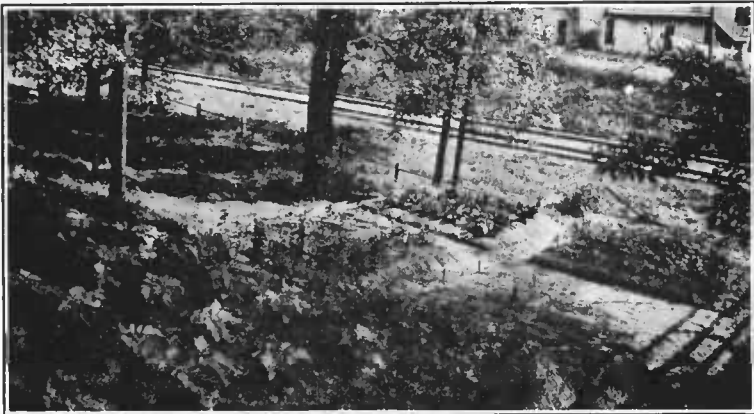


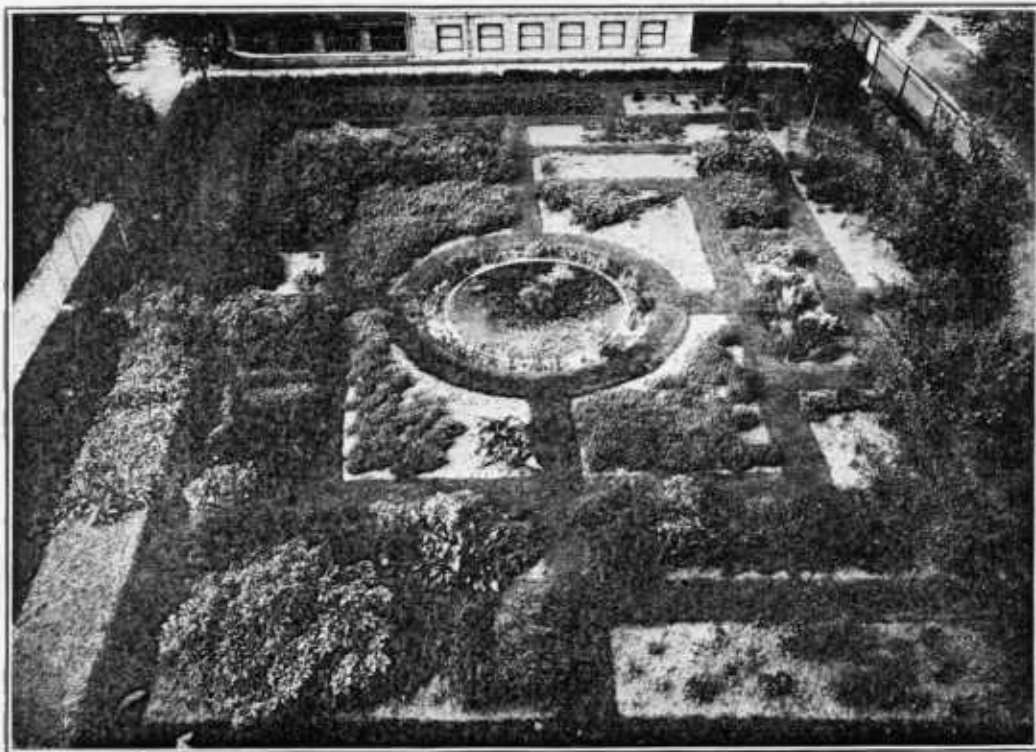
FIG. 2.—DRUG GARDEN OF NATIVE WOODLAND HERBS.

Portion of garden on the grounds of a university. Here the conditions under which woodland herbs grow naturally have been duplicated as closely as possible.



WILD GROWTH OF FOXGLOVE (*DIGITALIS PURPUREA*) ALONG A RAILWAY IN OREGON.

This plant is not grown extensively for drug production in the United States, but it has been widely introduced as an ornamental, and in many localities in Oregon and Washington, where it has escaped from cultivation, it is now found growing as a weed in such abundance that supplies sufficient to replace the shortage due to cessation of imports could readily be collected.



DRUG GARDEN FOR SCHOOL OF PHARMACY.

Drug gardens are now being maintained as a feature of the courses in pharmacy in a number of universities. This illustration shows a garden in which the cultures of medicinal plants furnish material of educational value for the pharmacy course and also serve as an ornamental addition to the grounds of the university.



in mind that all the belladonna needed can be grown on a very few acres. The quantity of belladonna annually consumed in the United States is not definitely known, but it has been estimated by men in the drug trade at approximately 300,000 pounds. Since the average yield per acre of dry belladonna leaves is about 600 pounds, it is evident that the area planted to this crop could not much exceed 500 acres without serious danger of overproduction. Indeed, any substantial increase in the present small acreage, by making more certain an available supply, will naturally tend to cause a material reduction in the market price.

#### HENBANE.

With very few exceptions, recent attempts to cultivate henbane as a drug crop in this country have resulted in failure. Although this plant is occasionally found growing wild in a number of the Northern States, it has not responded readily to cultivation on a field scale. When the seeds are sown in open ground germination is frequently uncertain, and often young plants grown under glass do not survive transplanting in the field. The leaves of henbane usually suffer severely from attacks of the potato beetle, and the crop is very likely to be destroyed if grown within the range of this insect. Since the difficulties connected with the cultivation of henbane are so great, this crop is not a desirable one for persons who can not well afford the loss which would be occasioned by a crop failure.

#### OTHER DRUG PLANTS.

A number of drug plants not mentioned here<sup>1</sup> are grown in a small way in various localities in this country, chiefly to supply a local demand. However, since the demand for them is very limited or a wild supply fairly available, their cultivation on a more extensive scale does not offer much prospect of profit. (See Pls. XVIII to XXI.)

#### HAPHAZARD PRODUCTION UNDESIRABLE.

As a safeguard to the public health, laws have been enacted which require manufacturers of drugs and medicines to

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<sup>1</sup> A detailed discussion of the cultivation of these plants is given in Farmers' Bulletin 663, entitled "Drug Plants under Cultivation," 1915.

maintain certain standards of purity and quality in their products. Official standards of quality have also been adopted for the more important crude drugs in common use. It is quite evident, therefore, that securing a high standard of quality should be a primary consideration in the production of drugs under cultivation. There are, however, good reasons for believing that this end will not be attained through the production of a small quantity of drugs by each of a large number of persons unskilled in drug growing, since the product would be very irregular in appearance and quality, owing to wide variation in the methods used in collecting, curing, preserving, and packing the drugs for market. For the production of a dependable supply of cultivated crude drugs of high quality, reliance must be placed upon well-equipped growers who make the growing of drug plants a special industry and who have the necessary experience in special methods of plant culture, acquaintance with trade requirements, and knowledge of the influence of time of collection and manner of preparation on the constituents of the drug upon which its value depends. If developed along these lines, commercial drug growing in this country promises to become established upon a sound basis for the future, when normal conditions return.

#### PRIME IMPORTANCE OF MARKET.

The person who seriously considers growing drug plants for profit can scarcely give too much attention to the problem of finding a market for his product. Unless the grower lives near a city in which dealers in crude drugs are located, the disposal of a small crop will present many difficulties. If the crop is shipped to a distant dealer the deductions which will probably be made on account of transportation charges and defective quality may so reduce the returns that the transaction will show little, if any, profit. The grower who produces a quantity of crude drugs sufficient to justify the expense of having their quality determined by a reliable analyst, and who is well informed in respect to the condition of the wholesale market, will be in a position to judge the fairness of the prices offered for his crop by the dealers and to protect his interests in effecting a sale.

Since this country has entered into war, many persons have seriously considered growing drug plants, not for profit but for patriotic reasons. This commendable spirit has been especially evident in many of the women's organizations throughout the country. However, it is not regarded as advisable to encourage this form of activity, since the need for women's services is so much greater in the work of food production and conservation and in preparing the various articles so much needed for the aid and comfort of the men at the front. Moreover, unless closely supervised by some central authority, any extensive movement to grow drugs might easily result in the production of far larger quantities than are needed. This would involve a useless expenditure of effort which might accomplish much good if exerted in other ways.

#### DRUG GARDENS FOR SCHOOLS OF PHARMACY.

An important feature of the development of drug-plant culture in the United States has been the establishment of medicinal-plant gardens as an adjunct of the schools of pharmacy of a number of colleges and universities. Unfortunately, the purpose for which these gardens were established is frequently misunderstood. They were designed primarily not as sources of information regarding the commercial cultivation of drug plants, but to facilitate and enrich the courses of instruction in the characteristics and properties of medicinal plants. During the last three or four years these educational gardens have rapidly increased in number and now form a part of the regular teaching equipment of 18 different institutions.

Although these gardens are not devoted to commercial drug growing, nevertheless they can be made to contribute in a very practical way to the public welfare. They afford unusual opportunities for students of pharmacy to acquire a thorough knowledge of many medicinal plants and to be thereby better enabled to recognize inferiority or adulteration in crude drugs. These gardens also supply material useful in the investigation of many problems arising in the necessary revision of the United States Pharmacopœia and the National Formulary, the official standards for drugs.

under the national food and drugs act. Since the improvement of the quality of drugs and the perfecting of the standards by which a high quality of drugs and medicines may be maintained are both questions of national concern, the service which the institutional drug garden can render in attaining these ends is worthy of wider recognition.

Much pioneer work remains to be done in establishing correct methods for the cultivation of drug plants and in determining the localities where the conditions are most favorable for the production of each particular drug. The progress of this work will be greatly furthered by the educational drug gardens, since they are located in widely separated localities and offer unusual opportunities for obtaining data on the behavior of drug plants under very diverse conditions of soil and climate. The obtaining of such data is the necessary preliminary step toward any rational experiments in commercial drug growing.