

Papers Presented to Local Branches

THE CULTIVATION OF MEDICINAL PLANTS IN AMERICA.*

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The object of this article is to direct attention to the work which is being done in the cultivation of medicinal plants in the United States and the progress that has been made during the past few years in both the scientific and practical development of this phase of pharmacognosy. The aims of pharmacognosy are not only to prove the identity and to determine the quality of drugs, but to study the conditions that make for their uniformity and to ascertain the manner in which this uniformity may be maintained. Under existing conditions our studies must naturally begin with the crude dried drugs of commerce. Indeed, the latter are the official articles and the materials from which both isolated principles as well as the preparations containing them usually are made. Time and time again, however, in our studies of these crude substances our inquiries are directed back to the living plant for the solution of the questions in dispute.

Experience has shown that true scientific progress is only possible when we base our pharmacopoeial and other standard work on material which has been derived from growing plants under direct observation. The more we study the growing plant the more we come to the conclusion that our work, in the first place, should begin here, for at this point we have the answer in most cases to every unsolved query and the verification or check on the conclusions drawn from the facts obtained in the study of the crude materials. So that we may say, given the identification of the plant, the locality of its growth, the date of the collection of the drug, and method of its preparation for commerce, we have the principal factors we require for all basic work. With this information we should know much more about the quality of the drug and what the finished preparation would be than if the drug was collected at random at any time of the year and mixed with old and inferior lots or even good and superior grades. It is not too much to expect that eventually every bale of drug will have a label supplying this information and each lot will be kept separate, and if admixture is attempted this will be left to the judgment of the manufacturer and not to that of dealer or jobber.

The pharmacognocist being somewhat familiar with the origin, formation, distribution, and transportation of various plant principles, and it being well known by actual experiments that the amount and character of these substances is influenced by external factors such as climate and soil and possibly even meteorological conditions, is in a position to indicate at least a possible if not adequate explanation for the discrepancies in analytical work and what should be done to

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establish a nearly uniform article. Furthermore, he is also familiar, by virtue of histological investigations, with the nature of the tissues and constituents as they occur in the recently dried drug gathered under ideal conditions, and the very great changes incident to the length of time of keeping, varying conditions of storing, etc., whereby interactions and changes among the substances themselves are brought about. Under existing conditions he who works on the finished product is at a very great disadvantage, whether he is the physician who prescribes the articles or the manufacturer who guarantees this product. In other words, there are changes in constituents in the plant due to conditions which affect its physiological activity and also changes in the drug which affect its medicinal constituents. So that the problem of obtaining a reliable drug is a very complex one. It is out of the question to begin our scientific studies with the crude materials of commerce concerning the origin of which and of whose marketing conditions we have no knowledge. It seems to me that there is but one point from which we can proceed with any degree of satisfaction, if we are to have drugs and preparations the guarantee of which may be assured, and that is that we must have the growing plants under competent supervision and scientific control.

When our forests and woods were full of wild plants and drugs they could be easily collected, there was hardly an incentive to consider the farming of medicinal plants. Now that they are becoming scarcer, the need is especially apparent. But our interest in the cultivation of medicinal plants is not primarily because there is a growing scarcity of the sources of supply, but our increased knowledge of crude drugs leads to the conclusion that, if manufacturing pharmacy is to develop to the same degree as the other branches of industry, it requires that rational methods be introduced if we are to attain the goal which the physician must expect of us. Of course, this requires research and investigation and an honest and sincere cooperation on the part of both pharmacists and the medical profession. The work of the physician is distinguished from that of the pharmacist in that he is dealing with a number of variables. His own diagnosis is not always uniform, his patient reacts more or less variously toward different medicines, and no two patients respond alike toward the same medicine. What definiteness can there be in any of his work, therefore, if in addition the preparation is of varying quality and of different strength whenever it is employed? The one constant in the equation must be the uniform quality of the drug, and this we must endeavor to supply as well as the physician should expect of us.

Without considering what is immediately practicable it is a safe rule, I think, to work from what is theoretically an ideal condition. We see that the theory of today is the practice of tomorrow and that upon the ideal of yesterday the success of the future is based. The tendency of the times is for men to become more thorough in their work at least in some special phase. One of the results of this specialization has been research. Investigations have given us a more complete knowledge and as a result of this we are very apt to be conservative regarding the things we know. Anyone who is a sincere student of drugs, and whether in research or in practical life is working out any problems, must come to the conclusion, sooner or later, that we are handling entirely too many drugs to have any very definite information regarding any of them and this does not apply only to the drugs of limited use but to those which have become the main-

stay of physicians. This, for instance, is seen even in such a widely known drug as digitalis, the investigation of which during the past few years has shown that even in the old world the pharmacopoeial standards are based upon nothing but tradition. Fortunately there is a tendency upon the part of some manufacturers, to concentrate their efforts upon a relatively few drugs and study them in relation to the growing plant throughout different periods of the season. These studies are of very great importance as they will enable the manufacturer to secure uniform preparations and it is very doubtful if this uniformity can be obtained under any other conditions. Should these experiments prove to be as successful as we believe they will be it opens up a future of very great possibilities. The effect of this on manufacturing pharmacy would indeed be most vital. It will establish a new era in this work. Instead of there being a few large firms each handling a thousand or more preparations, of which they can not have any very satisfactory knowledge, there will be a thousand manufacturers, depending of course upon initiative and enterprise, each of whom will make preparations of a limited number of drugs to which he gives a reasonable guarantee and the physician will have the satisfaction of knowing the capabilities of any drug which he chooses to employ.

The condition at the present time that prevails in the United States as well as in other countries on this question of bringing medicinal plants under cultivation reminds me very much of the condition in which aerial navigation was some twenty years ago. I happened at that time to be interested in this question and I found that there were several thousand people who were either on paper or practically engaged in experiments on this subject. No one could dream at that time that aviation would be established on a practicable basis as it is. So we find on the subject of the cultivation of medicinal plants that there are many thousand of inquiries regarding the possibilities of this subject, I myself having received not less than two hundred letters during the past four or five years on this question. These inquiries come from both pharmacists and persons who for one reason or another would like to get back to the country and have some definite work to do. Most of these inquiries are very difficult to answer satisfactorily. For instance, a very common inquiry is this: "I have forty acres, partly woodland and partly open country and would like to use it for the growing of medicinal plants. Kindly let me know what plants to grow." Another will say: "I am very much interested in the possibilities of growing medicinal plants. Kindly give me the names of such plants as you think I can profitably grow, and also tell me how to grow them." Others will ask specific questions such as, "Can ipecac be grown in one of our large northern cities?" Others again will write for the names of books on the subject of cultivating medicinal plants. Some few people ask for seeds or plants and seem to feel that you are honored by their requests for supplies. Many of these requests are from persons who have never had any practical experience in growing plants. They may have had some interest in keeping up a garden but their ideas on this subject are that all that is necessary is to give them some particular direction and they will have no trouble to work it out. Nearly all of these inquiries come from persons who know nothing about the commerce of drugs and have no idea of the problems connected with the disposition, drying, curing, and marketing of them. They pos-

sibly have been thrilled by that wonderful story of "The Harvester," or have read the alluring advertisements of "nuggets of gold," in golden seal. Now it happens that as there is no royal road to learning so there is no hewn path which leads to success in the growing of medicinal plants. It is true that some experiments have been conducted and we have some little general information as to how to proceed with the work, but at the best it is in a primitive stage requiring active intelligent pioneers to bring the subject upon a practical basis. It may be pointed out, however, at the outset that no one can grow medicinal plants without having some training and special education in growing plants. Again, unless one knows a good deal about practical conditions in the drug trade, that is in regard to the drug market and prices paid for drugs, even though one does succeed in making a good crop he may not be able to dispose of it. It would seem that a practical pharmacist would succeed best, even though he lacked a practical knowledge of growing plants. For while he may lack a knowledge of agricultural requirements yet by virtue of the fact that there are so many agricultural experiment stations and colleges where this practical information may be obtained, both through correspondence courses and through special practical courses, frequently given during the holiday periods, this deficiency may be made up. On the other hand, the inside information which gradually must amount to intuition regarding the crude drugs of the market can only come after a rather long practical experience. Of course there will be exceptions in this latter case, as the first successful marketing of oil of peppermint in this country was through the common sense of a Mr. Hotchkiss, the keeper of a country store in the village of Phelps, Ontario County, New York.

As has already been stated it is rather difficult to lay down any rule which one can follow invariably on this subject. In fact, very little work has been done to enable us to draw other than very broad conclusions. The first thing that one naturally would consider is locality. We would, of course, not expect to grow tropical plants in a temperate zone, nor mountainous plants at the seaside, although even here there are exceptions and nothing but experiment can reveal them. Then again, there are plants which only grow in the rich soil of the woods, others will grow in the open and on gravelly banks, where the soil is rather barren. In addition there are plants, such as belladonna and cannabis and sativa which grow only on certain kinds of soil, which do not seem to have been successfully cultivated except in a calcareous soil. This may explain why many attempts to cultivate those plants in certain localities in the United States have not been successful.

It is very important in beginning this work in a new locality for one to make a rather careful survey of the plants that are growing wild or have become naturalized. Within certain limits it would be safe to say that if there are a number of genera of any family well represented, and that if the plant which one desires to experiment with has something of the habits of the species represented, there is a probability that it may be grown successfully. Even this can sometimes be ascertained by the nature of the plants that have been brought under cultivation. For instance, *digitalis* might be grown very successfully in the vicinity of Philadelphia as there are a number of private grounds in which it has become naturalized. By a priori reasoning, if one wished to go into the

cultivation of licorice, the ideal location for growing the plant would be in the west and northwest where the wild licorice, *Glycyrrhiza lepidota*, is indigenous.

It is necessary to study the best ways of propagating the plant one wishes to grow. Sometimes this is by means of seeds, as in the case of belladonna and digitalis; at other times it is by propagation of rhizomes, as hydrastis and glycyrrhiza; or again by rootstocks or prostrate stems as in the mints. Sometimes both seeds and cuttings may be used as in the case of hydrastis.

Plants Grown from Seeds.—Most plants can be grown from seed, and Mitlacher (in Zeitsch. f. a. landw. Versuchswesen in Oesterreich) has given the results obtained with rhubarb, valerian, poppy, matricaria, lavender, hyoscyamus, gentian, pyrethrum, althaea, aconite, etc. When plants are grown from seeds, especially if in a temperate climate where the growing season is rather short, it is necessary to begin the germination of the seed early in the spring. This must be done then in the house or under conditions where there is some protection. These seeds may be sown either in small boxes or in seed pans, i. e. shallow, square flower pots, in which the soil is quite sandy or made up largely of broken granitic rock. The soil must be clean and free from organic matter which is likely to mould. The seeds should not be planted too deep and should be covered with glass so as to condense or hold moisture. Of course where there is the necessary attention as far as keeping the earth moist is concerned, this can be dispensed with. The time required in germination will vary considerably. Many seeds will germinate well within two weeks; usually probably four or five weeks is necessary. Occasionally some seeds, as with roses, may require a year or two before they germinate. The present tendency is to shorten the period of germination in several ways. The simplest, possibly, is to place the seeds in water for 24 hours. When the seed coat is somewhat resistant germination may be hastened by pouring boiling water upon them. Again, some special treatment may be given them as the use of dilute or even concentrated mineral acids. In the cultivation of maté for many years it was found that the seeds would not germinate unless they had previously passed through the alimentary tract of certain birds. Later it was found that the same end could be obtained by placing the seeds for a short time in solutions of hydrochloric acid. F. A. Miller reports that he has obtained good results in the case of belladonna by first placing the seeds for thirty or forty seconds in concentrated sulphuric acid. The germination of seeds may also be hastened by certain mechanical means. This is used when the seed coat is particularly thick and not easily penetrated by the moisture, when if they are large they are filed in one or two places. If they are small they may be shaken with sharp angular sand until the exterior is somewhat roughened.

After the seedlings have a few leaves upon them they are then set out in suitable boxes known as "flats." These are about three inches deep and about two feet square and the soil used should be of a sandy character, containing a certain amount of nutriment. The plants must be watched at this point to see that there is not damping off and loss by reason of the attacks of micro-organisms in the soil.

Should there be a damping off and loss of seedlings then one must study methods for overcoming this. Recently the Department of Agriculture (Carl Hartley, Proc. Society of American Foresters, March, 1912, pp. 96-99.) has

utilized dilute sulphuric acid for this purpose and which I have shown (Proc. American Philosophical Society, April, 1906, pp. 157-163.) is the active principle produced whenever sulphur is used in the greenhouse, and that it is one of the most effective agents for the destruction of insect pests as well as the blights due to fungi and other micro-organisms.

The seedlings are allowed to grow in the "flats," until they have developed a good root system and have three or four leaves. Before placing them directly in the soil out of doors they are acclimated or hardened by placing them in cold frames. This transferal should be done not later than the early part of May. The structure and use of the cold frame is perfectly familiar to the practical gardener. Information regarding the construction of this accessory to the garden can be had of any of the seedsmen. In fact, in many instances, they publish small booklets entitled "Vegetables Under Glass," giving information on the tilling of soil during the entire year, and these booklets can be had at a very moderate figure. Sometimes the plants are removed from the flats and placed directly in the soil in cold frames. This may give a temporary setback to the plants as the roots are more or less disturbed by the operation but if one wishes to continue the experiment in the cold frames, later removing the sash, considerable time will be saved.

If the plants are to be transplanted out of doors it is very desirable that this should be done as soon as possible after the last days of the possibility of frost are likely to occur in any given locality. The plants are arranged in rows and set sufficiently far apart so the maximum crop per acre can be obtained. Usually they are so arranged that weeds may be pulled out and the ground worked over.

The above outline may be used for the propagation of most plants by seedlings but they must be carefully cared for if one wishes to get maximum results. Some plants are rather easily grown if care is taken with their culture, as digitalis and belladonna. Other plants, like hyoscyamus, are with some difficulty cultivated, and very few persons, even seedsmen, are uniformly successful in growing aconite. Several good practical papers have been published on the cultivation of digitalis, namely one by Newcomb (American Journal of Pharmacy, Nov., 1911), and another by Borneman (ibid. Dec., 1912.) Some facts regarding the growing of Hydrastis from seed are given in a bulletin of the Bureau of Plant Industry, U. S. Department of Agriculture, by Alice Henkel and G. Fred Klugh. The subject of growing ginseng from seed is also considered in a bulletin of the Division of Botany, U. S. Department of Agriculture, by George V. Nash. At the present time there is considerable interest in the growing of Eucalyptus globulus and other species of Eucalyptus, seeds of which can be obtained from J. M. Thorburn and Company, New York City. A very valuable monograph on "The Eucalyptus cultivated in the United States" was prepared by A. J. McClatchie, and published as Bulletin No. 35 of the Bureau of Forestry, U. S. Department of Agriculture. In addition to these special plants which have been mentioned there are a large number of plants yielding medicinal products which are grown from seeds and require no more care than the usual garden plants. Among these are calendula, Chrysanthemum roseum, Echinacea, and a number of plants grouped under sweet, pot, and medicinal herbs.

Propagation by Cuttings.—This is a common method of propagating plants. A cutting is a severed portion of a stem having one or more nodes or buds. They are derived from over-ground shoots, as in carnation, rose, geranium, and coleus, or, where the plant produces rootstocks or rhizomes, they are made from these rather than from the over-ground shoots. In propagating plants from rhizomes the latter are cut into pieces, each of which has one or two buds, and these pieces are planted. This propagation by means of cuttings or rootstock is extensively carried on in the cultivation of peppermint. A. M. Todd, who has been growing peppermint on a very extensive scale, has given in some detail the method of propagating this plant in an article published in the Proceedings of the A. Ph. A. for 1903, p. 277. A later article on the cultivation of peppermint in the United States is one prepared by Miss Henkel and published as Bulletin No. 90, Bureau of Plant Industry, U. S. Department of Agriculture. Hydrastis is another drug, the plant of which is commanding considerable interest and is being propagated by means of rhizomes. There are three good articles which treat of the practical cultivation of hydrastis, namely, one by John Uri Lloyd in Proceedings of the A. Ph. A., 1905, p. 307¹; another by Alice Henkel and G. Fred Klugh, in Circular No. 6, Bureau of Plant Industry, U. S. Department of Agriculture; and a third by J. C. Baldwin in the American Journal of Pharmacy, April, 1913.

In the case of both ginseng and hydrastis one-year-old plants are frequently supplied by growers, and while taking everything into consideration this is not desirable, yet there may be conditions where, for experimental purposes, they may be used. It should be emphasized that it is not merely a matter of getting rhizomes or young plants but a very careful study should be made of the soil and light conditions which favor the maximum returns from the crop. The use of manure for increasing the yield of both crop as well as constituents should proceed with a good deal of caution until we know more about the subject.

Collecting and Drying of Drugs.—In many of the text-books on Practice of Pharmacy and on Pharmacognosy will be found general statements with regard to the collection and marketing of plant drugs. Some of the large firms also supply collectors general rules that should be followed. In addition, in nearly all of the drug journals will be found, if one goes over the files carefully, a certain amount of information bearing on these questions. When one, however, is farming drug plants, these questions become exceedingly vital for not only do the constituents vary at different times of the season but there is considerable variation in the amount of drug obtained. This information can be obtained only by the collecting of the drug at different times during the season and assaying the material and making preparations from it. For instance, experiments thus far seem to show that belladonna leaves collected in July and August show a higher toxicity than those gathered in September or October. It is quite possible that after the removal of the leaves high in alkaloidal content in July, another crop can be obtained by October. It is important to bear in mind that with some drugs a very slight difference in time of gathering and manner of drying, a great variation of the active constituents may be found, and this applies

¹See also Journ. A. Ph. A., Vol. 1, p. 5.

especially to the composite flowers, as in the case of insect flowers, and *santonica*. It is only when they are in the bud condition that they show the highest amount of active principle. Again, depending upon whether an article is gathered to be put upon the market or whether the active principles are to be isolated as in the manufacture of essential oils, different methods are to be followed, depending upon the nature of the plant and what previous experiments have demonstrated should be advisable. For instance, while in the preparation of oil of peppermint the herb is first dried, yet in other cases the collected material must be previously macerated in order to obtain the largest yield of oil as with those plants yielding volatile oils containing either cyano-benzaldehyde or methyl-salicylate.

Too much attention cannot be given to the entire question of the harvesting of the crop and proper methods of drying, and of course, again, depending upon the locality, different methods will be followed. There are some localities where at certain times it would be quite possible to dry the drugs out of doors. In other situations it would be necessary to dry them in barns and even in specially constructed drying ovens where artificial heat would be employed. Newcomb has constructed a special oven for the drying of *digitalis* leaves (*American Journal of Pharmacy*, May, 1912, p. 207). The drying of leaves, flowers, and seeds is comparatively simple and can usually be rather quickly performed without any special construction. In the case of roots and fleshy fruits the drying should be under special protection and is facilitated more or less by slicing or comminuting the article.

Relative Value of Drugs from Cultivated and Wild Plants.—For some years it has been a question whether the activity of drugs obtained from cultivated plants is equal to that of those derived from wild plants. We find in some of the foreign Pharmacopœias the specific statement that certain drugs as *digitalis*, belladonna leaves, and belladonna root, must be derived from wild plants. This would naturally lead to the inference that wild plants are better and yet it may be that this provision was made with the intention of securing uniformity in drugs rather than because the materials from wild plants are superior. In 1907 Mr. Rippetoe conducted some experiments in Virginia which showed that cultivated plants of belladonna yielded both leaves and roots which were equal if not superior to the average drug on the market. As this work was done without any particular care and in a limited way, it was more than gratifying to those who were especially interested in this subject. These results were published in an article in the *American Journal of Pharmacy* for November, 1907.

Careful comparative experiments on an extensive scale and for a number of years, show, as has been pointed out in a recent paper by Carr (*American Journal of Pharmacy*, December, 1913), that cultivated plants of belladonna contain a little more alkaloid than do the wild plants. "The percentage of alkaloid found in the leaves and stem of dried wild plants was 0.49, while the average of that found in cultivated plants during the eight years from 1906 to 1913 was 0.57. As other investigators have usually recorded about 0.45 in the wild plant it may be assumed that the plant employed was satisfactory. It therefore follows that the effect of cultivation has been beneficial." The investigations of Sievers also point to a similar conclusion. Sievers has also shown that the percent of alkaloids in the leaves of different cultivated plants is exceedingly large, and that plants high

in alkaloids will continue to breed plants high in alkaloids, so that by mere selection a better commercial article may be produced. While Carr states that nitrogenous manures tend to lower the percentage of alkaloids, and Sievers states that it is difficult to determine the influence of soil and climate on the development of alkaloids, Miller reports (*American Journal of Pharmacy*, July, 1913) having grown belladonna plants with commercial acid phosphate and that the yield of alkaloids is as high as 0.9 percent. Miller (*loc. cit.*) has obtained similar results in his comparative experiments with wild and cultivated plants of *Datura stramonium*.

Coming to the question of the cultivation of digitalis, we have some very interesting results. Hale, for instance, showed that cultivated digitalis leaves yield a much higher potency than those obtained from wild grown plants, and yet he concludes that it is doubtful whether the fact that they were cultivated had anything to do with the high activity. (*Hygienic Laboratory Bulletin* No. 74, p. 28.) One of the most valuable facts brought out in connection with his investigations is that the leaves of one-year-old plants seem to have as great toxicity as those of the two-year-old plants. Hale distinctly states later (*Proceedings A. Ph. A.*, 1910, p. 928), that "first-year leaves are not necessarily weaker than second-year leaves and might be used in preparing assayed digitalis preparations." This means that one does not have to wait for two years before securing a crop, and that practically he can obtain twice the quantity during the same period. Although there are published records of experiments which show that when aconite is cultivated it contains less alkaloids, yet Schweizinger (*Pharm. Ztg.*, 1891, p. 608) has demonstrated that cultivated plants are equally and even more toxic than wild plants.

There may be some instances during this experimental stage which might seem to indicate that certain external conditions, such as climate as well as soil, have a very great influence in the growing of plants of exceptional value. For example, in the case of American-grown cannabis, Eckler and Miller have shown that repeated plantings from carefully selected plants of American and Indian cannabis have failed to yield, when in cultivation near Indianapolis, a product testing over 65 percent of the active value of good Indian-grown drug and that the majority of the plants tested 50 percent and even less. Experiments conducted in Somerville, N. C., by the U. S. Department of Agriculture have shown that in that locality a drug of a somewhat higher degree of potency can be grown, although not quite equal to the plant grown in India. Of course it is well known that the hemp plant is grown extensively for fiber in Kentucky and other parts of the middle West. This may be due in large part to the fact that it requires a limestone soil and in practice the most favorable results are obtained where there is an underlying bed of blue limestone. (*Yearbook*, U. S. Department of Agriculture, 1895.) Sufficient has been said to show that success will attend the cultivation of medicinal plants, and indeed by a priori reasoning on the basis of other agricultural efforts we would expect that medicinal plants could be grown with the same certainty of increasing the yields of any particular constituent or quality that might be desired. Indeed, the history of the sugar beet industry has been duplicated in the work on cinchona, and the same thing can be said with regard to any other plant that man desires to conserve and cultivate.

It will require some years before we can say anything definite about the conditions necessary for the successful cultivation of the many plants that have scarcely been known outside of their native haunts. There are no insurmountable obstacles in this work and there are no intricate processes to be solved before success results. There are merely a few underlying principles that must be adhered to and by persistent effort and with a full understanding of market conditions, success must crown the efforts of any one who undertakes this work. What has been done in the selection of fruits and vegetables can be equally well accomplished with drugs with the proper incentive.

Some Steps of Progress in the United States.—We can scarcely appreciate that while the development of medicinal plant culture has been an exceedingly slow one, yet as a matter of fact, by reason of some of the products being more extensively used in other industries as in the case of hops, it is one of the oldest agricultural industries in the United States. The history of the cultivation of hops is very similar to the experiences recorded with other medicinal plants. For instance, hops were grown in Virginia and in Vermont and Massachusetts. In the former the quality was poor and in the latter the results were very successful. By virtue of the success obtained in the New England states it was in the early part of the last century introduced into New York State and later spread into some of the middle states as Michigan, Wisconsin, Indiana, and Ohio. Since that time the cultivation has been extended to some of the states on the Pacific coast, notably in Oregon, Washington, and northern California.

In the cultivation of peppermint we find a similar history. The industry was first developed in Wayne county, New York. Later it spread into Michigan, Ohio, and some of the southern states and by reason of the more favorable climate and soil conditions in Michigan the industry here has outstripped that of even New York State, being practically abandoned in Ohio and the other states.

The men connected with the Division of Botany of the U. S. Department of Agriculture have always manifested a keen interest in the possibilities of the cultivation of medicinal plants and have done what they could to encourage interest in this subject and the records show that they have supplied information as it might be needed by those disposed to take up the work in a practical manner. The development of the tea industry in North Carolina is one of the most creditable pieces of work of the National Government. Bulletin No. 234 of the Bureau of Plant Industry, on the "Cultivation and Manufacture of Tea in the United States," by George F. Mitchell, should serve as an inspiration to any one contemplating drug culture. If a plant of this kind can be grown successfully here and the technique of manufacture developed to such an extent that the cultivation at Pinehurst, North Carolina, has become remunerative, there is no reason but that within reasonable limits nearly every plant except the strictly tropical ones can be successfully grown in the United States.

Without doubt, the camphor industry will become successful in some of the southern states. Nearly fifty years ago when the price of camphor was very high, the government started some experiments in Florida in the growing of camphor. These experiments were subsequently abandoned as there was hardly any likelihood of any one being interested in this commercially, on account of the low price of camphor. During the past few years, however, interest in this

culture has been revived in Florida and southern Georgia by reason of the fact that frosts destroyed the citrus fruits and the land owners began a search for other possible crops which would not be so injured. Circular No. 12, Division of Botany, U. S. Department of Agriculture, shows just what can be done for the successful cultivation of this tree in the southern states, and some recent experiments of the Government show that by utilization of leaves and twigs there are great possibilities in the economical manufacture of camphor in the United States in spite of the high price of labor.

Owing to the fact that essential oils are used in such large quantities it is quite likely that the cultivation of many of these plants may be made successful, providing at the same time that suitable apparatus for their distillation is also installed upon the farms. The article in the Yearbook of the U. S. Department of Agriculture for 1898, by E. S. Steel, on "Can Perfumery Farming Succeed in the United States?" is deserving of careful perusal by those contemplating taking up any serious work in drug culture.

By reason of the fact that the cultivation of chicory is a permanent agricultural industry in nearly all of the countries having a temperate climate in Europe, experiments have been conducted in the United States in a small way and these have led to the conclusion that it may be successfully cultivated in those states where the sugar beet industry has flourished. The results of this work in the United States were published in Bulletin No. 19, Division of Botany, U. S. Department of Agriculture, entitled "Chicory Growing as an Addition to the Resources of the American Farmer," by Maurice G. Kains. I have elsewhere enumerated the plants which may be successfully cultivated and have indicated in a general way how either plants or seeds may be obtained. (Kræmer's Text-book of Botany and Pharmacognosy, pp. 403-416.)

Summary.—The following is a summary of the principal points which I have attempted to bring out in this article:

1. That there has been very great progress made in the practical cultivation of medicinal plants in the United States during the past five years.
2. That our interest in the subject should not be merely by reason of scarcity of drug supplies, but for a more important reason, viz., that uniform products may be produced.
3. That this uniformity in crude drugs and their products is a principle that should be practically attainable and is fundamental in the development of modern pharmacognosy, pharmacology and therapeutics.
4. That the experiments in the cultivation of medicinal plants which have been conducted in the United States have given us certain information that can be generalized and applied to plants other than those already experimented with.
5. That the following points might be held in mind by those who desire to take up the cultivation of medicinal plants.

In the first place he ought to determine whether there is a market for any drug under consideration, and this can only be obtained by personal inquiry and investigation, as not even any of the government publications show this.

In the next place, if one is satisfied that it is worth while to take up the cultivation of any particular plant, then its geographical range should be studied, both as to where it is indigenous and where it has become naturalized.

The literature should be gone over not only for facts regarding the cultivation and distribution of the particular plant in view but also of some of the related plants.

At the same time that these preliminary studies are made, a careful survey should be taken of the plants which are indigenous and in cultivation in the particular locality where one is proposing to locate the farm.

Then, of course, everything should be done on a small scale at first. If there is no information available then he must, on the basis of the general principles laid down for the cultivation of medicinal plants, proceed with their culture, conducting parallel experiments with propagation by both seeds and cuttings.

When the crop is harvested he must by analytical and other means satisfy himself as to the value of his product compared with the commercial article, and with these facts in hand submit specimens and request quotations from the dealer in crude drugs and from the wholesale druggist. On this basis he will arrange for all future crops with some certainty as to their market value. Experience has shown that cultivated crops command a higher price than the drugs obtained from wild plants even though their superiority cannot always be demonstrated by analytical means. For instance, no one is trying to determine by an analytical process whether any given lot of tobacco, tea, or coffee is of superior value, and yet the competent dealer and the discriminating public even recognize the qualities of the grades that are offered. This is even more marked with the products that have been derived thus far from cultivated medicinal plants and are appreciated by some pharmacists and physicians.

WINDOW DRESSING.*

IRA B. CLARK.

It would seem, in looking at the drug store windows of our fair city, that most of them could not be used for any other purpose than the admission of light and as a repository for various kinds of drug store junk that could not find a resting place in any other part of the store. In some of them, we see nothing but accumulated dust and flies, with a few sunburned packages of some patent medicine, or a set-up display of one of the numerous products of the tobacco trust, which is allowed to remain in the window week after week, and in still others, nothing at all.

To the majority of druggists, dressing a window is a big bugaboo with long horns and you frequently hear such expressions as this: "I know nothing about dressing a window" or, "It takes an artist to make a good window display," or "It takes too much time." Now I insist that no special artistic ability is required to arrange a window display that will pull trade right into your store. What is needed, however, is sufficient energy to do the work, a little application of gray matter, and judgment in the selection of seasonable and profitable articles of merchandise. The time required to do the work will be well and profitably spent.

*Read before the Nashville Branch, Dec. 11, 1913.