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COLUMBUS, OHIO,
August 10, 1918.

THE COMMERCIAL GROWING OF SOME EUROPEAN DRUGS IN MICHIGAN.*

BY E. L. WOODHAMS.[1]

In farming operations, as in other lines, the unusual attracts attention. People from other parts of the country who pass through our farms remark that "they didn't suppose peppermint was raised on a farm—they supposed it 'just grew' somewhere." Yet to the local resident, city man or farmer, there is nothing unusual in mint farms—he has seen or heard of them all his life. Climate and opportunity have united to make Southern Michigan and Northern Indiana the home of mint culture. Yet we receive many letters every year from farmers all over the country, inquiring about mint raising; the unusual evidently appeals to them, too.

We presume that it was partly for the same reason that we were favorably inclined toward commercial drug growing, when our Assistant Superintendent, who had had several years of experience growing drugs in England, imported some belladonna and henbane seed and urged that we attempt the culture of these European drugs. We began work in the spring of 1911, so that we had had four seasons' experience with their culture in the Michigan climate before a scarcity appeared and stimulated interest in the domestic growing of these heretofore imported drugs. This experience was invaluable.

There would be but little interest in a report of the culture of these drug plants if all were clear sailing. The cultivation of belladonna and henbane on a commercial scale is, however, new to this locality, and we have found that factors enter into their culture here in Michigan which are unknown in England. Hence it occurred to us that mention of some of the difficulties encountered might be of interest.

The first trouble appeared when we attempted to secure seed of high purity and germination. What little could be supplied by American seedsmen was almost without exception worthless as regarded germination. We decided to raise our own seed, and after two or three seasons' experimentation we found we were able to produce seed of 100 percent purity and over 90 percent germination. This involved the careful selection of parent seed plants and the subsequent propagation of these particular strains, but it was well worth the trouble.

Considering the plant in the order of growth, we fully agree with other investigators that belladonna and henbane are even more subject to the attack of the

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* Read before Scientific Section, A. Ph. A., Chicago Meeting, 1918.

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Colorado potato beetle than is their near relative, the potato plant itself. The beetle can be fought when the plants are young by means of the ordinary poisons, but poisons surely must not be used when the plant is approaching harvest. Then it becomes necessary to resort to the old-fashioned pan containing a little kerosene, and a stick. This is a rather tiresome procedure on a hot day. The potato beetle is unknown in the drug districts of England, unless it has been introduced very recently.

Another insect enemy is a tiny black "jumping flea beetle"—its scientific name I do not know—which voraciously attacks the plants almost under ground. If present in sufficient numbers a planting will be destroyed over night, and one might think the seed had failed to germinate, whereas it had sprouted and been eaten. It is very difficult to combat this pest, the use of new fields being the best remedy.

The newest insect to trouble the drug plants is the aphis, or potato louse, which according to our observations generally attacks the plants only in the greenhouse. But this year the Michigan Agricultural College has issued warning against this insect, as it is working on the potatoes throughout the State and it has troubled our drug plantations to some extent. Nicotine and "Black leaf 40" sprays are recommended by the College to control this pest, but we have not had any experience in killing it outdoors.

So much for the insect enemies of these drug plants—we have found that the proper use of insecticides, extremely heavy fertilization and clean fields in good tilth all help to give the plant a "running start" which aids greatly in the successful production of the drugs in question.

Another problem that confronted us was that of sufficient drying capacity to handle a commercial area. The first year that we had a large acreage of belladonna we were forced to use all the available shed room on our farm to dry the herb. The time consumed was over a month, as the weather was cool and rainy in the fall, consequently the color of many of the leaves was brown instead of green. We then planned and erected a steam-heated, electrically-lighted dry kiln, which consisted of four rooms or separate kilns which could be filled in rotation. This kiln had a drying area of over 40,000 sq. ft., and has since been extended. The temperature is kept constant by pressure regulators, and a system of ventilation is provided so that fresh hot air is passed through the herb continuously. The result is that the herb is in the kiln and the drying process begun before the plant has even wilted; and the finished product can be baled and enclosed in heavy cardboard cartons within 48 hours or less from the time it is growing in the field. The color is as perfect as it was in the field, and we feel sure that the darkness during drying, as well as the rapidity with which the material is handled, prevents the enzyme action which is supposed to cause the discoloration of the herb so noticeable in slowly dried leaves.

There is one other difficulty which we have encountered, of as much interest to the consumer as to ourselves. We refer to the extreme difficulty of securing comparable analyses, which are necessary if the buyer and seller are to agree. We have endeavored to investigate this matter very thoroughly, both for the protection of our customers and for our own satisfaction, and we may briefly summarize our findings as follows:

We believe that the prime cause of the discrepancies in analyses, which seem to occur even when the very best chemists are employed, is *not* in the slight difference in methods, nor in the technique of the analysts, but almost wholly in the method of selection of the sample from the bulk goods which it is to represent.

First taking the case of foreign drugs—they are imported in large bales of about 400 pounds, I believe; these are *for the most part not* cultivated plants, but are "weeds" as we would say in this country. The peasants in certain districts gather them and sell to dealers, who in turn may resell them, so that when the bale is finally exported from Europe it may contain leaves in all stages of growth from thousands of different individual plants grown under various soil and climatic conditions. Add to these the usual amount of chicken feathers, sunflower seeds, dirt, weeds and even adulterants found in the foreign drugs, and you will have some idea of the difficulty of securing a fair sample. The very thorough work of Dr. W. W. Stockberger and Mr. Arthur Sievers, of the Department of Agriculture, has shown that each belladonna plant has an alkaloidal content peculiar to that plant and that this peculiarity is largely transmitted to its descendants, so that the individual plants may vary from 0.10 percent to over 1.00 percent alkaloids. So it may readily be seen that the analyst, although trying as honestly as he can to secure a fair sample, may secure four different results from as many parts of a bale. In fact, one of the largest drug firms in the United States recently told us of having exactly this experience. The only fair way to do is to mill the whole bale, which is hardly practicable unless the bale has been purchased.

Turning to the domestic product, we find the problem much easier. In the first place, all plants are grown in one place at the same time, so that the stage of growth is practically uniform. In our work the seed that we use has been bred up from a very few plants of known origin in which the alkaloidal content is equal to or higher than the U. S. P. requirements. As regards dirt and foreign matter in the product, we try to keep our fields absolutely clean and free from weeds, and in addition the plants are cut singly by hand, thus eliminating any weeds that are hidden under the plants. When the herb arrives at the kiln from the field it is inspected and all dirty or discolored leaves sorted out.

Then you may inquire, "If all the factors which make the foreign bale variable have been taken care of, why not take a sample at random, say 4 ounces, from the 50-pound bale and assume that this will be the average of the bale?"

There is, however, one other factor present in both the foreign and domestic product which we did not mention in the discussion of the foreign bale, as in that case it was overshadowed by the other variables; but in our domestic product, which may be homogeneous in other ways, it assumes a position of paramount importance in the selection of a fair sample. This factor is the variation in the percentage of alkaloid present in various parts of any individual plant.

We have the analysis of a complete henbane plant as follows:

The flowering tops comprising 8% of the weight of the plant.....	0.135% alk.
Large leaves on main stem comprising 18½% of the weight of the plant....	0.113% alk.
Small branchlets and leaves comprising 41% of the weight of the plant.....	0.123% alk.
Stalks and coarse leaves comprising 32½% of the weight of the plant.....	0.102% alk.

This particular plant was almost double the U. S. P. requirements, but still greater differences have been found between the various parts of plants in other instances, but this instance shows the possibility of inaccurate results should a small sample be taken from a large bale, in case the chemist selected more than the correct proportion of any part of the plant.

We have adopted the following method as giving the fairest result and have used it satisfactorily during the past year: Suppose 1000 pounds from one field is harvested at one time; this is dried and placed in bins where it is thoroughly and carefully mixed until it is uniform. Next, 20 bales of 50 pounds each are pressed; a whole bale is then taken at random from the 20, milled and analyzed. This analysis is then rightfully assumed to show the content of the 1000-pound lot in question. This method is the only one that we have been able to devise which is fair to buyer and seller and which will allow comparable assays.

As to the future of the commercial drug growing industry in this country, we believe one man's guess is as good as another's. There are so many factors entering into the proposition, due to and arising from war conditions, that we really do not have a very firm opinion as to the outcome. We do not believe the small farmer will ever go into the drug business extensively—it requires too much capital for dry kilns and equipment, much more of an investment, for instance, than is required to distil mint. The small farmer is loath to enter a new field. As regards the small "back yard" grower, we do not believe he will ever grow enough to affect the market. The supply then, if raised in this country after conditions are normal, must come from the farms of pharmaceutical houses that are vitally interested in the production of good drugs or from the farms of the large growers who have sufficient land and equipment to warrant the continuance of the industry.

This brings us to the question of whether, after the war, the American drug houses will be content to go back to the pre-war quality of European shipments or whether they will demand the high quality drugs that they themselves have been raising on their experimental farms and such as the American growers have shown them can be successfully produced in this country under laboratory control. If American drug houses want "quality," the American drug industry will, we believe, survive after the war.

Addenda—June, 1919.

Since the above paper was submitted, the war has ended and a slight extension may be considered in order.

The European drugs which were imported previous to 1914, were, according to our best information, largely gathered by the peasants in Austria and Russia in a very crude way. Very little was done in Europe in the way of scientific cultivation except in England where several firms maintained small acreages of belladonna and henbane. These two drugs also grew wild in England and were gathered. England seldom, if ever, had a surplus to export—in fact, continental herb was sold in large amounts in England.

We firmly believe that the United States could compete in cost of production with their European competitors, despite the lower standard of living, if the competition were on an equality basis. However it is not possible to compete if

the European product is, in the future as in the past, to be simply "gathered" from waste places where there is no more production expense than there would be in this country in the gathering of rag-weed along the roadside.

Drug houses of the highest class, who aim to use the very best raw materials that the market affords, will doubtless be as anxious to continue the use of the higher grade American products as the American growers are to supply them. Other firms who desire the foreign drugs because they are cheaper, may not be interested in seeing the American industry protected. It is certain that the cultivated drug cannot be raised in this country as cheaply as the foreign wild drug can be gathered.

The Senate Committee is at present holding hearings covering this phase of the question, and it is the writer's opinion that if a moderate duty is placed on the importation of foreign drugs, sufficient to allow the high grade American *cultivated* herb to withstand the competition of the *wild, uncultivated* European herb, then the American drug industry can survive.

AN EXPERIMENT WITH COMPOUND TINCTURE OF BENZOIN.*

BY J. C. AND B. L. DEG. PEACOCK.

This paper is entitled "An Experiment on Compound Tincture of Benzoin" because it does not essay to be an exhaustive study. The experiment is limited to a single use of this renowned remedy. Indeed a study of any one of its ingredients must appear to be a life's work to those who read the descriptions of these drugs and the tables of their contents. There is, however, an aspect of similarity between the constituents of two of the ingredients, tolu and storax, which, although not the reason for this paper, did tend to make the subject more worthy of consideration. The report that no true storax was to be had at any price suggested the experiment; and as the pharmaceutical use of storax is chiefly for preparing Compound Tincture of Benzoin, the idea occurred to compare it with tolu under the conditions to be described.

The addition of compound tincture of benzoin to boiling water and the use of the vapor therefrom to treat the throat in certain conditions is the circumstance under which we experiment. This matter perhaps seems too well known to even bear mention. But, strange to say, like so many of the simple things, the exact products of this process do not appear to have been reported in the pharmaceutical lore of this "old-timer." Instead it appears to have been presumed that he who knows what is in the ingredients infers from their nature that certain substances pass off with the steam, and being carried by it to the throat have their effect. The writers have been unable to find any reference to the vapor having been examined, and realizing that it would be of interest to learn more of the matter, especially as regarded the necessity for storax, they sought to examine the vapor, by imitating the conditions under which the treatment is applied, through the use of a retort and condenser.

Accordingly, a half teaspoonful of Compound Tincture of Benzoin was poured into a pint retort half full of boiling water, and as would be expected, an intense

* Read before the Section on Practical Pharmacy and Dispensing, A. Ph. A., Chicago meeting, 1918.