

TABLE 2.

Experiment No.	Strychnine in 50 mls.	Strychnine found.	%.	No. shakings.
1	0.0376 Gm.	0.0360 Gm.	95—	5 <sup>b</sup>
2	0.0376 Gm.	0.0375 Gm.	99.9	7
3	0.0182 Gm.	0.0182 Gm.	100	7
4	0.0182 Gm.	0.0176 Gm.	97	5 <sup>b</sup>

## CONCLUSIONS.

The method, as shown by the results of the experiments tabulated above, is certainly reasonably accurate, in the hands of the writer at any rate. A comparison of this method with the other three methods is now being carried out by the writer, who hopes to present the results of his comparative study in the form of a paper at an early date.

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## COMMERCIAL DRUG GROWING IN THE UNITED STATES IN 1918.\*

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When some historian of the future writes the history of drug plant growing in the United States, the eventful year 1918 will stand out in sharp relief as a period of readjustment of popular opinion with regard to this important subject. The cumulative effect of the unusual conditions occasioned by the great war cannot yet be fully determined, nevertheless there is much positive evidence that certain important changes have occurred in the drug growing industry. By no means the least of these is the partial emergence of drug growing from the romantic phase which has been so pronounced during recent years into one which is more prosaic but certainly far more sensible and businesslike. Another change, brought about for the most part by bitter experience, is the growing realization that drug growing as a business proposition does not differ essentially from other types of agricultural enterprises, particularly in respect to crop risks and marketing problems, or if any appreciable difference is to be noted it is in the direction of greater uncertainty as to the successful outcome.

Stimulated by the high price levels reached by many important crude drugs during the early period of the war, or hoping thereby to render a patriotic service to our nation in a time of need, the commercial production of crude drugs was undertaken by numerous individuals who had little or no experience in this particular enterprise. In a regrettably large number of cases the outcome was very disappointing although this contingency had been foreseen and publicly predicted in advance by those whose previous experience placed them in a position to judge the situation fairly.

The situation with respect to some of the most important drug crops grown in 1918 fully demonstrates the danger of overproduction regarding which much

<sup>b</sup> After last shake-out still gave a decided precipitation with Mayer's reagent.

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has been said in recent years. The growers of belladonna for example although not very numerous found that the product from the relatively small acreage planted was more than the market would readily absorb, and it was soon currently reported in the trade that there was a heavy overproduction of the drug with the natural result that the price rapidly declined to a figure that was discouragingly low to the grower. Producers of cannabis and digitalis also experienced some difficulty in finding a satisfactory market although price fluctuation in the case of these two drugs was not very great.

From such information as it has been possible to secure, it appears that marketable quantities of the following annual drug crops were produced under cultivation in this country last year: Belladonna, henbane, digitalis, cannabis, calendula and sage. Senega, mandrake, pink root, valerian, cypripedium and blood root were also grown but in negligible quantity. As in former years the following oils were produced from cultivated plants: Peppermint, spearmint, wormwood, chenopodium and tansy. To obtain accurate data on all these crops was practically out of the question for a number of reasons. The individual growers are widely scattered over the country, thus making a personal canvass impossible. The only recourse was to send out written requests for the desired information but as complete lists of the growers of various drug plants are not available it is practically certain that many growers were not called on for a report. Moreover, another element of uncertainty was introduced by the fact that no reply was made to many of the requests sent out. It must therefore be distinctly understood that the figures given later in this report are to be taken with certain reservations and that with two or three exceptions, they merely represent the reported production which may be far from the actual production.

#### BELLADONNA.

The war-time interest in drug growing was chiefly centered on belladonna, and the success attained by some growers in 1917 was reflected in the increased acreage planted in the year following. The general distribution of the acreage and the production are shown in the accompanying tabulation:

State.	No. of growers.	Average.	Production in pounds.				
			Herb.	Leaves.	Stems.	Root.	
Michigan.....	13	45.5	20950	10075	2550	9825	
Indiana.....	7	32.73	2944	11114	3680	2445	
New Jersey.....	4	34.75	26725	340	25	5050	
Pennsylvania.....	6	41.75	1500	11258	1585	3017	
California.....	24	95.63	37675	20984	5500	1430	
Maryland	}	6	23.35	1256	5540	2373	510
Virginia							
West Virginia							
Illinois							
Wisconsin							
Oregon							
Iowa							
Total.....	60	273.71	91050	59311	15713	22277	

This tabulation which represents reports from 60 growers and an area of 273 acres, or an average of 4.5 acres for each grower, shows an average yield of approximately 600 pounds of belladonna herb (including leaves and stems), per acre.

From 136 acres twenty-four growers harvested 11.13 tons of root, an average production of 164 pounds of root per acre. Summarized, the total production for the year was approximately 83 tons of herb (including leaves and stems), and 11 tons of root.

The average yield by states expressed in pounds per acre was as follows: New Jersey 780, Michigan 703, California 671, Indiana 542, Pennsylvania 343. These data are insufficient to form a basis for any sound conclusions as to the section of this country most favorable for the cultivation of belladonna. It can be stated, however, that so far the results in California have been less favorable than were expected. Mr. N. R. Mueller of the Office of Drug, Poisonous and Oil Plant Investigations, visited practically all of the plantings of belladonna in California during the summer and fall of 1918 and found that in addition to the acreage reported above, about 35 acres planted to belladonna had not been harvested on account of failure of the crop. He also found that the potato stalk borer, *Trichobares trinotata*, had become a serious pest of belladonna, especially on plantings of second year growth, and that the ravages of this insect had introduced a large element of uncertainty with respect to this crop. Indeed the opinion has gained ground among growers that the cultivation of belladonna in southern California will be greatly reduced if not abandoned in the near future unless some effective means can be found to prevent the destructive action of the potato stem borer on this crop.

#### CANNABIS.

During the year under consideration, the quantity of cannabis produced was sufficient to meet market demands for the American grown drug. The reported acreage and production were as follows:

State.	No. of growers.	No. of acres.	Production in pounds.
Illinois.....	1	20	30,000
New Jersey.....	2	9	5,350
Pennsylvania.....	1	3.75	4,300
South Carolina.....	13	29.50	10,000
Virginia.....	1	20	10,000
Total.....	18	82.25	59,650

Owing to the different methods employed in harvesting and preparing cannabis for market, no just comparison can be made of acre yields in the different geographical locations. The South Carolina cannabis is produced under the general supervision of a representative of the Bureau of Plant Industry, and every precaution is taken to keep all of the drug marketed from that state up to the pharmacopoeial standard. After the flowering tops are harvested they are thoroughly cured under cover, then worked over by hand and all the stems and large foliage leaves removed. This process gives a drug of high quality, but greatly reduces the net or marketable yield per acre, since the portion rejected often equals or exceeds in weight the part which is regarded as suitable to offer to the drug trade.

#### DIGITALIS.

Judging from the reports received the cultivation of digitalis does not as yet appear to be established on a commercial basis. Small areas of cultivated digitalis,

usually from one-half to one acre in extent, were harvested in Pennsylvania, South Carolina, Washington, California and some other states. The figures which are available do not warrant even an approximate statement of the probable production but there is little doubt that with proper encouragement the quantity necessary to satisfy domestic needs would be readily available. In some sections the yield of the cultivated drug appears to be quite satisfactory, and unless the cost of production is excessive the crop should show a profit to the grower.

In addition to the strictly commercial plantings, digitalis was grown on a relatively large scale at several of the more important drug gardens which are maintained in connection with a number of Schools of Pharmacy. Several tons of digitalis leaves and a quantity of seed was also collected from plants of wild growth in the general region of the Coast Range of mountains on the Pacific Coast. The possible competition of this wild material is a factor that must be taken into account in the future development of the production of digitalis under cultivation.

#### CALENDULA.

Calendula continued to receive the attention of a few growers in 1918, notwithstanding the failure of the market to recover from the decline in prices that was precipitated in 1916 by the importation of this product from Japan. The reports at hand show that in 1918 two acres of calendula were grown in New York, six acres in Massachusetts, and a number of small plots in Los Angeles County, California. Some growers marketed the florets only, while others were able to sell the whole flowers in both the fresh and the dried state. Since these were not distinguished in the reports, no figure can be given for the total production.

#### SAGE.

Although sage is widely grown as a home and market garden crop, a comparatively small number of growers have attempted quantity production for the spice trade. Efforts in this direction have met with moderate success in Wisconsin, Missouri, Ohio, Massachusetts and South Carolina. A total of 12 growers from these states report the harvesting of from 8 to 10 acres of sage with a production of from 9,000 to 10,000 pounds. The yield per acre ranged from 300 to 1,250 pounds, the lower figure being largely due to unfavorable weather conditions which prevailed in some sections during the early part of the year.

#### HENBANE.

The cultivation of henbane has continued to be a very difficult problem for most growers. In the year under consideration attempts were made to grow henbane in a number of states but with little success except in Michigan, where one grower at least has been able to produce a good crop. The great decline in price from former high levels and the difficulties encountered in the production of henbane seem likely to retard progress in the cultivation of this crop at least for the immediate future.

This brief, although incomplete résumé of the situation, may serve to show something of the extent of the present development of the commercial cultivation of medicinal plants. It is evident that all of these enterprises are small and that in many cases they can hardly be regarded as having passed the experimental

stage. The experience of the past few years seems more than ever to point out the futility of depending upon a large number of amateur drug raisers to supply market demands. From the standpoint of the drug manufacturer, a constant and reliable source of supply is of primary importance, and it is believed that the interests of both producers and manufacturers will be best conserved by restricting drug growing so far as possible to those individuals who are in a position to undertake the work on a permanent business basis.

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### FERRUM REDUCTUM.\*

BY CHARLES H. LAWALL AND J. W. E. HARRISSON.

The standards for Ferrum Reductum were changed in the U. S. P. IX to provide for greater definiteness and accuracy, but were not made any more rigid than were the requirements of the U. S. P. VIII as regards the more important tests.

The test of greatest importance from the standpoint of the prescriber is the test for limit of sulphide.

Sulphide in reduced iron originates in the process of manufacture through the fact that the ferric oxide has not been entirely freed from soluble sulphates. These sulphates in the process of reduction are changed to sulphides and enter into combination with the iron to produce ferrous sulphide. The objectionable character of this impurity will be appreciated when it is realized that Ferrum Reductum containing larger amounts of sulphide than permitted by the U. S. P. test, will give evidence of the fact by unpleasant eructations of hydrogen sulphide when the reduced iron comes into contact with the hydrochloric acid of the gastric juices.

When the present standards were framed prior to 1914, there was no difficulty in obtaining supplies of proposed U. S. P. quality nor was there any protest on the part of any manufacturers of inorganic chemicals, who were consulted in framing these standards, that the requirements could not be met. Shortly after the U. S. P. IX became official in 1916, it became apparent that Ferrum Reductum of official quality was not being supplied by the manufacturers and wholesalers. Instead, an article was furnished which either bore the anomalous or misleading subterfuge "technical" so often resorted to by chemical manufacturers or it was stated on the label that "it contains sulphides in slight excess of the U. S. P. limit."

While the responsibility lies primarily with the wholesalers and manufacturers for furnishing a substandard article which is used for no other purpose than in medicine, there is also a lack of watchfulness evident on the part of the retail pharmacist who accepts and uses such an inferior article in filling prescriptions.

If every pharmacist would have returned to the manufacturer each package so labeled and would have followed this action with a vigorous protest, it would not have taken long for American chemical manufacturers to have realized their

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