1910.
72. Wm. H. Kendell. Palm sugar, vinegar and copra oil. Midland-Review, 44, p. 78.
*73. R. C. Roark. Oil from Mentha citrata.
74. John Swenholt. Oil of celery seed. Midland-Review, 44, p. 220.
75. S. K. Suzuki. Hydrothymoquinone and oxidation products from Monarda fistulosa. Midland-Review, 44, p. 342.
76. W. H. Kendell. Currant wine. Midland-Review, 44, p. 478.
77. C. Lefebvre and N. Wakeman. Oil of Monarda citriodora. Midland-Review, 44, p. 526.
1912.
*78. R. C. Roark. An unusual oil of wormwood.

THE IMPROVEMENT OF MEDICINAL PLANTS.†

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Certain suggestions were made before the last meeting of the Academy for the possible improvement of valuable medicinal forms through the application of breeding methods. Some of these suggestions have been carried out during the past summer upon experimental plots of belladonna, henbane, stramonium, digitalis and cannabis. The results, though only tentative, are extremely encouraging, and indicate a means of obtaining not only greater yields of the resultings drugs, but better and more reliable medicinal products.

Belladonna has shown great uniformity in morphological characters, but considerable variability in the percentage of alkaloids in selected plants. In a comparatively small number this variation was found to be over 50 percent, or from 0.52 percent to 0.87 percent total alkaloids as found in the highest and lowest yielding individuals. Much has been said concerning the variation in total alkaloids as influenced by various conditions. In fact, some experimental work has been done upon the influence of such factors as food elements, light and shade, soils, meteorology, etc., upon the production of alkaloids and other active principles. It now seems apparent, however, that before such data can have any scientific bearing, or be utilized as a means of following the influence of given factors, uniform strains of the plants under investigation must first be obtained. This apparent necessity is due to the wide variations which have been found to exist between the individuals of a given group which have been grown under uniform conditions.

A group of individual plants varying over 50 percent when grown under uniform ecological conditions cannot be expected to behave uniformly when grown under varied conditions. Differences no greater than 50 percent have been reported as being due to certain external influences as affecting all plants upon a given area, while according to recent individual plant investigations, such an area might produce plants varying this much or more among themselves, and representing at the same time any possible mixture with reference to yield. It seems necessary, for this reason, to first obtain a strain of the form under investigation, the individuals of which will react uniformly to certain external conditions. To investigate this point, plants of known alkaloidal yield are being propa-

*These studies will appear in later issues of this publication.—EDITOR.

†Read before the Botanical Section, Indiana Academy of Science, Nov., 1912.

FIG. I. COMMERCIAL TEST AND BREEDING PLOT OF BELLADONNA.
Experimental Farm, Eli Lilly & Company, Indianapolis, Indiana.

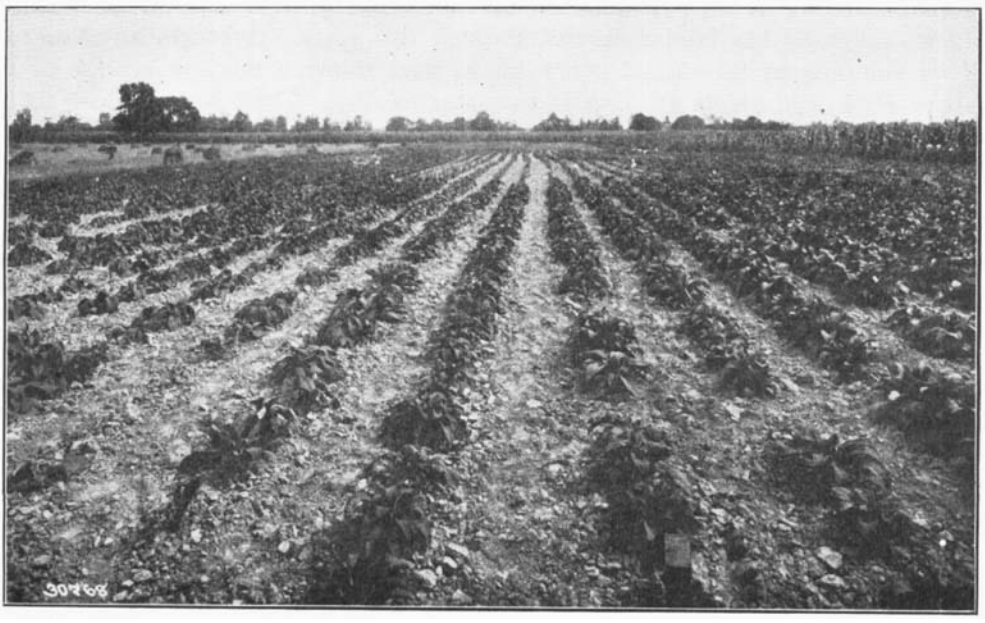

FIG. II. COMMERCIAL TEST PLOTS OF VARIOUS SPECIES AND VARIETIES OF DIGITALIS.
Experimental Farm, Eli Lilly & Company, Indianapolis, Indiana.

gated both from inbred seeds and from vegetative cuttings. The progeny thus produced is being grown under the same conditions as the parent plants, as well as under widely different conditions. The alkaloidal yield of these plants will later be taken as a means of determining the results of the various treatments.

The highest yielding individuals from all groups examined are immediately selected as parent plants for possible high yielding strains. The propagation of these favorable individuals is continued throughout the year by means of greenhouse and cold-frame accommodations, and are tested as rapidly as sufficient material becomes available.

The production of henbane, even upon a small experimental scale, has proven extremely difficult. This difficulty is largely due to the ravages of insects, although cultural difficulties with this plant are not uncommon. It will not reproduce itself from open field sowings and transplants with uncertainty. However, a small number of biennial plants were grown and found to test 0.089 percent total alkaloids at the end of the first season's growth, while commercial drug has only averaged 0.067 percent for the past year. The Pharmacopoeia requires that this drug be collected from plants of the second year's growth. The above figures indicate that it may be entirely unnecessary to grow this plant through the second year to obtain a high yield of alkaloids. The annual form was again observed and though no tests were made, an abundance of seed was obtained from which plantings will be continued. The appearance of this annual form in many plantings of henbane of supposed biennial origin has led to much dispute. Its investigation is necessary from this point of view as well as the possibility for developing an annual form which would possess many cultural advantages over the biennial.

The selecting of high-yielding stramonium plants upon a basis of their contained alkaloids has been continued through two years. Averages as obtained from the progeny of selected parent plants have shown a marked increase over those from wild plants growing in the same locality. These averages are 0.61 percent, 0.50 percent, 0.60 percent and 0.64 percent from Datura Stramonium L., and 0.49 percent, 0.54 percent, 0.62 percent and 0.68 percent from Datura tatula L., as compared with 0.28 percent from wild plants of Datura Stramonium L. and 0.42 percent from wild plants of Datura tatula L.

Thirty-two forms of the genus Digitalis are under cultivation. These consist of all the species and varieties so far obtainable. These must first be tested for identity before any extensive breeding operations can be performed. Physiological tests have been made which indicate great differencs in the toxicity of some of the more accurately named species and varieties. Though more strictly biennial in habit, it has been found possible to bring a number of the varieties into flower the same year from seed, thereby shortening any breeding operations by one year.

It has been interesting and valuable to follow the effects of Indiana soil and climate upon the medicinal value of Cannabis Indica. This is an imported drug consisting of the flowering tops of Cannabis sativa L. It always contains more or less seeds of high percentage germination. Repeated tests have been made upon material obtained from plants grown from seed found in shipments of high-testing drug. Without exception these tests have shown a decrease of from

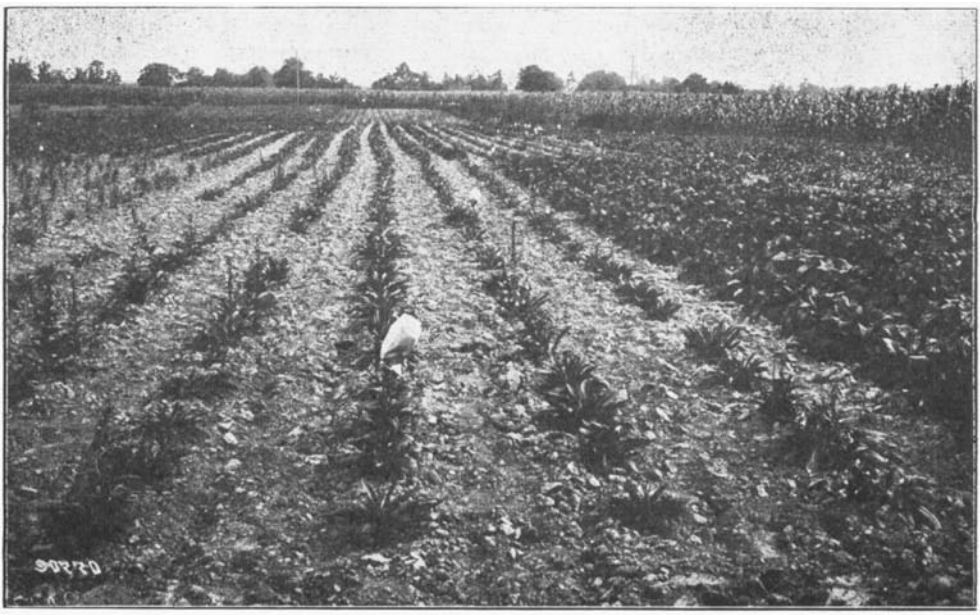

FIG. III. BREEDING PLOTS OF DIGITALIS.
Experimental Farm, Eli Lilly & Company, Indianapolis, Indiana.

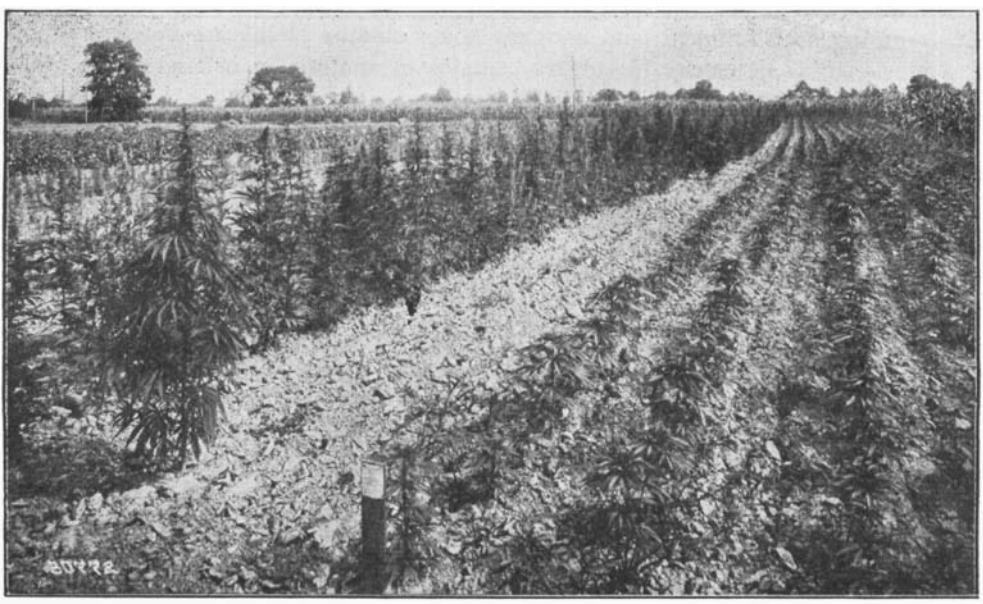

FIG. IV. GROWING CANNABIS FROM DIFFERENT GEOGRAPHICAL SOURCES.
Experimental Farm, Eli Lilly & Company, Indianapolis, Indiana.

40 percent to 60 percent in value as compared with the original shipments from which the seeds were obtained. One strain has been continued under cultivation in the same locality and upon the same soil for four consecutive years, and its value as indicated by physiological tests has fluctuated between 40 percent and 65 percent. This fluctuation has been intermittent, and not in the nature of a regular annual increase or decrease. During this time, however, a marked improvement has resulted in the size and character of the inflorescence. By selection, this has become heavier, more compact, larger and less leafy. A dwarf form has also resulted which would greatly simplify the process of collection.

Figures No. I, II, III and IV show some of the experimental plots, and convey some idea of the scale upon which the work is being done. Large numbers of plants are being used, and these are observed throughout the entire growing season before any selections are made. In this manner the entire life history of the plants, from earliest seedling stage to maturity, is made to serve as a record from which intelligent selections can be made.

DEPARTMENT OF BOTANY, ELI LILLY & COMPANY, Indianapolis, Ind.

METHODS FOR THE ANALYSIS OF CASTILE SOAP.*

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Aside from the fact that the sale of a spurious castile soap may subject the seller to legal prosecution, its use causes the difficulty so frequently encountered in preparing soap liniment, and as many soaps sold as castile are not what they are labeled it is necessary to subject samples to analysis in order to determine whether they are properly made olive oil soaps.

In my own work I nave employed the following methods with excellent results:

Sampling. Select a sample which is representative of the whole lot or bar. If in the latter form, shavings should be taken from different parts, such as the outer and inner surfaces, and after being thoroughly mixed kept in a tightly corked bottle from which samples are taken for analysis.

Water. The method of U. S. P., that is taking 0.500 gram of sample, placing in a previously tared beaker containing 1 gram of sand, adding 10 cc. of alcohol and evaporating to dryness and then drying at 110° C. to constant weight is entirely satisfactory. Care must be exercised in heating to conduct the evaporation on a water bath and to employ a small flame, otherwise the sand may be very forcibly ejected from the beaker and the determination ruined.

The quantity of water allowed by the Pharmacopœia, 36 percent, is excessive and should be very much reduced.

Tests for Animal Fats. The Pharmacopœia states that if a four percent alcoholic solution of soap be allowed to cool it should not gelatinize, indicating

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* Read before the Kings County Pharmaceutical Society, May 13, 1913