

Note.—The tincture of digitalis used in these experiments was standardized by the following method, which briefly consists of the intravenous injection of the drug into a normal dog without anesthesia. The heart rate is counted before and after the injection of the drug and the slowing of the heart rate is taken as a measure of the activity of the drug. If the preparation be of standard strength, 0.02 cc. of the tincture per kilo weight of the dog will reduce the heart rate 20 per cent in from thirty to sixty minutes.

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PRODUCTION OF OIL OF PEPPERMINT.*

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INTRODUCTION.

The production of oil of peppermint is not confined to any one particular country. Its production is, however, fairly well confined to the Northern Hemisphere. As far as I am aware, no peppermint is produced commercially south of the equator. The chief countries of production are the United States, England, France and Italy. Some oil is produced in Germany and Russia and small plantings are to be found in practically all countries. Australia recently has been experimenting somewhat extensively and intensively in the production of oil of peppermint and the published reports indicate very favorable results.

It must be understood that in this discussion reference is made only to the oil of peppermint from *Mentha piperita*. The so-called Japanese peppermint oil is obtained from *Mentha arvensis*; and is recognized in this country under the common name "Corn Mint Oil." Its production runs into hundreds of thousands of pounds and is of sufficient interest to warrant special attention. This paper does not consider Japanese corn mint oil but is confined to peppermint oil as we know and understand it.

The botany of peppermint is somewhat complicated. Suffice it to state here that the main source of the oil is from *Mentha piperita* var. *officinalis*. Of this species there are many modifications, chief of which are the so-called "black" and "white" mints. The "black" mint is the form most extensively cultivated since it yields more oil than the "white" although the quality is not so good.

The world production of peppermint oil, not including Japan, is in the neighborhood of 500,000 to 600,000 pounds, of which the United States produces the major portion. Next to Japan we are the largest producers of mint oil of any description; this paper is confined to the home activities.

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PRODUCTION IN THE UNITED STATES.

The cultivation of peppermint was introduced into our country by way of the New England States. Some time previous to 1816 the industry was established in Wayne County, New York. At about the period from 1816 until 1889, a period of almost seventy-five years, the industry prospered. The area under cultivation during this period was said to exceed 3500 acres. From 1889 on, the cultivation of peppermint in Wayne County gradually decreased until at present there are very few acres under cultivation in that section.

The industry gradually moved westward extending first into western Ohio and later into Michigan. In 1836 the cultivation of peppermint was begun on White Pigeon Prairie, St. Josephs County, Michigan. This venture failed in a financial way. The industry was revived in 1842 in the township of Florence and from then it was developed into one of the routine farm crops.

About 1875, mint growing on muck land came into vogue and to-day one seldom finds the plant being cultivated on upland in either Michigan or Indiana. Within the past few years the cultivation of peppermint has reached the Pacific coast so that now in Oregon several thousand pounds of oil are produced annually. In your own State of North Carolina, near Elizabethtown, there exists a small planting of peppermint which is said to be producing a large volume of oil per acre of a very good quality. We may look for expansion of the acreage in this section of the State when the value of the crop is fully demonstrated.

CULTIVATION.

The cultivation of peppermint is not difficult, and requires only the usual attention given such crops as corn, potatoes, etc. The methods of planting, cultivating, harvesting and distilling have been worked out through years of trial and experiment.

Muck soil to be planted in peppermint is best plowed in the fall. The following spring the soil is thoroughly disced, usually both ways, then harrowed and well dragged down. It is then thoroughly packed with a heavy roller. This treatment leaves the soil in excellent condition to receive the planting stock.

The roots and runners which constitute the planting stock are dropped in freshly made trenches which have been opened up by any convenient method suitable to the area under cultivation. These roots, which may come from old plantings or from plants grown for the purpose on highland, are distributed by hand in the trench and immediately covered with soil. The planter carries a sack of roots over his shoulder and, as he walks along, drops the roots in the trench so as to form a continuous row. He also scrapes the soil into the trench over the roots with his foot. One acre planted by this method is considered a day's work. After planting, the field is dragged over to level it off and also to finish covering the roots thoroughly.

Within a few days after planting, the field is cultivated with a spike tooth harrow or with a weeder, no attempt being made to follow the rows but rather the cultivating is done in all directions. This treatment destroys the young weeds and keeps the surface of the soil well stirred. When the plants attain a size of about three to five inches, the young mint is then cultivated in the row,

and this cultivation is kept up until the growth of the plants is such that "runners" begin to fill the space between the rows.

Hand weeding is necessary in addition to thorough cultivation. This weeding is especially desirable and necessary just before harvest for weeds not only interfere with the growth of the mint but, when distilled with it, impart to the oil a disagreeable and undesirable odor and flavor. Many of the more common weeds found on muck soils contain volatile oils, and the careful grower always keeps his fields clean of weeds in order to insure a good quality of mint oil.

Peppermint is harvested when the plants have just reached the stage when flowers begin to open, in other words, in the late bud stage. This stage of growth varies with the locality and with the age of the plantation, mint two or three years old comes into bud earlier than one year plants. It is frequently cut with a scythe, especially when the crop is exceedingly heavy in the first year, but more often with a mower. The cut herb is allowed to lie in the swath for about one day, and is then raked with a side delivery rake and bunched with a fork to facilitate handling. It is then loaded on hayracks, and taken to the still where the oil is removed by distilling with steam.

DISTILLATION.

The process of distillation is simple. The partially dried herb is packed in a steam tight retort, known locally as a "tub," and steam is then passed through the herb and carries the oil with it into a condenser where both are condensed. The oil being lighter than water floats on the latter and is withdrawn from time to time and packed in iron drums or cans. This constitutes the "natural" oil of the trade. If subjected to redistillation the product is called, once, twice or triple-distilled, as the case may be and these oils are usually of U. S. P. quality.

Distillation is a physical process. Being the nearest to a chemical process, however, in the production of oil of peppermint, it should be briefly explained. In this process we have the phenomenon of a substance having a boiling point considerably higher than water being taken from a plant by the use of steam. The reason this is possible is due to the vapor pressure. From your knowledge of vapor pressure it is clear that when a liquid is boiling it has a vapor pressure slightly greater than the pressure of the atmosphere in contact with it. If then we have a system containing two immiscible liquids, such as oil and water, each will exert a vapor pressure dependent upon the temperature.

The vapor pressure of any volatile oil will vary throughout a wide range, owing to the various components that constitute the oil. Hence, we can call the vapor pressure of water P_1 , and the vapor pressure of the oil P_2 . The vapor pressure of the system will then be $P = P_1 + P_2$, where P is the total vapor pressure. Boiling will, therefore, commence when the vapor pressure of the mixture becomes slightly greater than the pressure of the atmosphere in contact with it. The result is that the mixture of water and oil boils at a lower temperature than would either if distilled separately.

COSTS AND RETURNS PER ACRE.

The costs of producing peppermint oil have been estimated by various investigators. The Federal Department of Agriculture has estimated the cost at

\$55.00 per acre for the first year and \$30.00 per acre for the subsequent years of the plantation. This cost is, in all probability, a good average but extreme yearly variations, mostly upward, may be expected.

Some comparative costs of production have been worked out and these it is believed will give a better idea of the labor and money involved.

GROSS COST OF PRODUCTION.			GROSS VALUE PRODUCED.		
Crop.	Days of labor, man.	Per acre, horse.	Crop.	Per acre.	Per day of man labor.
Peppermint	8	4	Peppermint	\$64.70	\$8.09
Potatoes	9	7	Potatoes	35.97	4.00
Celery	375	18	Celery	161.52	4.31
Onions	32	4	Onions	176.82	5.83

It will be seen from these tables that in comparison with other muck land crops, peppermint occupies a good position. It can be fairly compared in returns of man labor with intensive crops such as celery, onions and potatoes, but it cannot be compared in fairness with corn, oats, rye, wheat and hay.

The figures here given show only a comparison among themselves. These figures are averages for a number of muck farms and are for the year 1914, none being available for a later date. However, by substituting present-day gross values the per acre and per day gross values can be obtained. If such a substitution is made, it must be borne in mind that it applies only to the individual case under consideration unless an average substitution figure is employed.

The returns per acre are variable, running from a few pounds of oil per acre to 60 pounds per acre. The average price for peppermint oil is steadily on the increase, which increase probably takes care of the increase in labor charges. The average prices paid distributors for a period of years are as follows:

From 1895 to 1904, inclusive	\$1.23 per pound
From 1905 to 1914, inclusive	1.94 per pound
From 1915 to 1924, inclusive	3.02 per pound

USES.

Peppermint oil finds its greatest use as a flavor in confections and dentifrices. Hundreds of thousands of pounds are used in this manner each year. Pharmaceutically, it is dispensed to some extent in the treatment of colic, nausea and vomiting. It is quite often used to disguise ill-smelling or ill-tasting drugs. It possesses stimulant, carminative and anodyne properties.

CONCLUSION.

In all types of farming there is a great element of risk. This is due to a variety of causes such as fluctuations in prices, variations in yields and unfavorable climatic conditions. The element of risk is high in intensive types, such as peppermint farming. This element of risk is well recognized by all farmers, and most farmers realize that a high yield of oil means a lower price and *vice versa*. This season as well as last the crop has been short and the price high. However, the immediate benefit to the actual producer of mint oil is somewhat doubtful. Taken throughout a period of years, the mint farmer's income from his crop averages as high, if not higher, than most other intensively grown crops.