# Cultivation of Fennel in Washington

*By Troy E. Becker, Edwin J. Isler and Forest J. Goodrich**

Because of the economic and pharmaceutical importance of the fruit and volatile oil of *Fœniculum vulgare*, Miller, and since they are largely imported into the United States, cultivation of the plant has been conducted for several years in the College of Pharmacy drug garden. The character and quality of the products have been determined and comparisons made with the imported fruit and official oil. It is interesting to note that fennel has been cultivated for the past ten centuries in the old world. Plants have been grown in this country but not in sufficient quantities to meet the demand for the fruit and volatile oil.

## EXPERIMENTAL

*Description of Plant.*—Large perennial herb attaining a height of five and one half to six feet. The stem is furrowed, glaucous, green and branched. Leaves are alternate, twice pinnate with narrow pinnea. The root stock is thick, the flowers a pale yellow and arranged in a compound umbel. The fruit is a large cremocarp. All parts of the plant are aromatic.

*Planting and Collection of Fruit.*—The soil was a good sandy loam with considerable limestone. The plantings were made in March in rows eighteen inches apart. The plants were later thinned to about twelve inches apart in the rows. No fruit was obtained from the first year's planting. The latter part of September of the third year, the fruiting branches were cut off and the ripe fruit threshed, screened and allowed to dry. The yield of air-dried fruit was slightly under two tons per acre, 3960 pounds.

*Extraction Ash and Oil.*—Several pounds of the fruit were ground to approximately a number forty powder and reserved for experimental use.

Successive extractions of forty gram samples gave the following percentage extractions:

| Solvent | Extractive |
|---|---|
| Petroleum ether | 19.62 |
| Ethyl ether | 2.31 |
| Chloroform | 2.29 |
| Ethyl acetate | 3.01 |
| Ethyl alcohol | 4.70 |

Two-gram samples of the powdered fruit were ignited to constant weight and the following determinations made:

| | |
|---|---|
| Total ash | 7.14 |
| Water insoluble ash | 4.32 |
| Acid insoluble ash | 0.60 |

Several pounds of the ground fruit were macerated and steam distilled until all of the oil was carried over. The following results were obtained:

| | |
|---|---|
| Yield of Volatile Oil | 4.1% |
| Properties of Oil | |
| Sp. gr. at 25° C. | 0.9641 |
| Soluble, 10 parts 80% alcohol | |
| Not entirely sol., 1 part 90% alcohol | |
| Optical rotation | −14.1° |
| Refractive index 20° | 1.534 |
| Odor, strongly fennel-like, somewhat pungent | |
| Color, pale yellow | |
| Congealing point | 2.9° C. |
| Heavy metals test | negative |
| Appearance, bright | |
| To litmus, slightly acid | |
| U. S. P. Requirements for Oil of Fennel | |
| Sp. gr. | 0.953/0.973 |
| Solubility | 8/80% |
| Solubility | 1/90% |
| Optical rotation | −12°/24° |
| Refractive Index 20° | 1.5280/1.5380 |
| Odor, fennel-like | |
| Color, pale yellow | |
| Congealing point | 3° C. or above |
| Heavy metals test | negative (approx.) |

The solubility in alcohol and the congealing point is slightly below U. S. P. requirement, otherwise, the oil meets the requirements of the U. S. P. XI by all constants and tests.

Histological sections were made of the fruit and comparisons made with species grown in Europe. The Washington-grown fruits are somewhat lighter in weight and not as full and plump as some European samples examined. The Vittæ in many cases seem to be somewhat more ellipsoidal.

Considering the large yield of American-grown fennel and the fair quality of oil, it would seem worth while to develop *Fœniculum vulgare* cultivation in this country, at least in this section of the country where growing properties have been established.

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# A Permanently Stable Elixir of Ferrous Sulfate*

*By Donald A. Clarke*†

It is the purpose of this report, not to disclose any startling discoveries, for such have not been made, but merely to recount a simple study which has been conducted on the preparation of an elixir of ferrous sulfate

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