THE AGRICULTURAL GEOGRAPHY OF PEPPERMINT
IN THE PACIFIC NORTHWEST

by

ROBERT CHARLES BROWN

A THESIS
submitted to
OREGON STATE UNIVERSITY

in partial fulfillment of
the requirements for the
degree of

MASTER OF SCIENCE

June 1962
APPROVED:

Professor of Natural Resources
In Charge of Major

Chairman of Department of Natural Resources

Chairman of School Graduate Committee

Dean of Graduate School

Date thesis is presented [June 22, 1941]
Typed by Elaine Anderson
ACKNOWLEDGEMENT

In completing a study of this kind it is necessary
to depend upon the guidance and cooperation of many
individuals. Thanks are extended to John Keene, Yakima
County Extension Agent; Amos Bierly, Jefferson County
Extension Agent; Dr. C. E. Horner, Oregon State University
Plant Pathologist; the farmers who gave much of their
valuable time in addition to information, and to many
other persons who provided facts, ideas, and inspiration
for this thesis.

A special thanks is due Dr. Richard M. Highsmith Jr.
for his interest and guidance in the writing of this
thesis, and for his constant enthusiasm toward the project.

Finally, I wish to express my sincere gratitude to
my wife for her contribution toward the completion of the
thesis. She has been of immeasurable aid in her patience,
and in countless hours of typing and proof reading.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter I</th>
<th>INTRODUCTION ..................................................................</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Purpose and Organization of the Study.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Research Methods</td>
<td>2</td>
</tr>
<tr>
<td>Chapter II</td>
<td>HISTORY OF PEPPERMINT IN THE PACIFIC NORTHWEST .............</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Oregon</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Washington</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Idaho</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Economic Importance of Peppermint to the Region ............</td>
<td>9</td>
</tr>
<tr>
<td>Chapter III</td>
<td>ADAPTABILITY OF THE INDUSTRY TO THE REGION ..................</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Soils</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Climate</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Biological Factors</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Verticillium Wilt</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Mint Rust</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Nematodes</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Weed Control</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Adaptability to Farming</td>
<td>31</td>
</tr>
<tr>
<td>Chapter IV</td>
<td>PEPPERMINT PRODUCING AREAS .......................................</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>The Willamette Valley.</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>The Physical Landscape.</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>The Allison-Blacker Farm</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Peppermint Production Distribution of the Willamette Valley</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Yields and Quality of Oil</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>The Yakima Valley.</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>The Physical Landscape.</td>
<td>44</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS (continued)

<table>
<thead>
<tr>
<th>Chapter V</th>
<th>CULTURAL PRACTICES, USES, AND MARKETS</th>
<th>62</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mint Culture</td>
<td></td>
<td>62</td>
</tr>
<tr>
<td>Preparation of Soil</td>
<td></td>
<td>62</td>
</tr>
<tr>
<td>Propagation</td>
<td></td>
<td>63</td>
</tr>
<tr>
<td>Planting</td>
<td></td>
<td>65</td>
</tr>
<tr>
<td>Cultivation</td>
<td></td>
<td>66</td>
</tr>
<tr>
<td>Fertilizers</td>
<td></td>
<td>66</td>
</tr>
<tr>
<td>Irrigation</td>
<td></td>
<td>67</td>
</tr>
<tr>
<td>Harvesting</td>
<td></td>
<td>68</td>
</tr>
<tr>
<td>Distillation</td>
<td></td>
<td>71</td>
</tr>
<tr>
<td>Uses and Markets</td>
<td></td>
<td>77</td>
</tr>
<tr>
<td>Uses of Peppermint</td>
<td></td>
<td>77</td>
</tr>
<tr>
<td>Markets</td>
<td></td>
<td>79</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter VI</th>
<th>SUMMARY AND CONCLUSIONS</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIBLIOGRAPHY</td>
<td></td>
<td>82</td>
</tr>
<tr>
<td>APPENDIX</td>
<td></td>
<td>84</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Peppermint Production.</td>
<td>6</td>
</tr>
<tr>
<td>2.</td>
<td>Mint Field in Willamette Valley.</td>
<td>7</td>
</tr>
<tr>
<td>3.</td>
<td>Stages of Verticillium Wilt.</td>
<td>22</td>
</tr>
<tr>
<td>4.</td>
<td>Diseased Plant</td>
<td>22</td>
</tr>
<tr>
<td>5.</td>
<td>Effect of Verticillium Wilt on Stand of Mint</td>
<td>23</td>
</tr>
<tr>
<td>6.</td>
<td>Weedy Mint Field</td>
<td>29</td>
</tr>
<tr>
<td>7.</td>
<td>Geese in Mint Field for Weed Control</td>
<td>29</td>
</tr>
<tr>
<td>8.</td>
<td>Willamette Valley</td>
<td>34</td>
</tr>
<tr>
<td>9.</td>
<td>Allison-Blacker Farm</td>
<td>37</td>
</tr>
<tr>
<td>10.</td>
<td>Mint Producing Areas</td>
<td>41</td>
</tr>
<tr>
<td>11.</td>
<td>Mint Oil Value per Pound</td>
<td>43</td>
</tr>
<tr>
<td>12.</td>
<td>Yakima Valley</td>
<td>46</td>
</tr>
<tr>
<td>13.</td>
<td>Gans Farm</td>
<td>48</td>
</tr>
<tr>
<td>14.</td>
<td>Agency Plains</td>
<td>53</td>
</tr>
<tr>
<td>15.</td>
<td>Yungun Farm</td>
<td>56</td>
</tr>
<tr>
<td>16.</td>
<td>Fry Farm</td>
<td>61</td>
</tr>
<tr>
<td>17.</td>
<td>Swather Cutting Mint</td>
<td>70</td>
</tr>
<tr>
<td>18.</td>
<td>Swather Cutting Mint</td>
<td>70</td>
</tr>
<tr>
<td>19.</td>
<td>Field Chopper and Round Tub.</td>
<td>72</td>
</tr>
<tr>
<td>20.</td>
<td>Field Chopper and Rectangular Tub.</td>
<td>72</td>
</tr>
<tr>
<td>21.</td>
<td>Mint Distillation Unit</td>
<td>73</td>
</tr>
<tr>
<td>22.</td>
<td>Mint Distillation Unit</td>
<td>74</td>
</tr>
<tr>
<td>23.</td>
<td>Removing Spent Mint Straw</td>
<td>76</td>
</tr>
<tr>
<td>24.</td>
<td>Spreading Mint Straw on Fields</td>
<td>76</td>
</tr>
</tbody>
</table>
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cost of Mint - Southwest Prosser</td>
<td>11</td>
</tr>
<tr>
<td>2.</td>
<td>Cost of Mint - Columbia Basin</td>
<td>12</td>
</tr>
<tr>
<td>3.</td>
<td>Cost of Mint - Jefferson County</td>
<td>13</td>
</tr>
<tr>
<td>4.</td>
<td>Cost of Mint - Northern Linn County</td>
<td>14</td>
</tr>
<tr>
<td>5.</td>
<td>Acreage and Value of Peppermint by County</td>
<td>15</td>
</tr>
</tbody>
</table>
Chapter I
INTRODUCTION

The Pacific Northwest is the leading peppermint (Mentha piperita) producing region in the United States. The plant was introduced in the early part of the Twentieth Century, but the eminent position of the region in production is a relatively recent achievement. In 1960 the three states, Washington, Oregon, and Idaho, accounted for 82 per cent of the nation's peppermint oil.

Several districts within the region are admirably suited to the physical requirements of peppermint. Outstanding areas of production are the Willamette Valley of Oregon, the Yakima Valley of Washington, and the irrigated lands north of Madras in Jefferson County, Oregon. There also are several other small production districts.

PURPOSE AND ORGANIZATION OF THE STUDY

This thesis attempts to present a geographical analysis of peppermint production in the Pacific Northwest. It includes a collation, correlation, and synthesis of materials assembled from primary printed matter, interviews
with specialists and farmers, and field observations. The goal is to present a reasoned appraisal of the factors attracting the industry, its role in the region’s agriculture, the character, organization, and localization of production, and the problems and possibilities for the future.

**RESEARCH METHODS**

The author began his research with some background and considerable interest in mint production in the Pacific Northwest, having lived and worked on a mint farm for a period of five years.

Perusal of printed material was initiated during the academic year of 1959-60. This phase was aided by an inclusive bibliography made available by Dr. C. E. Horner, Oregon State University plant pathologist. Materials not found in the library were procured from the Extension Services of the Northwestern states and from the United States Department of Agriculture. In addition to those cited in the text, references useful in establishing background are included in Appendix I.

Interviews were conducted with the agricultural agents in the principal producing counties, with field representatives of major marketing organizations, and a score of farmers. Dr. Thomas L. Jackson, Oregon State
University soil scientist, and Dr. C. E. Horner also were consulted.

Field observations were conducted in the Willamette Valley from 1959 through the spring of 1961, in the Yakima Valley during the winter vacation of 1960, and in the Madras area during the winter and spring of 1961. In this procedure localizations, ecological relationships, cultural practices, and production techniques were studied.

Information for maps and graphs contained in the text was gathered from data compiled by the Oregon Crop and Livestock Reporting Service, the Federal Cooperative Extension Services of Oregon State University and Washington State University, the Corps of Engineers, and the Bureau of Reclamation. Some historical data was obtained from the United States Department of Agriculture publication "Agricultural Statistics."
Chapter II

HISTORY OF PEPPERMINT IN THE PACIFIC NORTHWEST

Peppermint has been grown in the United States since 1812, when stolons (roots) were introduced into Ashfield County, Massachusetts, by early settlers from England (10, p. 2). In 1835, the industry extended into the Midwest where it gained in importance until a peak of 52,200 acres was reached in 1930 (9, p. 3). Since that time the significance of Midwest producing areas has been steadily decreasing. In 1960 only 10,600 acres were grown.

Peppermint culture was introduced into the Pacific Northwest in 1908 with stolons\(^1\) imported directly from England and planted in Columbia County, Oregon (9, p. 3). Interest in the crop remained slight until the early 1940's when a rapid expansion in acreage occurred with the demands of World War II.

OREGON

Shortly following the introduction of peppermint into Oregon the center of industry shifted to the Coburg area, near Eugene, in Linn County. Here, in 1911, stolons

\(^1\) For purposes of this thesis the use of the term "stolons" will include roots and rhizomes.
which had been transported overland from the Midwest, were planted (13). Stolons from the Coburg area then were used to establish fields near Crabtree in 1914. During the next few years, the crop spread to recent alluvial soils in most parts of the Willamette Valley. By 1916 Oregon had become the third largest peppermint producing state in the nation (9, p. 4).

During the following two decades plantings in Oregon remained fairly stable. In 1940 a tremendous expansion began. Acreage increased from 2,200 in 1939 to 11,000 in 1949 (Figure 1). Since 1949 production has been fluctuating in response to markets and disease problems, with a peak of 15,259 acres producing in 1958. In 1960, 14,900 acres were in production.

Although acreage has remained fairly stable during the past five years, there has been an important shift in areas of production. New plantings have been established in Jefferson, Josephine, Umatilla, and Malheur Counties. These new areas have been developed primarily in an attempt to escape the Verticillium wilt disease which is now plaguing Willamette Valley growers. It is worthy of note that many of the plantings in these new areas have been made by former Willamette Valley mint farmers.
PEPPERMINT PRODUCTION
Thousands of Acres

Source - U.S.D.A. Agricultural Statistics

Figure 1
Figure 2. Peppermint field in the Willamette Valley. Notice the height of the stand, and the light-purple blooms.

Photograph by Walt Harrison
WASHINGTON

After the 1908 harvest in Oregon, stolons were planted in Cowlitz and Clark Counties, Washington. Acreage remained unimportant, however, until the early 1920's, when high prices encouraged establishment of new areas of production in the irrigated districts of south-central Washington. Total plantings averaged about 2000 acres until 1945 (9, p. 2).

Unlike Oregon, the industry in Washington did not expand significantly during the 1940's. Increase occurred, but at a lesser rate. It was in the mid 1950's that major expansion began, with an increase of 3,700 acres in one season. Acreage rose from 7,300 acres in 1954 to 11,000 acres in 1955 (19).

The significant rise in acreage during the last ten years can be attributed to the effects of the Verticillium wilt disease on peppermint producing areas of the Midwest. Washington, in 1960, was second only to Oregon in acreage planted to peppermint and, due to higher yields, produced 998,000 pounds of oil compared to 924,000 pounds produced in Oregon (15).

IDAHO

Peppermint is a newcomer to agriculture in Idaho.
There was no production of any significance in the state before 1958, when about 300 acres were reported under cultivation in the Payette area. It is expected that this area will increase in importance as disease problems reduce Yakima Valley production.

ECONOMIC IMPORTANCE OF PEPPERMINT TO THE REGION

Peppermint ranks 13th in acreage harvested among the agricultural field crops of the Pacific Northwest.\(^1\) The average total value of the crop for the three year period of 1957-59 was $7,216,000 (15). This places it 18th in value among all of the crops of the region. These figures may not seem impressive, because they do not indicate the true value of the crop in terms of the individual farmer. Only 720 farms in the three states are mint producers. The average gross income per acre for the region as a whole during the 1957-59 period was $322. The average cost for growing established mint is about $157. per acre, leaving an average net return of $165. Income and costs vary considerably from district to district within the region as well as from year to year. Tables I through IV indicate some of these differences. Although there are a number of

\(^1\) In totaling these figures all hay crops were combined as one, as were crops harvested for seed.
intensive crops grown within the region that yield higher returns per acre, few do better in terms of comparative investments or labor and machinery requirements. For these and other reasons most mint farmers prefer to grow mint. Table V shows a breakdown of peppermint value by producing region for the year 1958.
Table I
Cost of Mint

Estimated Costs\(^1\) (except land) and Returns Per Acre to Land

Southwest Prosser - 1955

<table>
<thead>
<tr>
<th></th>
<th>Standard 1st Year</th>
<th>Standard Years 2-5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land Preparation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plow</td>
<td>$ 6.00</td>
<td>$ 6.00</td>
</tr>
<tr>
<td>Disc and harrow</td>
<td>5.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Float</td>
<td>2.50</td>
<td>2.50</td>
</tr>
<tr>
<td><strong>Fertilizer N - 160#</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td>20.00</td>
<td>20.00</td>
</tr>
<tr>
<td><strong>Roots</strong></td>
<td>25.00</td>
<td></td>
</tr>
<tr>
<td><strong>Planting</strong></td>
<td>50.00</td>
<td></td>
</tr>
<tr>
<td><strong>Irrigation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor 10 times</td>
<td>8.00</td>
<td>8.00</td>
</tr>
<tr>
<td>Water and electricity</td>
<td>10.00</td>
<td>10.00</td>
</tr>
<tr>
<td><strong>Cultivation</strong></td>
<td>22.25</td>
<td>15.00</td>
</tr>
<tr>
<td><strong>Weed control</strong></td>
<td>12.00</td>
<td>10.00</td>
</tr>
<tr>
<td><strong>Insect and disease control</strong></td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Total pre-harvest</strong></td>
<td>$142.75</td>
<td>$ 78.50</td>
</tr>
<tr>
<td><strong>Harvesting Costs</strong></td>
<td>63.75</td>
<td>63.75</td>
</tr>
<tr>
<td><strong>Total costs</strong></td>
<td>$226.50</td>
<td>$142.25</td>
</tr>
<tr>
<td><strong>Yield per acre</strong></td>
<td>75 lbs.</td>
<td>75 lbs.</td>
</tr>
<tr>
<td><strong>Value per acre</strong></td>
<td>$337.50</td>
<td>$337.50</td>
</tr>
<tr>
<td><strong>Net return to land</strong></td>
<td>$111.00</td>
<td>$195.35</td>
</tr>
</tbody>
</table>

\(^1\) These costs are guides based on custom rates.
Table II
Cost of Mint

Estimated Costs\(^1\) (except land) and Returns Per Acre to Land

Columbia Basin - 1955

<table>
<thead>
<tr>
<th>Land Preparation</th>
<th>Standard 1st Year</th>
<th>Standard Years 2-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plow</td>
<td>$ 4.00</td>
<td></td>
</tr>
<tr>
<td>Disc and harrow</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Ditching out</td>
<td>6.00</td>
<td></td>
</tr>
<tr>
<td>Fertilizer N - 160# Application</td>
<td>30.00</td>
<td>$ 30.00</td>
</tr>
<tr>
<td></td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Roots</td>
<td>50.00</td>
<td></td>
</tr>
<tr>
<td>Planting</td>
<td>12.50</td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor</td>
<td>6.25</td>
<td>6.25</td>
</tr>
<tr>
<td>Water and electricity</td>
<td>7.21</td>
<td>7.21</td>
</tr>
<tr>
<td>Cultivation</td>
<td>18.00</td>
<td>24.00</td>
</tr>
<tr>
<td>Weed control</td>
<td>20.00</td>
<td>25.00</td>
</tr>
<tr>
<td>Insect and disease control</td>
<td>4.70</td>
<td></td>
</tr>
<tr>
<td><strong>Total pre-harvest:</strong></td>
<td><strong>$158.96</strong></td>
<td><strong>$101.16</strong></td>
</tr>
<tr>
<td><strong>Harvesting Costs</strong></td>
<td>51.00</td>
<td>68.00</td>
</tr>
<tr>
<td><strong>Total costs:</strong></td>
<td><strong>$209.98</strong></td>
<td><strong>$169.16</strong></td>
</tr>
<tr>
<td>Yield per acre</td>
<td>60 lbs.</td>
<td>80 lbs.</td>
</tr>
<tr>
<td>Value per acre</td>
<td>$300.00</td>
<td>$400.00</td>
</tr>
<tr>
<td>Net return to land</td>
<td>$ 91.04</td>
<td>$230.84</td>
</tr>
</tbody>
</table>

\(^1\) These costs are guides based on custom rates.

Table III
Cost of Mint
Estimated Costs *(except land)* and Returns Per Acre to Land
Jefferson County - 1959

<table>
<thead>
<tr>
<th></th>
<th>1st Year</th>
<th>Standard Years 2-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Preparation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plow, disc, harrow</td>
<td>$6.45</td>
<td></td>
</tr>
<tr>
<td>Fertilizer N - 180# Application</td>
<td>28.00</td>
<td>$28.00</td>
</tr>
<tr>
<td>Roots</td>
<td>25.00</td>
<td></td>
</tr>
<tr>
<td>Planting</td>
<td>12.50</td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor</td>
<td>20.50</td>
<td>20.50</td>
</tr>
<tr>
<td>Water and electricity</td>
<td>5.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Cultivation</td>
<td>6.20</td>
<td>9.30</td>
</tr>
<tr>
<td>Weed control</td>
<td>28.00</td>
<td>28.00</td>
</tr>
<tr>
<td></td>
<td><strong>Total pre-harvest:</strong></td>
<td><strong>$133.65</strong></td>
</tr>
<tr>
<td>Harvesting Costs</td>
<td>60.00</td>
<td>60.00</td>
</tr>
<tr>
<td></td>
<td><strong>Total costs:</strong></td>
<td><strong>$193.65</strong></td>
</tr>
<tr>
<td>Yield per acre</td>
<td>60 lbs.</td>
<td>60 lbs.</td>
</tr>
<tr>
<td>Value per acre</td>
<td>$300.00</td>
<td>$300.00</td>
</tr>
<tr>
<td>Net Return to land</td>
<td>$106.35</td>
<td>$147.20</td>
</tr>
</tbody>
</table>

1 These costs are guides based on *custom rates*.

Source: Federal Cooperative Extension Service, Jefferson County, Oregon
Table IV
Cost of Mint

Estimated Costs\(^1\) (except land) and Returns Per Acre to Land

Northern Linn County - 1959

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Standard 1st Year</th>
<th>Standard Years 2-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Preparation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plow, disc, harrow</td>
<td>$ 7.00</td>
<td>$ 7.00</td>
</tr>
<tr>
<td>Fertilizer N - 200#</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td>14.00</td>
<td>14.00</td>
</tr>
<tr>
<td></td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Roots</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36.30</td>
<td></td>
</tr>
<tr>
<td>Planting</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>14.30</td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor</td>
<td>10.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Water and electricity</td>
<td>10.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Cultivation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.00</td>
<td>20.00</td>
</tr>
<tr>
<td>Weed control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hoeing</td>
<td>8.00</td>
<td>8.00</td>
</tr>
<tr>
<td>Chemical</td>
<td>10.50</td>
<td>10.50</td>
</tr>
<tr>
<td>Insect and disease control</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.00</td>
</tr>
<tr>
<td>Total Pre-harvest:</td>
<td>$128.10</td>
<td>$ 86.50</td>
</tr>
<tr>
<td>Harvest Costs</td>
<td>65.00</td>
<td>65.00</td>
</tr>
<tr>
<td>Total costs:</td>
<td>$193.10</td>
<td>$151.50</td>
</tr>
<tr>
<td>Yield per acre</td>
<td>57 lbs.</td>
<td>65 lbs.</td>
</tr>
<tr>
<td>Value per acre</td>
<td>$285.50</td>
<td>$325.00</td>
</tr>
<tr>
<td>Net Return to Land</td>
<td>$ 91.90</td>
<td>$173.50</td>
</tr>
</tbody>
</table>

\(^1\) These costs are guides based on custom rates.

Source: Federal Cooperative Extension Service, Linn County, Oregon
Table V

Acreage and Value of Peppermint by County
1958

<table>
<thead>
<tr>
<th></th>
<th>Acreage</th>
<th>Value - Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Washington</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12,300</td>
<td>3,613,200</td>
</tr>
<tr>
<td>Yakima</td>
<td>10,070</td>
<td>3,051,180</td>
</tr>
<tr>
<td>Clark</td>
<td>840</td>
<td>169,510</td>
</tr>
<tr>
<td>Benton</td>
<td>500</td>
<td>150,750</td>
</tr>
<tr>
<td>Cowlitz</td>
<td>400</td>
<td>104,400</td>
</tr>
<tr>
<td>Grant</td>
<td>320</td>
<td>89,110</td>
</tr>
<tr>
<td>Walla Walla</td>
<td>70</td>
<td>21,105</td>
</tr>
<tr>
<td>Franklin</td>
<td>40</td>
<td>11,055</td>
</tr>
<tr>
<td>Snohomish</td>
<td>40</td>
<td>9,570</td>
</tr>
<tr>
<td>Wahkiakum</td>
<td>20</td>
<td>5,520</td>
</tr>
<tr>
<td><strong>Oregon</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>15,259</td>
<td>4,307,564</td>
</tr>
<tr>
<td>Willamette Valley</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marion</td>
<td>4,509</td>
<td>1,482,902</td>
</tr>
<tr>
<td>Linn</td>
<td>4,494</td>
<td>1,347,384</td>
</tr>
<tr>
<td>Polk</td>
<td>975</td>
<td>257,694</td>
</tr>
<tr>
<td>Lane</td>
<td>824</td>
<td>222,133</td>
</tr>
<tr>
<td>Benton</td>
<td>204</td>
<td>48,998</td>
</tr>
<tr>
<td>Yamhill</td>
<td>40</td>
<td>12,180</td>
</tr>
<tr>
<td>Jefferson</td>
<td>2,506</td>
<td>581,429</td>
</tr>
<tr>
<td>Josephine</td>
<td>550</td>
<td>143,550</td>
</tr>
<tr>
<td>Malheur</td>
<td>483</td>
<td>83,770</td>
</tr>
<tr>
<td>Umatilla</td>
<td>480</td>
<td>131,224</td>
</tr>
<tr>
<td>Columbia</td>
<td>194</td>
<td>30,300</td>
</tr>
</tbody>
</table>

Source: U.S.D.A. Agricultural Statistics
Chapter III

ADAPTABILITY OF THE INDUSTRY TO THE REGION

Peppermint is a perennial plant. It has square stems, grows to about three feet in height, has deep-green, slightly dentated leaves, and produces profuse light-purple blooms. The bulk of the oil is contained in the leaves. The commercial variety, *Mentha piperita*, rarely sets seed, and reproduction occurs through the lateral growth of runners both under and on the soil surface (17, p. 3). The plant will grow in a wide variety of soils and climatic conditions. Few areas, however, can provide the combination of environmental conditions which are ideal for commercial production. The Pacific Northwest contains several suitable areas.

SOILS

The most desirable soil conditions are found in well-drained swamp lands, usually called muck\(^1\) soils, but the plant grows well on deep, rich soil that has fairly loose structure and permits easy root penetration.

Soils high in nitrogen, potassium, and phosphorus give best plant response; and the presence of minor

\(^1\) As used here muck soils include all soils of high organic content.
nutrients, such as copper, sulphur, zinc, and boron, seems to be beneficial (7). These conditions can be improved with a fertilizer program. For example, tests conducted by Oregon State University soil scientists on plots near Dayton, Clatskanie, Jefferson, and Lacomb, Oregon, indicated that best results were obtained when a complete fertilizer, containing nitrogen, phosphorus, and potassium, plus copper chloride and zinc sulphate, was added to the soil. Over-all yields were increased by as much as 40 pounds per acre (14, p. 2).

Peppermint tolerates a soil reaction of mildly acid to slightly alkaline. The desirable pH range is 6.0 to 7.5 (17, p. 6). A very acid soil may require liming before it can be used. The soils should be well-drained, yet retentive of moisture. Clay soils usually are unsatisfactory. An abundance of humus is desirable.

The Lake Labish region, near Salem, in the Willamette Valley is a typical area of muck soils. Such soils also are found along the lower Columbia River in both Oregon and Washington. Peppermint is well-adapted to the recent alluvial soils of the Willamette Valley, mainly Chehalis and Newberg, and to Willamette soils. It also does well on the Ephrata sandy-loam soils of the Yakima Valley and similar soils in other areas. Most mint is grown on the better soils of each farm. Soils deficient in nutrients
can be used for mint culture with the addition of fertilizers.

**CLIMATE**

Climate is an important factor in mint culture, being largely responsible for variations in oil quality. The plant, to produce high quality oil, requires from 50 to 60 inches of water in arid areas, a 140 day growing season, and warm, dry summers with a fairly wide diurnal range of temperature.

Precipitation varies considerably within the mint producing sections of the Pacific Northwest, but none of the areas has a natural moisture supply which meets mint requirements. In the Willamette Valley and the lower Columbia area annual precipitation averages about 40 inches per year, but approximately 80 per cent of the total arrives between October 1 and April 30. Thus a summer moisture deficiency must be eliminated with supplemental irrigation. In the Yakima Valley and other areas east of the Cascade mountains arid conditions exist, with annual precipitation averaging as low as five inches in some years. In these areas total irrigation is necessary.

Temperature conditions have marked bearing upon peppermint culture. It has not been proven, but there is
evidence that the degree of maximum temperature in a producing region has an effect on the amount of an undesirable, menthofuran, in the oil. This is indicated by differences between Willamette Valley and Yakima Valley oils. The high quality Willamette Valley oil averages between three and five per cent menthofuran (5). The average maximum temperature for July and August is about 82.2°F. (21). Yakima Valley oil, however, has an average menthofuran content of 10 per cent or more, sometimes reaching as high as 20. Here the average maximum temperature is 89.1°F. The validity of the temperature relationship seems sound since it has been proven that soils have no relationship to menthofuran content. Tests conducted by Dr. C. E. Horner, Oregon State University plant pathologist, involving soils brought to the Willamette Valley from the Yakima Valley, showed that mint grown on these soils produced oil with a menthofuran content comparable to that of oil produced on Willamette Valley soils. It would thus appear that the Yakima Valley is near the extreme limit of desirable temperatures.

The 140 day growing season required by mint is amply provided by frost free seasons of 200 days in the Willamette Valley, 190 days in the Yakima Valley, and 140 days in the Madras area. The growing season, therefore,
is not a critical limitation in the present producing areas. It, however, may be important in limiting future expansion within the region.

**BIOLOGICAL FACTORS**

There are several biological problems which plague mint growers. Foremost among these are: the diseases, *Verticillium* wilt and mint rust; the pests, nematodes and insects, including cutworms, flea beetles, symphillids; and various types of weeds.

**Verticillium Wilt**

*Verticillium* wilt of peppermint was not found in the Pacific Northwest prior to 1944, when it was discovered near Salem, Oregon. Freedom from this disease was a major factor in the early growth of the industry. Wilt is caused by a fungus (*Verticillium albo-astrum* R. & B.) that lives in the soil and in the roots and stems of certain plants. It is known that about 200 kinds of plants are affected by various strains of the disease.

The fungus enters the plant through the roots and

---

1 The bulk of the data on peppermint diseases and pests was drawn from the following publication: Horner, C. E. Control peppermint diseases. Corvallis, 1955. 14 p. (Oregon. Agricultural Experiment Station. Station Bulletin 547.)
attacks the water conduction system, causing a partial blocking of the water supply. It also produces a poison which injures or kills plant cells.

The first symptoms of the disease are recognized as the yellowing, twisting, and curling of the upper leaves. The plant becomes stunted, and as the disease progresses the lower leaves die and drop (Figure 3,4). Eventually all of the plant above ground may die (Figure 5).

Although the disease was found in Oregon in 1944, it did not become serious until the late 1950's. It now occurs throughout the Willamette Valley, and the mid and lower portions of the Yakima Valley. It has been responsible for the retirement of several thousand acres of land from mint production, and is causing grave concern to the growers of the region. Dr. C. E. Horner, well-known expert on mint diseases, has predicted that unless a fairly cheap, economical control is found mint farmers eventually will be unable to continue to produce in the Yakima Valley (5). He also predicts that drastic reductions in acreage will occur in the Willamette Valley within the next 10 to 15 years unless a control is developed. Research is being conducted on the disease and some progress has been made. Dr. Horner has developed a soil fumigant which appears to be successful, but at present the technique is economically prohibitive except
Figures 3 and 4. Effect of Verticillium wilt. Notice the contrast between diseased and healthy plants.

Photographs by C. E. Horner
Figure 5. Effect of *Verticillium* wilt on a field of peppermint.

Photograph by C. E. Horner
under the most ideal conditions. Its application, however, may allow certain Willamette Valley areas to retain some production.

The most promising area of research at present is in plant breeding. Work is being done by the U.S.D.A. Industrial Crops Section to develop wilt resistant strains of peppermint. This is slow, tedious work, and there is a shortage of funds for the project. Money for additional research is being supplied by the major users, buyers, and growers. Growers are donating at the rate of one cent per pound of oil produced (11).

As noted earlier this disease is a primary factor in the development of new producing areas. In the Madras section of Jefferson County mint acreage is increasing rapidly. No wilt has been reported there as yet, and growers hope that restrictive selection of planting stock will prevent its introduction. Scientists generally agree, however, that eventually the disease will develop. When wilt does appear, the infected area will be isolated immediately and fumigated. Wilt will be difficult to control, however, because the gravity flow system of irrigation used rapidly transfers the disease (1).

Mint Rust

Rust was first discovered in commercial mint in Columbia County, Oregon, in 1948. The disease was
observed, however, on wild mint as early as 1885. It is likely that spread of the fungus (*Puccinia menthae* Pers) to commercial plantings originated by transfer from wild to cultivated mint.

Mint rust fungus reproduces by a series of five different kinds of spores. In order for fungus to complete its annual cycle all five stages must be produced. Only three of the five spore stages are important for recognizing the disease on the plant. These are the yellow, the brown, and the black spore stages. Each of the stages occurs at different times of the year.

The yellow spore stage occurs from late February to late May. The leaves and young shoots are affected and become twisted or distorted. The leaves may break off at the point of infection. Some shoots may never survive to maturity.

The brown spore stage occurs from May to November and affects the underside of the leaves. It is recognized by brown spots, each composed of the thousands of tiny spores. These brown spore masses break through the leaf surface, destroying oil-bearing glands and cause serious losses of oil. It also has been shown that plants which are heavily rust infected produce about one-third less rhizomes and stolons than do healthy plants.
The black spore stage occurs on leaves, stems, and stolons during late October and November. It resembles the brown spore stage except for the color of the spores. These spores break through the surface of the stolons, allowing rot-causing fungi to infect the plant, often killing it.

Through research work conducted at Oregon State University, methods of control have been developed which are both effective and economical. The most current rust control program consists of clean plowing in the fall or early spring, and application as a spray of three to four pounds of dinitro amine to the soil surface after it is worked smooth and before most mint has emerged.

Actually, clean plowing is the most important step in rust control. Overwintering spores of rust fungi are on stubble, regrowth, and soil surfaces. When the surface is thoroughly turned under by clean plowing most of the sources of infection are removed. Other important practices are the spraying of wild and escaped mint, and eliminating spring sources of rust in the field.

Thus, it can be said that although rust is a serious problem and adds to production costs, it is not prohibitive to production as is wilt.

Nematodes

Nematodes are very small thread-like worms which live
in the soil. Those that attack plants have a hollow, spear-shaped organ in the head with which they attack plant cells and feed on the cell contents.

The most serious nematode attacking peppermint is a species (*Longidorus sylphus* Thorne) which is very slender, white in appearance, and averages about one-fourth inch in length. More than 10,000 of these nematodes have been collected from one pint of soil around a moderately diseased mint plant. Two other nematodes that attack mint are root knot (*Meloidogyne hapla* Chitwood) and pin nematodes (*Paratylenchus macrophallus* Goodey). These species are less important but must be watched carefully as they are potentially destructive.

Peppermint which has been attacked by the nematode *Longidorus sylphus* is recognizable by its stunted appearance and reddish color. Mint plants affected by root knot nematodes are unthrifty and stunted, and have galls and enlarged areas formed on the roots. These contain female nematodes and egg masses. Pin nematodes cause yellowing and stunting of peppermint plants.

The easiest method of control is to rotate peppermint with resistant crops such as alfalfa or sweet corn. A rotation scheme of four to six years of mint production followed by a nematodes resistant crop for three years is effective and most desirable. Nematodes are likely
to become more serious in the future if rotation does not become an accepted practice.

Other, more minor diseases are root rots, powdery mildew (*Erysiphe uchoracerum* D.C.), leaf blight (*Cephalosporium* Sp.), and black stem rot.

**Weed Control**

Weeds reduce yields if not controlled, add costs to production when controlled, and reduce the quality of peppermint oil. If distilled with the crop, weeds tend to color the oil, causing off-flavor and lowering the value. Since mint is generally farmed as a field crop, except during the first year, it cannot be cultivated when weed growth is most rapid. The high fertility level of the soil, and irrigation practices in Northwest producing districts are ideal for weed growth. Mild winters, especially in the western districts, further enhance weed establishment (Figure 6). Therefore, control practices are essential in all districts.

A large number of weeds are considered undesirable. During the summer, quackgrass, Canada thistle, pigweed, nightshade, lambsquarter, groundsel, purselane, water grass (*Wild millet*), and many others must be controlled. In the winter, groundsel, annual bluegrass, chickweed, common rye grass, and wild oats carpet the fields (2).

There are several weed control practices utilized
Figure 6. Mint field with a heavy growth of weeds.

Figure 7. Geese in a mint field to control weeds.
by mint farmers. The most common practice has been to
fall or spring plow and harrow. Then geese, sheep, and
hand hoeing are used after mechanical cultivation is no
longer possible. Chemical weed controls also are used
(Figure 7).

Diuron (Karmex D-W) is the most common chemical
control. It is a wettable powder that forms a suspension
in water and acts through the soil. It is recommended
for use at two or three pounds per acre mixed with 30
gallons of water. This rate normally will give control
of most species of weeds throughout the summer. Extreme
care is used in application, because failure to apply
properly may result in serious damage. For example, in
Jefferson County in 1956, only 891 acres of 1,391
planted were harvested, and the yield was only 20 pounds
per acre. Weed killer was not the only cause of this
disaster, but it received the majority of the blame (1).
Spraying is done prior to peppermint emergence, immediately
after the last working. Peppermint foliage is not usually
sprayed as the crop may be damaged. In abnormal
situations it is a common practice to consult the county
Agricultural Extension Agent.

Diuron (Karmex D-W) tends to settle out of solution,
and a sprayer with a mechanical agitator is required.
Irrigation or rain is necessary to carry the chemical into
the soil where weeds are germinating and rooting. After application the soil is not disturbed. This prevents turning up new seeds to the surface.

Diuron (Karmex D-W) is not used on new plantings as it may retard mint establishment. This is especially true on sandy soils. Thus, unless the weed problem is extremely serious, cultivation is the most effective practice for controlling weeds in newly established row mint. It also is not applied on mint that is to be plowed up and planted to any other crop within one year of treatment.

ADAPTABILITY TO FARMING

Peppermint fits well into the intensive farming systems of the Pacific Northwest producing areas. In the irrigated districts east of the Cascade Mountains relatively high land values, small farms, water and production costs, and competition from other crops demand comparatively high value enterprises. Peppermint meets this requirement and at the same time fits well into management programs. The major development of supplemental irrigation in the Willamette Valley since 1940 also has resulted in a favorable position for mint in the farming programs of this area.

Peppermint farming utilizes techniques which are
common to a variety of intensive crops. Potatoes, dill, spearmint, sweet corn, and grass seeds, among others, all require initial farming practices and equipment which are common with peppermint. Many of the commodities also are complimentary in labor requirements. For example, labor required to cut asparagus in the Yakima Valley in the early part of the day may be used to pull weeds out of mint fields in the afternoon (9, p. 8). A staggering of harvest periods, such as with corn and dill in the Willamette Valley and potatoes in Jefferson County, allows labor and machinery to be utilized more efficiently. Perhaps most important is the fact that even the most specialized equipment, the distillery unit, may be used for spearmint and dill as well as for peppermint. These factors plus the economic safety of diversification, results in mint being grown in conjunction with these crops.

Size of plantings vary from area to area and farm to farm. In Oregon the average mint acreage planted per farm is about 53, with ranges from less than 10 to over 700. In Washington the average is about 45 acres, ranging from less than 10 to 1000. One of the largest operations is controlled by the Broadview Farming Company of Sunnyside, Washington.
Chapter IV

PEPPERMINT PRODUCING AREAS

Study of the producing districts revealed considerable similarities in production methods. Principal differences were found to be in the physical characteristics of the land resource base, in crop response, and the quality of the oil. In this chapter attention is centered on the individuality of the principal areas. Cultural practices from planting to processing and marketing will be considered in the following chapter.

THE WILLAMETTE VALLEY

The Willamette Valley includes portions of nine Oregon counties: Lane, Linn, Benton, Marion, Polk, Yamhill, Clackamas, Washington, and Multnomah. The valley is terminated in the south by the Calapooya Mountains. The Columbia River marks the northern boundary, but the structural depression which forms it extends on through the Cowlitz Valley and the Puget Sound Lowland of Washington.

The Willamette Valley encompasses an area extending north-south 130 miles and east-west from 25 to 40 miles. It contains a total of 8,439,040 acres of land of which 2,661,857 acres are in farms, and 993,152 acres are classified as cropland harvested (19).
The Physical Landscape

The surface of the Willamette Valley is largely the flat to rolling alluvial plain of the Willamette River and its tributaries. On the west the valley is limited by the gently rising foothills of the Coast Range, on the east by the more abrupt rise of the Cascade Mountains. The main stream, the Willamette, enters from the south and flows northward in a braided, meandering channel. The bottomlands are more undulating than the main valley floor, which lies 20 to 50 feet higher on each side and extends as a flat plain to the foothills. Most of the major tributaries duplicate these conditions on a smaller scale.

Machine agriculture is well adapted to the topography of the valley and to peppermint production. The soils, however, are complex, and not all are suitable for mint culture. Most mint is grown on recent alluvial adaptability Class I soils, consisting primarily of the Chehalis and Newberg types, although some is grown on the Willamette soil series, which are adaptability Class II soils. Muck soil in the Lake Labish region also is important in mint production.

The climate is characterized by wet, mild winters and dry, moderately warm summers. The frost-free season averages 200 days, with a temperature curve showing a
gradual rise to a peak average of $67^\circ$ F. in July, followed by a gradual lowering to $39^\circ$ F. in January. The climatic factor of greatest concern to peppermint culture is rain-fall distribution. The 40-inch average annual precipitation would appear to class the valley as humid, but 80 per cent of the total falls between October 1 and April 30. June, July, and August together average slightly less than two and a half inches and frequently receive less than one inch. Thus the effectiveness of the long, moderate frostless season is lessened by summer drought, and supplemental irrigation is required. Due to the rolling topography of the bottomlands and the availability of surface and subsurface water, sprinkler irrigation is the method most used.

Peppermint is grown on 218 farms throughout the Willamette Valley. The crop is produced on a variety of farm types, ranging from specialized farms, to general farms, or those growing a variety of crops. The latter of these is dominant, with the average mint acreage planted per farm estimated to be about 60 (12). A case study of a Willamette Valley general farming operation will give a better understanding of farm organization and operation.

The Allison-Blacker Farm: The Allison-Blacker farm, consisting of 225 acres, is operated on a father-son-in-law
partnership arrangement, with the son-in-law, Worth Blacker, in charge of farm operation. This unit, located near the Willamette River in Linn County, is one mile north and one mile east of Corvallis, and is a general farming operation. Oil crops are dominant, however, with peppermint and dill occupying about fifty-four per cent of the cultivated land, and supplying about seventy per cent of the farm income. Sweet corn, small grains, and seed crops are grown in conjunction with the oil crops. The actual breakdown of these crops is as follows:

<table>
<thead>
<tr>
<th>Crop</th>
<th>Acreage</th>
<th>Yield per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>15</td>
<td>32 1/4 tons</td>
</tr>
<tr>
<td>Crimson Clover</td>
<td>15</td>
<td>500 lbs.</td>
</tr>
<tr>
<td>Merion Blue Grass</td>
<td>10</td>
<td>Not known</td>
</tr>
<tr>
<td>Oats and Vetch</td>
<td>4</td>
<td>2 tons</td>
</tr>
<tr>
<td>Alta Fescue</td>
<td>2</td>
<td>pasture</td>
</tr>
<tr>
<td>Sweet Corn</td>
<td>30</td>
<td>8 tons</td>
</tr>
<tr>
<td>Dill</td>
<td>48</td>
<td>50 lbs.</td>
</tr>
<tr>
<td>Peppermint</td>
<td>70</td>
<td>60 lbs.</td>
</tr>
</tbody>
</table>

The farm is of level to gently undulating topography, with good drainage, and excellent soils, chiefly Chehalis. This allows for a uniformity of farming techniques, with few problems relating to land adaptability. Water for household needs and the irrigation of 150 acres of mint, dill, and sweet corn is supplied by four, 30 foot wells.

Machinery used on this unit is both modern and abundant, consisting of:

- 4 wheel tractors
- 3 plows
- 2 field discs
2 spring-toothed harrows (twelve-foot)
1 spike-toothed harrow (twelve-foot)
1 field chopper
1 distill (two unit)
1 truck
1 pickup
2 cultivators
1 manure spreader and loader
1 fertilizer spreader
1 planter
1 drill
1 roller
2 sprayers
1 combine (rented)
4 mint tubs (mounted on trailers)

Allison and Blacker hire no year around help, but usually take on three to five boys during the summer to help with the harvest. One man is hired to move irrigation pipe and to hoe weeds in the oil crop fields. Blacker tries to plan the work to maximize the use of family labor. The work season begins in March, weather permitting, and extends through the middle of September, when the last of the peppermint is finally harvested.

The products of this farm are marketed locally. The sweet corn is sold to the Blue Lake Cannery in Salem, and the oil crops are sold to local buyers for midwestern companies, primarily the A. M. Todd Company, of Kalamazoo, Michigan. No livestock is raised commercially, but a few chickens are kept to supply home needs.

The total investment in this farm is about $185,000; consisting of land, $111,000; buildings, $40,000; and machinery, about $30,000.
Peppermint Production Distribution of the Willamette Valley

Seven of the nine counties have some peppermint production. The two exceptions are Clackamas and Washington Counties. Acreage varies considerably among the counties depending largely on the availability of disease free, adaptable soils. Marion County is the leader in planted acreage with 4,600 acres in 1960. Muck soils, located on the bed of Lake Labish near Salem, plus the extensive areas of recent alluvial soils combine to give a greater amount of suitable land than can be found elsewhere in the valley. Production in the other counties is restricted largely to the recent alluvial soils bordering the Willamette River and its tributaries.

Linn County closely follows in importance with 4000 acres. Virtually all plantings in Linn County are confined to an area within one-half mile of the Willamette River and its tributaries. The other counties in order of importance are Lane, 1,100 acres; Polk, 400 acres; Benton, 160 acres; Multnomah, 40 acres; and Yamhill, 15 acres (15). Figure 10 shows a more exact location of plantings.

The center of the industry in the Willamette Valley is the small town of Talbot in northern Linn County, near Jefferson. Major buyers have established receiving stations here to which growers deliver their oil after
Each Dot Represents 100 Acres

Mint Acreage

Washington  13,400
Oregon     14,900
Idaho      300
Total      28,600

Source
1960 Census of Agriculture
distillation.

The pattern of mint production in the valley is undergoing a change due to disease problems. As Verticillium wilt spreads through the valley old, established mint fields are being removed from production and new plantings are being established. It is estimated that disease free land is available to maintain this migratory system for from 10 to 15 years. After that, further peppermint cultivation in the valley will depend on research achievements, on disease control, or on increased prices.

YIELDS AND QUALITY OF OIL

The yields of peppermint oil in the Willamette Valley are relatively small when compared with other Northwest producing regions, averaging 56 pounds per acre from 1950 to 1959 (15). Willamette Valley yields, however, are higher than the national average of 51 pounds per acre.

Oil quality in the Willamette Valley is good. Price, which is the best indicator of quality, averages about one dollar per pound more than in the Yakima Valley, and is consistently higher than in most other Pacific Northwest areas (Figure 11). The oil produced here is not as high in quality as Midwest oil, however, as price paid per pound averages about $.60 less. This price
MINT OIL

Value per pound

Source: U.S.D.A. Agricultural Statistics

Figure 11
differential is enlarged when distance from markets and transportation costs are considered.

THE YAKIMA VALLEY

The Yakima Valley, with the development of irrigation, has become one of the most prominent agricultural regions in the West. The drainage basin of the Yakima River extends diagonally through three Washington counties: Kittitas, Yakima, and Benton, and contains an area of 5,970 square miles. For the purposes of this study, however, the term 'Yakima Valley' will be limited to the 342,000 acres of irrigated land in Yakima and Benton Counties.

The Physical Landscape

The Yakima Valley is unique in its topography. It is composed of a group of broad valleys separated by a series of east-west ridges. The valleys are connected by gaps through which the Yakima River flows. These transverse valleys slope gently toward the Yakima River which, in turn, slopes toward the Columbia River at a gradient of about eight feet per mile. The rise of the Yakima River and its tributaries in the Cascade Mountains, and the resultant slope of the valley was highly favorable to the development of gravity flow irrigation.
This series of valleys, which are collectively called the Yakima Valley, is divided by Union Gap into two sections: 1) the Lower Valley, extending from Union Gap to the Columbia River; and 2) the Upper Valley, including those sections in the vicinity of Yakima. This thesis is concerned only with the Lower Valley as no peppermint is grown above Wapato (Figure 12).

The use of gravity flow irrigation has necessitated land leveling in most mint producing areas. Thus machine agriculture fits well into the local farming pattern. The soils of the valleys are alluvial in origin and fine in texture. Most are suitable for mint production, but small areas of shallow soils are common. Many of the slopes of the ridges are covered with drifts of wind-lain soils, which is normally a fine, sandy loam texture and is excellent for mint production.

The climate is characterized by moderate winters with only occasional sub-zero weather. The growing season averages 187 days at Prosser, in the Lower Valley, with temperatures varying from a January average of 31.5°F, to a July average of 72.5°F. Precipitation is scant, with average annual rainfall totaling only 7.6 inches at Prosser (3, p. 8). Nearly seventy per cent of the precipitation comes between October 1 and March 31. Summer rainfall usually amounts to less than one inch. Thus
GENERALIZED TOPOGRAPHY
Yakima and Benton Counties, Washington
complete irrigation is required to provide the needed water for peppermint. Since the primary source of irrigation water is the Yakima River and its tributaries, gravity flow irrigation is the method most used.

Peppermint is grown on both specialized and general farming operations in the Yakima Valley. Small plantings on general farms are prevalent, but large farms specializing in essential oil production also are important. A case study of a specialized farm is included to illustrate farm organization and operation.

The John Gans Farm: The Gans farm, operated by Gans and his son-in-law, Gerald Klebaum, consists of 280 acres of land located four and one-half miles west of Wapato on West Wapato Road. This is a specialized farming operation, with total acreage devoted to essential oils in most years. Peppermint is most important, utilizing 200 acres. The remaining 80 acres usually is planted in spearmint, although occasionally sugar beets are grown.

The topography of the farm is essentially level, because leveling equipment was used in preparing for gravity flow irrigation. The soils are good, consisting primarily of the Ephrata sandy loam series. Drainage is excellent. Water for irrigation is supplied by the Wapato Irrigation Division, under the control of the
JOHN GANS FARM
WAPATO, WASHINGTON

SPEARMINT
80 ACRES

PEPPERMINT
80 ACRES

FARM SIZE — 280 ACRES

DISTILLERY UNIT

IRRIGATION DITCH

0
1/8
1/4
United States Indian Service. The source of the water is the Yakima River.

The operators attempt to organize the farming schedule so that they are able to handle most of the labor needs, but during the planting and harvest periods it becomes necessary for them to hire up to 16 men. Work begins in mid-March with soil preparation, and extends through the final harvest in mid-September. During the 24 day harvest period, work is conducted on a 24 hour basis, with two crews working 12 hour shifts. The farming operations are completely mechanized. The equipment and machinery include:

- 4 wheel tractors
- 2 plows
- 1 land leveler
- 1 field disc
- 2 spring-toothed harrows (twelve-foot)
- 1 spike-tooth harrow (twelve-foot)
- 1 corrugator
- 4 mint tubs (mounted on trucks)
- 1 manure spreader
- 1 mint planter (modified manure spreader)
- 2 swathers
- 2 field choppers
- 1 distillery (four units)
- 2 pickups
- 1 truck
- 1 cultivator
- 1 fertilizer spreader

The oil of both crops is grown under contract to the Brown and Sons Company, of Lemen, Indiana. Delivery is local, however, as a company representative is present in the area during harvest. The peppermint yield averages
103 pounds per acre, and the spearmint yield is 87 pounds per acre.

Weed control is partially maintained by geese. Every spring Gans purchases about 500 goslings for this purpose, costing about one dollar each. Those remaining in the fall are sold to local packers for about fifty cents each. No other livestock is raised.

The total investment of the farm is about $245,000, consisting of land, $140,000; buildings $50,000; and machinery, about $55,000.

The only work done during the winter months consists of equipment and household repairs.

Peppermint Production Distribution of the Yakima Valley

The Lower section of the Yakima Valley is the most concentrated area of mint production in the United States. Between Wapato and Prosser, a distance of about 30 miles, 364 farms raised 11,400 acres of peppermint in 1960 (19). This concentrated area of production outstrips the Willamette Valley in its intensity and equals 41 per cent of the peppermint acreage in the Pacific Northwest. It is the leading area of production in the United States.

Production in the Yakima Valley, unlike the Willamette Valley, is not confined primarily to lands bordering the river. The system of transverse valleys and wind deposits have resulted in an abundance of loam
soils well suited for mint culture. Thus mint can be grown considerable distances from the floodplain.

Yields and Quality of Oil

The Yakima Valley is noted for its tremendous yields of oil. They are consistently higher than those obtained in the Willamette Valley, and are sometimes twice the national average. The average yield for the period 1950-59 was 77 pounds per acre; but individual farms recorded yields of up to 140 pounds per acre (19).

The poorer quality of the oil produced in the Yakima Valley tends to offset the high yields. A high menthofuran content limits the usage of the oil for domestic purposes, and, as a result, the selling price is consistently the lowest of the major United States producing areas, averaging about one dollar per pound below the national average. Thus growers tend to delay harvesting operations somewhat to allow full development of oil content and further maximize yields.

Future

Peppermint culture in the Yakima Valley is in a precarious position. Verticillium wilt, due to the utilization of gravity flow irrigation practices, is spreading rapidly throughout the valley. John Keene, Yakima County Extension Agent, estimates that between
1,500 and 2,000 acres of peppermint were removed from production in 1959 and 1960 due to this disease; and Dr. C. E. Horner, Oregon State University Plant Pathologist, estimates that with present technology peppermint culture will be discontinued in this region within a 10-year period. Thus, the future of the industry depends on the technological battle with this disease.

**JEFFERSON COUNTY, OREGON**

The third major mint-producing area in the Pacific Northwest is located on the Deschutes Irrigation Project near Madras, in Jefferson County. The area consists of about 12 square miles of irrigated land on what is commonly termed the Agency Plains section of the central Oregon plateau. The project is bounded to the north and west by the Deschutes River canyon, to the south by the Crooked River canyon, and to the east by the foothills of the Ochoco Mountains. The topography of the Agency Plains is level to gently rolling; but the plain is higher than its surroundings and a marked ascent is notable when approaching from Madras or Warm Springs.

The soils of the Agency Plains are wind deposited and fine in texture, primarily loams. Most soils are suitable for mint production, but in some cases small areas of clay retard plant development. These clay soils
AGENCY PLAINS
Deschutes Irrigation Project, Oregon

Figure 14
are the result of cutting the soil severely when leveling for irrigation. Gypsum normally is applied as a corrective measure.

The climate of the Agency Plains is in essence a transition between that of the Willamette Valley and areas farther east. Temperatures, in particular, are transitional. Average temperatures vary from a low of $29.6^\circ F$ in January to a high of $65.7^\circ F$ in July. The average frost-free season is about 140 days. Variations from mean annual temperatures are common. This has considerable affect on peppermint production, because the quality and quantity of the oil vary with degree of temperature. Precipitation is scant, averaging 9.02 inches per year (18). Thus, total irrigation is required, with gravity-flow the method most used. The primary source of water is the Deschutes River, which is supplemented by Crane Prairie and Wickiup Reservoirs.

Intensive agriculture on the Agency Plains is relatively recent. The completion of the first stage of the Deschutes Project by the Bureau of Reclamation in 1949 created a "boom" in the area as land was quickly acquired and readied for intensive cultivation. Since that time the Agency Plains has developed into the most important agricultural region in Central Oregon.

Peppermint culture was first introduced into the
Madras area on a commercial basis in 1954 when a group of seventeen growers, encouraged by the A. M. Todd Company, planted 651 acres on the North Unit Irrigation Project (1). Since that time the industry has expanded at a modest rate of growth until in 1960 about 3000 acres were grown on 70 farms. Mint acreage will undoubtedly continue to expand, probably at an increasing rate, as disease reduces production in other areas. Like the Yakima Valley, peppermint on the Agency Plains is grown on both general and specialized farms. At present small plantings on general farms is prevalent; but, as the industry matures in the area, there is a trend for these farmers to specialize more and more in peppermint production. A case study of an Agency Plains specialized farm will illustrate the pattern of operation.

The Art Yungun Farm: The Yungun farm, consisting of 160 acres, is located seven miles north-west of Madras, on the Agency Plains. The farming operation is highly specialized, with only peppermint grown.

The land has been leveled for gravity flow irrigation, and the soils are very light, locally called Madras loam. Spots of clay exist however, resulting from heavy cutting of the soil while leveling. The clay has been modified by adding gypsum to the soil.
Water for irrigation is supplied by two sources: the North Unit Irrigation district and the Central Oregon Irrigation district. Due to the depth of the water table in the area, the water must be drawn from the Deschutes River.

Yungun usually hires year around labor, keeping one man on the farm at all times. Yungun spends only the working season on the farm, moving to the Willamette Valley during the winter months. During the 16 day harvest, 14 men are employed on a 24 hour basis. The work begins about the 15th of March and extends until about the 15th of November, when the spent mint straw is spread on the fields and fall fertilizing is completed. Equipment and machinery include:

4 mint tubs (mounted on trucks)
1 distillery (four unit)
2 field choppers
2 wheel tractors
1 truck
1 swather
2 harrows
1 disc
1 land leveler
2 plows
1 corrugator
1 self propelled combine
1 manure spreader

The oil, grown under contract to the A. M. Todd Company, of Kalamazoo, Michigan, is delivered to a local receiving station in Madras. The annual yield per acre of oil averages about 67 pounds.
Yungun purchases about 100 geese every spring for weed control. Geese remaining at the harvest period are given to the Warm Springs Indian Reservation, which is located nearby. No other livestock is kept.

Yungun estimates the total investment in the farm at about $140,000. This is broken down into $80,000 for land; $55,000 for equipment; and $5,000 for building. No permanent residence buildings are located on the farm as the Yungun family make their home in the Willamette Valley.

Yields and Quality of Oil

The average yield per acre of mint oil in the Madras area for the period 1957-60 was 58 pounds, ranging from a low of 50 pounds in 1959 to a high of 65 pounds in 1960. This represents an average yield slightly above that of the Willamette Valley, but considerably below Yakima Valley figures for the same period. Individual yields as high as 101 pounds per acre have been recorded.

Major buyers appear to be somewhat reluctant to give a definite classification to the quality of oil produced in the Madras area. They prefer to say that the oil is "comparable" in quality to that of the Willamette Valley. Their reason for being cautious in classifying the oil is the uncertainty of summer temperatures. Normally, however, the quality of oil from this area is
classed as "fairly good", and the price offered per pound is generally the same as that received in the Willamette Valley.

The possibility for the growth of the peppermint industry on the Agency Plains is favorable, and expansion will undoubtedly occur. Since there is limited potential for extension of irrigation, expansion must be at the expense of established crops which return lower profits, such as potatoes, hay, and grass seed crops. Thus, the rate of growth of the industry is largely dependent on the economics involved. Current disease problems in the Willamette and Yakima Valleys, however, would indicate that growth might be rapid.

OTHER AREAS OF PRODUCTION

The other generalized mint growing area in the Pacific Northwest is located on both sides of the lower Columbia River, primarily in Cowlitz and Clark Counties, Washington, and Columbia County, Oregon. These are old producing areas, with small plantings located on muck soils on islands along the banks of the Columbia River. Clark County lead in importance in 1959 with 840 acres; Cowlitz had 400; and Columbia, 300. Yields, problems, and future possibilities in this area are similar to those of the Willamette Valley.
With the discovery of Verticillium wilt in the Yakima and Willamette Valleys, growers, well aware of the effect of the disease, began to search for new areas adaptable to mint culture. Several relatively small plantings in Josephine, Malheur, and Umatilla Counties in Oregon; and Grant, Franklin, and Walla Walla Counties in Washington are the result of that search. Most of these counties have fewer than ten farms growing peppermint, and in no county is the bearing area more than 700 acres. The location of these areas is shown in Figure 10.

The future of peppermint culture in these new areas depends on the answers to three questions. First, how profitable will the crop remain? This depends on demand. Second, can peppermint compete with other crops such as potatoes, grass seed, etc.? And third, and most important, what is going to happen in competing areas? No one can foresee the answers to these questions with accuracy, but unless disease can be overcome in the Willamette and Yakima Valley growth of the industry surely will occur and the future of these areas should be bright for peppermint.
Figure 16. The Fry mint in Josephine County. Notice the sprinkler irrigation system in operation.

Photograph by James Jack
Chapter V
CULTURAL PRACTICES, USES, AND MARKETS

The techniques of production and the market outlets were found to be similar among all the districts. It, therefore, is possible to generalize the common characteristics in this chapter.

MINT CULTURE

Peppermint spreads vigorously by lateral growth of stolons and the sprouting of plants from the stolons. It is grown as a solid stand, called meadow mint, or as a row crop. The same field may remain in mint for several years, requiring only shallow plowing each fall, with rows defined in the spring; or the original mint may be removed in the spring with a potato digger, and new rows established between the old rows of the year before (8, p. 8).

Preparation of Soil

In preparing the soil for new mint the land is clean cultivated to reduce the possibility of weed growth (18, p. 7). Often a clean-tilled crop is planted in a field the year before it is to be planted to mint; thus further reducing the threat of weeds. The land usually is worked as early in the spring as possible before
planting.

Plowing usually is completed in the spring, after the winter rains have subsided. This late plowing reduces the possibility of severe erosion which could occur during the early spring floods that are common in some parts of the Northwest. After plowing, the ground is worked by conventional equipment to insure optimum conditions for the growth of the young plants. The preliminary farming techniques are common to most row crops; that is, plowing, discing, and harrowing.

Propagation

Peppermint fields usually are started by stolons, although sometimes young plants are used (18, p. 8). Stolons are obtained by thinning well established, disease free mint. One acre of producing mint normally will supply enough stolons to plant 6 to 10 acres of new land. It is important to exercise extreme caution in selecting stolons for planting, as one of the most common methods of spreading Verticillium wilt is through the transfer of diseased planting stock from one area to another.

Most of the planting stock in the Pacific Northwest now is obtained in the Yakima Valley. With the spreading of wilt there, however, it is probable that growers will become increasingly reluctant to use this stock and will
turn to new producing areas for stolons. Indeed, this is already the case in Jefferson County. Here, as a means of controlling disease and pest problems, farmers have established, through legal means, a control district (1). This district has many functions, one of which is to assure that no more planting stock is imported from diseased areas, including the Yakima Valley. Henceforth all stolons planted in this area must be locally produced and inspected. A similar procedure will probably develop in other areas where wilt is not presently found.

Stolons are sold for about $30 per ton, varying slightly with elasticity of demand. Supplying stolons for planting stock is important to growers, because additional income is provided with little increase in total costs.

The second method of propagation is the use of immature plants. This method is not widely used because it requires greater initial costs, both in planting technique and cost of stock. The use of young plants does have certain advantages, however, as late planting avoids cold weather which, in some areas, may retard young growth from stolons. Transplants, therefore, may serve as insurance against crop loss. When used, the young plants are set in the late spring when they are
four to five inches high. Planting is normally done by machine in slightly dampened soil (18, p. 9).

Planting

Planting is executed as soon as soil and climatic conditions will allow, and normally is completed during the early weeks of March. In muck soil areas, planting is delayed until April or May, because the land is generally not in a workable condition earlier.

Furrows prepared for stolons are laid from 18 to 36 inches apart. The width of the furrows may vary to suit cultivating equipment. The furrows are made just prior to planting, so the soil will remain moist until the process is completed.

Stolons are planted either by hand or machine. The hand method is most common in new producing areas, because less stolons are required per acre planted. This method utilizes a drag, pulled by a tractor, on which workers ride placing stolons in the furrows as they move along. The stolons then are immediately covered with soil by another drag which is pulled behind the first.

A mint planting machine usually is an ordinary farm implement, such as a spreader, which has been modified by the farmer for this purpose. A funnel system attached to a spreader, to direct the stolons to the furrow, is the most common type. There is difficulty in regulating
the flow of the stolons, however, and for this reason machine planting is most common in areas where the farmer can supply his own planting stock. This method also utilizes a sled pulled in tandem to cover the stolons.

Although the hand method requires less stolons than machine planting, it requires more labor. Therefore, cost factors are weighed carefully in deciding which method to use.

**Cultivation**

Peppermint requires frequent cultivation during its growth to destroy weeds which color the oil and reduce its quality. Until the plant is five or six inches high it is cultivated with fine-toothed harrows, weeders, and rotary hoes. After machine cultivation is no longer possible, hoeing and animals, normally sheep and geese, are used. Spring-toothed cultivators are used in established row mint (18, p. 9).

**Fertilizers**

Fertilizers are now commonly used for most crops in the region. Peppermint is no exception. The added soil nutrients, as was shown in Chapter III, can have considerable affect on the yield of oil.

Pacific Northwest mint farmers use both organic and commercial fertilizers. Various types are used, a few of
which are 11-48-0, 16-20-0, 27-14-0, Nugreen, and ammonium nitrate, all nitrogen and phosphate supplying fertilizers. Potash is supplied in some areas in the form of Murate of Potash; and trace elements, such as boron and manganese sulfate, are added if need is indicated by soil analysis. The amount of fertilizer used varies with soil type and existing level, ranging from 100 to 200 pounds of nitrogen per acre. Fertilizers are applied in the spring or immediately following the harvest in the fall (18, p. 11).

Organic fertilizers, such as manure and decayed mint straw, are recommended for mineral soils. Only well rotted manure is used, however, in order to minimize weed growth. Manure is not used on muck soils, because it may reduce the yield of mint in dry years. The average application of organic fertilizers is about $8\frac{1}{2}$ tons per acre (9, p. 11).

**Irrigation**

Owing to the characteristically dry summers of the Pacific Northwest, irrigation is essential to peppermint culture. Two types are used: the furrow or gravity method, and the sprinkler method. Each type is especially well suited to certain areas.

In south-central Washington and central and eastern Oregon, due to the depth of the water table, the system of water supply, and surface character, furrow or gravity
irrigation is used. In these areas water must be transported by a series of canals from diversion dams, which, in many cases, are several miles from the irrigated land. The water is supplied to individual farms by controlled flood gates. Under this system of water supply sprinkler irrigation, except in special cases, is impractical.

Irrigation begins in early May in the central and eastern regions and continues through the summer, with water supplied at intervals of one to two weeks, depending on prevailing conditions. The primary sources of water in these areas are the Columbia and Yakima Rivers in south-central Washington, the Deschutes River in central Oregon, and the Snake River in eastern Oregon.

Sprinkler irrigation is common in mint producing areas west of the Cascade Mountains. Irrigation here is of a supplementary nature, with the crop receiving water one to five times during the season, according to need. Wells supply most of the water in these areas, but a considerable amount is pumped from the Willamette River and its tributaries.

**Harvesting**

Time of harvest is very important in mint farming. It generally is assumed that the quality of the oil is highest at the flowering stage; thus the crop usually is
harvested at that time. If the crop is harvested before flowering begins, low yields may result, and if the plants are allowed to reach full bloom the menthofuran content of the oil will increase and quality is reduced. As an indicator many farmers run trial distillations and then apply a test for menthol that indicates the proper stage for harvesting (18, p. 17).

Mint grown on muck soils usually is the first to be harvested, as these moisture retentive soils may cause the loss of the lower leaves before the best harvesting stage is reached. It is desirable, however, to allow the crop to grow to as near maturity as possible before harvesting, as early cutting may result in inferior oil. In the Pacific Northwest the harvest usually begins about mid-August and continues until mid-September.

Most farmers now use swathers (Figure 17, 18) to cut their mint, although some continue to use the short-sickle mowing machine. Swathers are very efficient because they cut the mint hay and place it in wind-rows in one operation, with a minimum loss of leaves. The mint usually is allowed to lie in the field for a day to partially cure. It is not allowed to dry completely, however, as this might result in a serious loss of leaves. Prior to distillation the mint is picked up by a field chopper which chops the hay and transfers it to waiting
Figures 17 and 18. Swather cutting mint during harvest season. Willamette Valley

Photograph by Walt Harrison
receptacles (Figure 19, 20).

Distillation

Distillation is a process which utilizes a system of passing steam through the mint. This vaporizes the oil, which is later condensed, separated from water, and collected. The steam and oil vapors are conducted through a worm or other form of condenser which reduces the vapors to liquids. The liquids are collected in suitable receivers, where they separate into layers with the oil floating on the surface of the water. Finally, the oil is separated from the water and transferred to containers (Figure 21, 22).

Stills used in this process vary in detail, but all utilize the same basic principle. A high-pressure boiler is necessary for generating steam, and a minimum of one tub, condenser unit, and a receiver unit are required. Usually even the smallest units have two tubs, operated with one condenser so that while one tub is being processed the other can be emptied and recharged with fresh hay. On larger farms four or more tubs usually are operated in pairs, with one condenser for each pair.

1 For a detailed description of a mint distillery unit see Hughes, A. D. Improvements in the field distillation of peppermint oil. Corvallis, 1954. 60 p. (Oregon. Agricultural Experiment Station. Bulletin 525.)
Figure 19. Field chopper and cement tub in operation.

Photograph by Walt Harrison

Figure 20. Field chopper and rectangular tub.
Submerged condenser
~to~
Draif't
Separating can

Water

Steam from boiler

Cooling water
to boiler feed pump

Oil removal pipe

Cool water

to drain

Separating can

Field Distillation Unit

Source: Pound, R.E.
Figure 22. Distillation unit showing circular tub and coil.

Photograph by Walt Harrison
Sometimes a single large condenser is adequate for as many as four tubs. Multi-tub arrangements are most efficient when each tub is equipped with its own condenser as this allows continuous operation (18, p. 21).

When the tub is charged, the mint is packed down thoroughly so the steam will not channel. After the cover is clamped in place more steam is turned on and adjusted so that condensation is complete with no loss of oil vapor. The time required to complete the distillation of each tub depends on the rate at which steam is admitted and the condition of the mint. The drier the herb, the shorter the time needed to complete the process. A normal cycle is usually 45 minutes to one hour. During this period the other tub or tubs are emptied and recharged. Exhausted materials may be fed as fodder or returned to the soil as a mulch (Figure 23, 24). The feeding value of mint straw is relatively poor, however, equaling that of Timothy hay (18, p. 23).

The oil is stored in 55 gallon drums. It can be kept for indefinite periods with no harmful effects as long as it is placed in a dry, cool place.

The distillery unit is the most specialized and expensive equipment connected with mint farming. The boiler is the most expensive item, costing about $4000. Coils are about $400 each (coil type), and tubs are
Figure 23. Removing spent mint straw from tub and placing it in a spreader.

Photograph by Walt Harrison

Figure 24. Spreading mint straw on a field as mulch.

Photograph by Walt Harrison
priced around $1500 each. Thus an average size unit costs between $8000 and $10,000. Cooperative distillery units have been established in some areas to help relieve this expense. Custom distilling also is common, with cost per pound of oil varying between $.75 and $1.00.

USES AND MARKETS

Peppermint has a relatively constant demand schedule which fluctuates little from year to year. Thus the price of the oil is dependent largely on yearly production and existing surplus stock. For this reason most mint is produced on a contract basis. That is, the processors offer annual contracts to growers at a price based on demand. In surplus years, when large stocks of oil are on hand, price for additional production decreases and, after a few years of low prices, less oil is produced. This has been the case for the past few years in the Pacific Northwest. It appears now, however, that shortage of oil exists among processors and they are offering contracts with a substantial increase in price for 1961.

Uses of Peppermint

Peppermint is one of the most useful and important of the volatile oils. It has a cool, refreshing flavor that makes it very popular in improving the taste of medicinal
preparations, dentifrices, cough drops, and cold remedies. The oil also is used in pharmaceutical preparations, where it reflects pronounced medicinal properties. The main use, however, is not in the field of medicine, but for flavoring such items as chewing gum, candies, jellies, dentifrices, liquers, and flavoring extracts. Also a large portion of the annual production of oil goes into export channels for shipment abroad.

The greatest single use of peppermint is for flavoring chewing gum. It is estimated that 50 per cent of the total national production is used for this purpose (9, p. 17). Approximately 8 per cent goes into the flavoring of candies and confections. The other main users are dentifrice, 5 per cent; pharmaceutical and drug preparations, 3 per cent; and the flavoring of jams and jellies, 1.5 per cent. The remaining 32.5 per cent goes into export channels (9, p. 17).

Peppermint oil produced in the Pacific Northwest probably enters all of the markets listed above. It is significant, however, that there is a considerable variance in the use of oil, depending on where it is produced. Most of the oil grown in the Willamette Valley and other areas west of the Cascade Mountains\(^1\) is used

\(^1\) Oil produced in the Madras area also must be classified in quality with "western" oils, although it is actually east of the Cascade Mountains.
primarily for domestic purposes, such as in flavoring gum, toothpaste, candies, etc.; Yakima Valley oil, however, due to its lower quality, is not acceptable for many domestic markets but meets no objections from foreign consumers. Thus most Yakima Valley oil is exported.

Markets

Most of the mint oil produced in the Pacific Northwest is grown under contract to two large processing companies, the A. M. Todd Company of Kalamazoo, Michigan, and the I. P. Callison Company of Seattle, Washington. These companies have receiving stations placed throughout the region to which the oil is delivered by the farmer for grading and payment. Other companies which purchase substantial amounts of oil are Brown and Sons, of South Bend, Indiana; and William Leman of Bremen, Indiana (18).

After the oil has been graded and processed by the processing companies it is sold to the various industries that utilize the product. The most important buyers of processed oil are the Beech-Nut Packing Company of Carnajoharie, New York; the William Wrigley, Jr. Company of Chicago, Illinois; and the American Chicle Company of New York City. Most of the exported oil goes to Japan and the United Kingdom, with Canada, Australia, Mexico, and Argentina also receiving small quantities (9, p. 17).
Chapter VI
SUMMARY AND CONCLUSIONS

Following the introduction of peppermint into Oregon in 1908, the industry extended into several sections of the Pacific Northwest and has grown in importance until in 1960 the region accounted for 82 per cent of the nation's oil production.

Several factors were responsible for the development of the industry. Of primary importance were: (1) adaptable soils; (2) suitable climate; (3) favorable farming complex; and (4) disease problems in Midwest mint growing areas.

Two Pacific Northwest areas are outstanding in mint production. They are the Willamette Valley, in Oregon, and the Yakima Valley, in Washington. Together these areas account for about 76 per cent of Pacific Northwest peppermint acreage, and about 55 per cent of United States acreage. Other significant areas of production in the region are Jefferson County, Oregon, and the lower Columbia Basin of Oregon and Washington.

As the industry has evolved in the region, several biological factors have come to plague mint growers. Most serious is Verticillium wilt, a fungus disease for which there is no adequate control. This disease is responsible
for the development of a migratory pattern of mint farming in the old established areas of production, and for the extension of the industry into new areas. Drastic reductions in acreage will result unless an economical method of control is developed within the next few years. Mint rust, nematodes, and various weeds also present cost problems, but, since control measures are available, they are not prohibitive to production.

The future prospects of the peppermint industry in the Pacific Northwest depend on the answers to three questions. First, will a method of control for Verticillium wilt be discovered? Second, how profitable will the crop remain? And third, can peppermint continue to compete with other high value crops? The answer to these questions are in the future, but present trends indicate that the industry will decrease in importance in the Willamette and Yakima Valleys and that plantings will increase in new areas.
BIBLIOGRAPHY


APPENDIX
APPENDIX

Anatomy


Chemistry


Culture


Diseases


Horner, C. E. Mint rust control. Plant Disease and Insect Control, No. 3. Corvallis, 1953. 3 p. (Oregon State College Agricultural Extension Service Mimeograph)


General


Hughes, A. D. Improvements in the field distillation of peppermint oil. Corvallis, 1954. 60 p. (Oregon. Agricultural Experiment Station. Bulletin 525.)


Thompson, B. G. Insect pests of mint in Oregon. Corvallis, 1946. 5 p. (Oregon. Agricultural Experiment Station. Circular 384.)