outlook for a further spread in growing deciduous fruit trees is bright.

However, in spite of our progress with regard to the use of rest-breaking chemicals, complete substitution for chilling requirement of buds in deep rest has never been achieved. An initial chilling requirement seems to be indispensable. It is anticipated that future research into the mechanism of rest, and on the effect of the various chemicals that break it, will lead to treatments that fully substitute for the lack of chilling.

**Literature Cited**


**Is Growing Temperate-zone Fruits Profitable in the Tropics and Subtropics?**

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Fruit trees normally thrive in zones with ecological conditions similar to their original habitats. The majority of temperate fruit trees require climates with sufficient winter chilling to break internal bud dormancy. This condition generally can not be fulfilled in tropical or subtropical climates. Temperate-zone cultivars have not been commercially productive in these areas; however, some poor-quality fruits have been obtained from seedy plants and some local selections.

Temperate-zone fruits in the tropics and subtropics. Recent attempts have led to the development of new cultivars of apples (10, 14), peaches, and nectarines (11). These cultivars can be grown successfully under subtropical and tropical highland conditions. Locally adapted cultivars of apricots and some Japanese plum cultivars produce crops of high quality in many subtropical countries. The use of dormancy-breaking agents (3) made it possible to grow cultivars with moderate chilling requirements in areas having mild
Table 1. Imported temperate zone fruits in the tropics and subtropics, 1984.

<table>
<thead>
<tr>
<th></th>
<th>Apples</th>
<th>Pears</th>
<th>Peaches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>Value</td>
<td>Value</td>
</tr>
<tr>
<td></td>
<td>(1000 $US)</td>
<td>t</td>
<td>(1000 $US)</td>
</tr>
<tr>
<td>Africa</td>
<td>17,578</td>
<td>10,648</td>
<td>650</td>
</tr>
<tr>
<td>Latin America</td>
<td>176,896</td>
<td>63,074</td>
<td>35,802</td>
</tr>
<tr>
<td>Near East</td>
<td>339,708</td>
<td>207,490</td>
<td>13,101</td>
</tr>
<tr>
<td>Far East</td>
<td>124,060</td>
<td>88,201</td>
<td>100,304</td>
</tr>
</tbody>
</table>

Table 2. Average yield per hectare for 8 successive years under Egyptian conditions

<table>
<thead>
<tr>
<th>Years</th>
<th>Apples</th>
<th>Peaches</th>
<th>Navel oranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>4.9</td>
<td>9.9</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>7.4</td>
<td>19.8</td>
<td>2.5</td>
</tr>
<tr>
<td>5</td>
<td>9.9</td>
<td>24.7</td>
<td>9.9</td>
</tr>
<tr>
<td>6</td>
<td>12.3</td>
<td>29.6</td>
<td>17.3</td>
</tr>
<tr>
<td>7</td>
<td>17.3</td>
<td>29.6</td>
<td>24.7</td>
</tr>
<tr>
<td>8</td>
<td>19.8</td>
<td>29.6</td>
<td>29.6</td>
</tr>
</tbody>
</table>

Table 3. Net financial return in 8 successive years (Egyptian pounds$).

<table>
<thead>
<tr>
<th>Year from planting</th>
<th>Apples</th>
<th>Peaches</th>
<th>Navel oranges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Production costs</td>
<td>Gross receipts</td>
<td>Net returns</td>
</tr>
<tr>
<td>1</td>
<td>1266</td>
<td>0</td>
<td>-1,266</td>
</tr>
<tr>
<td>2</td>
<td>565</td>
<td>0</td>
<td>-565</td>
</tr>
<tr>
<td>3</td>
<td>775</td>
<td>2,000</td>
<td>1,225</td>
</tr>
<tr>
<td>4</td>
<td>993</td>
<td>4,000</td>
<td>3,007</td>
</tr>
<tr>
<td>5</td>
<td>1330</td>
<td>8,000</td>
<td>6,670</td>
</tr>
<tr>
<td>6</td>
<td>1660</td>
<td>10,000</td>
<td>8,340</td>
</tr>
<tr>
<td>7</td>
<td>1660</td>
<td>12,000</td>
<td>10,340</td>
</tr>
<tr>
<td>8</td>
<td>1660</td>
<td>12,000</td>
<td>10,340</td>
</tr>
</tbody>
</table>

*One Egyptian pound = $US0.60-0.80.*

winters. Accordingly, growing of temperate-zone fruits has spread rapidly in new latitudes in the subtropics and tropical highlands (1, 6, 7, 9–12, 14).

Production of temperate-zone fruits in the tropics and subtropics.

The most widely planted temperate-zone fruits in the world are apples, pears, peaches, nectarines, plums, and apricots (5). These crops are produced mostly in areas north of 30° lat. in the northern hemisphere and south of 30° lat. in the southern hemisphere.

Most countries in Africa, Latin America, the Middle East, and the Far East are situated in the tropical and subtropical zones. However, although some countries, such as Mexico, and some parts of the southern United States are in the tropical and subtropical zone, they are not considered in the statistics on these regional groups, which are gathered by the FAO and printed in the production and trade yearbooks (4, 5). Production of temperate-zone fruits in the area considered to be tropical and subtropical is shown in Fig. 1 for both 1974 and 1984. It shows a significant increase in the production of most crops (apples and pears). The percentage of their production to total world production is shown in Fig. 2.

Consumption of temperate-zone fruits in tropical and subtropical countries. Temperate-zone fruits are highly appreciated in tropical and subtropical countries. A considerable amount of consumed fruit is imported from the original area of production. Total amounts and values of imported apples, pears, and peaches in different regions

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Fig. 1. Annual production of temperate-zone fruits in the tropics and subtropics.

Fig. 2. Percentage of world production of temperate-zone fruit produced in the tropics and subtropics.
of this area are summarized in Table 1.

Since the majority of the countries in this area are still developing, these imports are not favorable to their national economy. However, considerable amounts of these fruit are also exported from these countries as well. Nevertheless, it can not be easily detected whether they are exported to countries of the same zone or outside it. Production of new cultivars of temperate-zone fruits in the tropical and subtropical areas could reduce the import of these fruits. Also, new markets for the export of early season cultivars could be initiated.

**Profitability of temperate-zone fruits in Egypt.** Egypt is a subtropical African country that lies between lat. 22°N to lat. 30°N. The major fruit crop produced in Egypt is oranges, with an annual production of around 1,200,000 t (2). Considerable amounts of temperate-zone fruits are produced in Egypt (Fig. 3). New cultivars have been introduced (13) and programs have been initiated for the development of their production.

Growers are shifting extensively and rapidly to the production of these crops. During the last decade they have persistently asked whether it is possible and advisable to extend the production of temperate-zone fruits in Egypt or better to maintain our traditional subtropical and tropical crops. To respond to such questions, production costs, income, and profit of apples, peaches, and navel oranges were determined for 8 successive years. This study was carried out on a sample of average Egyptian orchards of 4 ha in the Nile Delta. Successfully developing an orchard depends on yields obtained during the early years, the price received for the crop, and costs of operation (8). Location also affects costs because of differences in land value, wage rates, etc.

Some data are based on recent detailed studies, other data are estimates. The following procedure was used in compiling this information. Cost of operations performed in planting and growing trees, including amount of labor and material used, were determined. Irrigation costs were calculated based on cost of pumping water from side canals and labor costs (water itself is free in Egypt).

All estimates are presented in local currency (EE = US $0.60–0.80). Investment costs and gains were calculated. Average yields to be obtained from year-to-year for each crop were determined and their value (in the orchard) calculated (Table 2). The cost was subtracted from the income to get the net return for each year (Table 3). These net returns were then accumulated until the 8th year (Fig. 4). This information reveals that the highest return and profit comes from growing apples, followed by peaches, while that from navel oranges is much lower. These accumulated returns were estimated.
to be, respectively, 39, 303, 23, 309, and 4,046 £E in 8 successive years. Some may suspect that the estimates are exaggerated. Nevertheless, it is worth mentioning that many growers receive higher returns after adopting better techniques for producing, handling, and marketing their fruit. It is possible that production will overcome demand and cause surpluses. I do not think this situation will be reached soon.

Increasing populations and improved standards of living in developing countries, which comprise the majority of those located in the concerned area, intensify the demand for such fruits continuously. However, further detailed studies on economics of fruit production in tropical and subtropical areas are needed.

Literature Cited