PRUNING

BEARING
APPLE
TREES

Agricultural
Extension Service
State College
of Washington
Pullman, Wn.
PRUNING BEARING APPLE TREES

John C. Snyder, Extension Horticulturist
W. A. Luce, Assistant Agent

Pruning bearing apple trees is worth while only insofar as it maintains or increases profits from the orchard. To prune for any other purpose not only increases pruning costs but also reduces bearing capacity. Avoiding losses resulting from excessive or wrong pruning is not easy. It requires considerable knowledge concerning the growth and fruiting habits of trees.

Pruning is one of several factors which influence production. No one can prune an orchard right without taking into consideration factors such as soil fertility, soil moisture, regularity of bearing and past treatment of the orchard.

The ability to prune apple trees is not a gift. It comes from experience and an interest in working with them. In their own way, trees tell whether past treatment has been good or bad. He who wishes to prune, then, need only to observe them well. The experienced pruner differs from the inexperienced pruner in that over a period of years, he has observed the way trees respond to various kinds of treatment, and learned to choose and fit into the picture the kind of pruning needed. A good pruner sees the tree, not only as it is before him, but as it will be in two, three, four or more years later. As he works he applies fundamental principles of pruning. For example (knowing that pruning delays bearing), he does not overprune for fear of throwing the tree out of production. He adjusts his pruning to the growth habits of the tree, whether they be upright or spreading. It is not necessary to caution him against cutting off new growth not yet in full bearing, even though at the time it appears to be too high. He well knows that it will pull down into position with the first load of fruit.

Relation of Pruning to Vigor

Vigor is the first thing to consider when deciding how much to prune a tree. Bearing trees making an annual terminal growth of 8 to 12 inches are in about the right state of vigor and should be pruned moderately. More vigorous trees, because they are capable of bearing larger crops, should be pruned less. Weak trees with a terminal growth of 8 inches or less, on the other hand, should be pruned heavier. Increasing the amount of nitrogenous fertilizer should be considered also.
Moderately vigorous trees receiving good cultural treatment may be thought of as being in good balance as far as top growth, root growth, and fruit production are concerned. They bear regular crops and do not make excessive growth one year and none the next; neither do they produce excessive water sprouts. In order that this balance may not be upset, a moderate pruning program should be planned over a long period of time. Trees in good balance which have been receiving moderate pruning should continue to receive such pruning unless other operations disturb the balance. Moderate to light pruning should be the general rule and heavy pruning the exception.

**Fig. 1.** (left) Branch in good vigor. (right) Branch in poor vigor.

**Relation of Pruning to Leaf Area**

Trees in good average vigor usually possess about the right amount of foliage in relation to fruit. Pruning too much or too little
may throw the balance one way or the other. The number of leaves of average size required to produce an apple of medium size or larger is approximately 30.* Generally about five good leaves per spur are sufficient.

**Relation of Pruning to Fruiting Habits of Different Varieties**

Varieties show considerable variation in growth and fruiting habits. Some are spreading and some are upright; some bear almost entirely on spurs, while others bear both terminally and laterally on new growth; a few varieties tend to bear biennially; with some, color is an important factor of grade, whereas with others it is of little importance. These varietal characteristics should be taken into consideration when pruning.

**Delicious and Winesap.** Trees of these varieties, being fairly open, do not require artificial spreading. Pruning usually consists of separating lateral and sub-lateral branches and removing or shortening old spur wood that has become pendant. Singling out sections of the tree to provide maximum exposure to sunlight is relatively simple. Spur thinning is sometimes necessary and, except with red sports, pruning that favors color development is essential.

**Jonathan.** With this variety the good fruiting wood gradually moves toward the outside of the tree, unless its growth on the inside is encouraged by such practices as keeping the tree fairly open. Such pruning also permits the development of color, essential for this variety. Little detailed pruning on the outside of the tree is needed, except occasionally to remove or shorten old pendant spur wood.

**Rome Beauty.** The fruiting wood on the outside of the tree gradually becomes overlapping, because much fruit is borne on the terminals of new growth. It is necessary to thin out some of the fruiting wood in the outer portion of the tree in order to eliminate and prevent overlapping. This practice also permits the development of color and fruiting wood on the inner portions of the tree.

**Newtown and Golden Delicious.** With these varieties, although color is not essential, it must be kept in mind that the production of good fruit requires considerable exposure to sunlight. Inasmuch as the tendency to bear biennially is pronounced in these varieties, some attention should be given to the removal of spurs during “on” years and saving them during “off” years.

---

Renewal of Fruiting Wood

A tree is as old as its fruiting wood. Its life is not measured in terms of years. Under some conditions it may begin to decline at 25 years, but under others it may not reach peak production until several years later. The behavior after the point of peak production depends directly upon the ability of the orchardist to renew the fruiting wood. Renewal in any section of the tree takes place normally as long as the branches have space and there is necessary plant food and water available.

As the inside becomes crowded, growth here gives way to that on the outside where there is more room. The job of the pruner, therefore, is to provide suitable growing conditions for the inner portion of the tree by eliminating weak wood which hinders inside growth.

Renewal of Leaders

Leaders eventually pass their peak of production. Their fruiting wood becomes spindly and weak and the leaders themselves begin to droop. Each must be renewed when it reaches this stage if a high total production of the tree is to be maintained. Fortunately, new growth usually appears on the trunks at this time if not earlier. By foreseeing the need for renewing two or three years in advance, suitable shoots can be trained for this purpose. They should be on the upper side of the leader trunk and not more than eight feet from the junction of the leader with the main trunk of the tree; if farther up they become unnecessarily high. Ideally, the renewal should be at the base of the bend of the leader.

Fig. 3. (left) Early stage of renewing leader. (right) Late stage of renewing leader.
Training Renewals. Ordinarily it is not advisable to head the renewal. Heading not only tends to keep it from bending down into position in later years, but also delays bearing. It should be so trained that it will grow toward the outside of the tree. Occasionally it is necessary to remove some of the inside laterals that tend to keep it upright.

It is unwise to permit numerous shoots to develop on the upper side of the leader trunk with the idea that they may eventually be used for renewals. They develop into branches commonly referred to as “risers,” which in a few years dwarf the leader; and unless trained and given room, become so unwieldy that they are unsuitable for renewals. These “risers,” usually in a key position as far as sap flow is concerned, grow rapidly in an upright direction. It is better to select two or three new growths on each leader two or three years before the leader is to be renewed than to allow more of them to start. It may be necessary to remove all but one of these potential renewals the second or third year after they start, or a year before the leader is to be renewed. Occasionally neglected “risers” pulled and tied down into position make good renewals.

Renewal of Laterals

Laterals which are branches arising directly from the trunk of the leader eventually become fruiting out. Originally, they are rather upright in position. As they come into bearing they become more slanting and eventually droop. When they reach a horizontal or drooping position, they should be renewed. As the laterals begin to droop, new shoots appear on the upper sides. For each lateral to be renewed, select a renewal in the same general direction of the original lateral and arising at the bend. Select the renewal two or three years before the lateral is cut off next to the base of the renewal and train it toward the outside of the tree. No heading is necessary. The original lateral may be “bobbed” previous to making the final renewal cut.

Renewal of Spurs

Fruiting spurs eventually reach the stage where it is more profitable to renew them than to try to keep them in production. Generally, spurs over five years old should be renewed. They may be renewed by selecting moderately vigorous twigs and branches growing in a horizontal position along the laterals. Here healthy young spurs soon appear. Such branches arising on trunks of leaders may also be used.
Maintaining Tree Structure

Most bearing apple trees in the State of Washington have too much structural wood. The removal of such wood must be done carefully if weaknesses are to be avoided. It is best to make the cuts at some distance above the junction of the leaders with the trunk and to avoid bench cuts as much as possible. Leaving a short stub the first year and cutting it off some years later, after it has become dwarfed in relation to the remaining branch, is sometimes practiced to keep decay from reaching large structural branches. Allowing water sprouts to start and continue to grow near the large cuts aids in keeping the wood here solid and alive.

Fig. 4. (upper left) Tree with good cut. (upper right) Tree with poor cut. (lower left) Tree with 3 leaders. (lower right) Tree with too many leaders.

Relation of Pruning to Alternate Bearing

The apple bears biennially by habit. Pruning as well as several other orchard operations influence this tendency. Although the influ-
ence from pruning is not pronounced, it may keep the trees in fairly regular production.

The kind and amount of pruning for trees bearing biennially varies with the “off” and “on” year. “On” year pruning consists of detailed small cuts to remove old spur wood. Such pruning reduces thinning costs. “Off” year pruning consists mainly of saw cuts to space laterals and reduce to a minimum the elimination of spurs. No thinning may be needed during this season.

**Pruning for Convenience**

It must not be forgotten that the primary objective of growing apple trees is to produce fruit at a profit. The biggest possible crop that a tree may produce is not necessarily the most profitable crop. If on a tree the worm control is poor and the harvesting and spraying costs high, the net income may be less than that from a similar tree with less but clean fruit produced at lower costs.

Inasmuch as fruit can be grown more economically on low branches than on high branches, it is well to encourage fruiting in this part of the tree even though it may cause some inconvenience in orchard operations. Spraying, thinning, and harvesting costs increase rapidly as ladders over 12 feet are needed. Although low branches interfere with scattering boxes and other harvesting operations, this inconvenience is more than offset by the advantage in picking from low branches.

Opening up spaces in dense trees, so that ladders may be set to good advantage and spray material applied to the inside of the tree, may comprise the principal part of the pruning in dense trees. Such pruning on mature bearing trees, if done properly, can easily reduce the cost of thinning, spraying and harvesting without reducing production capacity. To do such pruning will require thought and planning if serious injury to the orchard is to be avoided.

Many trees have been forced to grow too tall. In many of them vertical leaders have not been pulled down. In others, “risers” have been permitted to grow to unreasonable heights. Many of these high leaders and “risers” can be lowered without reducing the profit.

**Propping Usually Necessary for Heavy Crops**

It generally is more economical to use props when necessary than to attempt to eliminate their use by pruning. They should be set so that when the maximum weight develops, there is a slight sway in the section of the branch between the prop and the tree.
trunk (cover illustration). If set too far from the trunk the branch may slip out; if set too close it may break beyond the point of prop support.

Propping may be minimized by reducing the number of structural branches and by thinning off fruit at tips. Branches allowed to grow without crowding develop diameter enough to withstand considerable strain. These same branches, on the other hand, grow less in diameter and require extra propping if crowded.

**Summer Pruning**

Summer pruning has a devitalizing influence on the tree. This devitalizing influence is less pronounced if the pruning is done early in the spring or after the terminal growth has ceased than if it is done when the tree is growing rapidly. Summer pruning delays hardening of the wood and may stimulate late summer growth, which may in turn lead to serious winter injury.

The removal of water sprouts and such inside growth in the summer favors color development and the control of aphis and codling moth. Removing them early, when they can be pulled off without slivering the wood, therefore not only wounds the tree less but aids in color development and pest control more than does removing them later.

**Pruning Trees in Windy Areas**

The wind complicates pruning in some areas. Here it is not practical to force the tree into the wind by pruning. Reducing pruning to an absolute minimum until full production is reached, on the other hand, hastens the time when the fruit load helps to pull the branches into position. As the tree loads up, most branches pull into position surprisingly well. Some tying may be desirable in some instances.

Ordinarily, most pruning should be done on the side toward which the wind blows. Opening up alleys through the tree in the direction of the wind relieves the pressure against the tree by permitting it to pass through.

**Pruning Neglected Trees**

A neglected tree of bearing age is usually in low state of vigor, bearing irregular crops of undersized fruit. Too often it is a mass of crowded, twisted and overlapping branches with all of the good fruiting wood on the outside of the tree. If the trunk and scaffolds are sound, such a tree may usually be brought into production without
Fig. 5. Pruning trees in windy areas.
(upper left) Before pruning, at right angles to direction of wind.
(lower left) Before pruning, from direction of wind.
(upper right) After pruning, at right angles to direction of wind.
(lower right) After pruning, from direction of wind.

Fig. 6. Pruning neglected tree. (left) After pruning. (right) Before pruning.
much trouble. Pruning made necessary because of neglect should be planned over a period of two or three years. Crowded and broken branches and those with weak angles may be eliminated the first year. Using fairly large cuts as much as possible speeds up pruning and has no serious ill effect upon the tree. In case the removal of all of these undesirable branches entails too much pruning the first year, those with weak angles may be left for the second year; although pruning the second and third years normally should consist of thinning crowded branches. It is important that the pruning be distributed uniformly throughout the tree rather than confined to the bottom or top. Tall trees frequently may be lowered during this rejuvenation process by eliminating some of the high branches.

**Relation of Pruning to Tree Spacing**

Although it may not seem economical to remove half the trees in a crowded orchard, it has been proved experimentally that production equalling that at the time of removal can be restored within two to five years. Most growers who have done tree spacing have equalled or exceeded their previous production record within three years.

It is the nature of most apple trees to remain relatively low and spreading. Given necessary space in which to develop, most varieties develop a spread of at least 40 feet with a high percentage of the production capacity in the lower half of the tree. In unusually good soil of unlimited depth, they occupy even more space to good advantage.

![Fig. 7. Diagram showing sun exposure of trees.](image)

It is much easier to work with than against Nature in trying to maintain high production from an orchard. The first requirement is that the trees be given necessary space in which to grow. It is true that they can be crowded into less space than they really require,
but to do so seriously complicates other operations. First of all, it makes it almost impossible to expose the maximum outer tree surface to sunlight (fig. 7). Cutting down the amount of light in the lower part of the tree not only reduces the percentage of fancy and extra fancy fruit but also forces the tree to grow taller. The operation of many orchards has been seriously handicapped because of the extra height resulting from crowding. This handicap has become so serious that some orchardists have been forced into desperate and costly means of lowering the trees; all of which could have been avoided by timely tree spacing.

The fact that it is necessary to have as many trees on the ground as there is room for, if maximum production is to be obtained, cannot be overlooked. It must also be borne in mind, however, that to have more may seriously injure the orchard and increase production costs. To meet the situation of having the right number of trees and no more, orchardists set out more trees than they intend to bring into full production. Generally, when the trees were being set two or three tree thinnings were planned, each to be done as adjacent trees began to interlace, except where more permanent trees were crowded on only one or two sides by fillers. In these instances the filler trees were to be pruned severely on the sides crowding the more permanent trees. Unfortunately, these plans have not been carried out as per schedule in many orchards; with the net result of considerable injury to the permanent trees and loss to the operators.

Now, when labor must be used so wisely, is an excellent time to do this job that has been needed for so long. The most common planting and tree removal plans are shown in the accompanying tables. Further information may be obtained from the County Agent.
**Table 1. Number of trees at various planting distances before and after tree removal.**

<table>
<thead>
<tr>
<th>Distance in feet between trees</th>
<th>Original stand</th>
<th>After first removal</th>
<th>After second removal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trees per acre</td>
<td>Distance in feet between trees</td>
<td>Trees per acre</td>
</tr>
<tr>
<td>15 x 15</td>
<td>193</td>
<td>21.2</td>
<td>96</td>
</tr>
<tr>
<td>16 x 16</td>
<td>170</td>
<td>22.6</td>
<td>85</td>
</tr>
<tr>
<td>18 x 18</td>
<td>134</td>
<td>25.4</td>
<td>67</td>
</tr>
<tr>
<td>20 x 20</td>
<td>108</td>
<td>28.2</td>
<td>54</td>
</tr>
<tr>
<td>22 x 22</td>
<td>90</td>
<td>31.1</td>
<td>45</td>
</tr>
<tr>
<td>24 x 24</td>
<td>76</td>
<td>33.9</td>
<td>38</td>
</tr>
<tr>
<td>25 x 25</td>
<td>70</td>
<td>35.3</td>
<td>35</td>
</tr>
<tr>
<td>26 x 26</td>
<td>64</td>
<td>36.7</td>
<td>32</td>
</tr>
<tr>
<td>28 x 28</td>
<td>56</td>
<td>39.7</td>
<td>28</td>
</tr>
<tr>
<td>30 x 30</td>
<td>48</td>
<td>42.4</td>
<td>24</td>
</tr>
<tr>
<td>32 x 32</td>
<td>43</td>
<td>45.2</td>
<td>21</td>
</tr>
</tbody>
</table>


**Fig. 8.** Planting and removal plan, showing (1) original stand with no trees removed; (2) permanent and semi-permanent with fillers removed; (3) permanent with semi-permanent and fillers removed.
HEXAGONAL SYSTEM

Table 2. Number of trees at various planting distances before and after tree removal.

<table>
<thead>
<tr>
<th>Distance in feet between rows</th>
<th>Trees per acre</th>
<th>After first removal</th>
<th>Trees per acre</th>
<th>Distance in feet between rows</th>
<th>Trees per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 x 15</td>
<td>222</td>
<td>158</td>
<td>27.2</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>16 x 16</td>
<td>196</td>
<td>131</td>
<td>25.9</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>18 x 18</td>
<td>154</td>
<td>103</td>
<td>31.1</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>20 x 20</td>
<td>124</td>
<td>83</td>
<td>34.6</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>22 x 22</td>
<td>104</td>
<td>70</td>
<td>39.7</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>24 x 24</td>
<td>87</td>
<td>58</td>
<td>41.5</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>25 x 25</td>
<td>80</td>
<td>54</td>
<td>43.2</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>26 x 26</td>
<td>74</td>
<td>50</td>
<td>44.9</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>28 x 28</td>
<td>64</td>
<td>43</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 x 30</td>
<td>55</td>
<td>37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 x 32</td>
<td>49</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 8. Planting and removal plan, showing (1) original stand with no trees removed; (2) permanent and semi-permanent with fillers removed; (3) permanent with semi-permanent and fillers removed.

<table>
<thead>
<tr>
<th>Original stand</th>
<th>Surplus removed</th>
<th>Semi-permanents and fillers removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>p f p f p f f</td>
<td>p p p</td>
<td>p p p</td>
</tr>
<tr>
<td>f s f s f s f</td>
<td>s s s</td>
<td></td>
</tr>
<tr>
<td>p f p f p f f</td>
<td>p p p</td>
<td>p p p</td>
</tr>
<tr>
<td>f s f s f s f</td>
<td>s s s</td>
<td></td>
</tr>
<tr>
<td>p f f f p f f</td>
<td>p p p</td>
<td>p p p</td>
</tr>
</tbody>
</table>