

ORCHARD PLANNING

Tree Density Guide

Semi-dwarf orchards today have densities of 123-311 trees per acre at spacings of 16' x 22' to 10' x 14'.

Dwarf orchards are planted with spacings as tight as 2' x 10', but more commonly 4' x 14' and up to 7' x 16' for densities of 388-777 trees per acre.

Standard orchards are no longer planted because they take too long to produce. Today, high density means more than 500 trees to the acre and will exceed 1000+ with multi row systems.

$$\frac{\text{TREES}}{\text{ACRES}} = \frac{43,560}{L \times W}$$

FEET	6	7	8	9	10	12	14	16	18	20	22	24
4	1815	1627	1361	1210	1089	907	777	680	605	544	495	453
5	1452	1240	1089	966	871	726	622	544	484	435	396	363
6	1218	1037	907	806	727	605	518	453	403	363	330	302
8	907	777	680	605	544	453	388	339	302	272	247	226
10	726	622	544	484	435	363	311	272	242	218	207	181
12	605	518	453	403	362	302	259	226	201	181	165	151
14	518	444	388	345	311	259	222	194	172	155	141	129
16	453	388	339	325	272	226	194	169	151	136	123	113
18	403	345	302	268	242	201	172	151	134	121	110	100
20	363	311	272	242	218	181	155	136	121	108	99	90
22	330	282	247	220	207	165	141	123	110	99	90	82
24	302	259	226	201	181	151	129	113	100	90	82	75

Planning the optimum density orchard

Both rootstock vigor and variety vigor are important components of required space per tree and proper planting distances. Rootstocks have the most influence on tree size and growth characteristics. Therefore, choice of rootstock should match with the chosen variety to produce a mature tree with the desired tree size. The characteristics imparted to the mature tree should also match the management and training system you are using.

The semi-dwarf rootstocks with less size control (MM-111, M-7A, M 106, B 118 and G.30) are usually best adapted to free standing central leader trees spaced at lower densities (100-300 trees/acre). The more size controlling dwarf rootstocks (M-26, M-9, and Bud 9) are best adapted to supported (staked or trellised) medium or high density plantings (300-1000+ trees/acre).

Although the rootstock will have the greatest influence on the mature size of a tree, genetic factors in the variety such as vigor, precocity and growth habit will have a large influence as well. On the same clonal rootstock, the mature size of different varieties can vary as much as 30%. For this reason, the apple varieties sold by Stark Bro's have each been placed in a Variety Vigor Category (VVC). On any given rootstock, differences in mature tree size will vary with the VVC.

When varieties from different vigor categories are planted in the same orchard, it is important that these vigor differences be considered, especially if choosing the closer of the recommended spacings. Adjusting the planting distances or selecting different rootstocks for different varieties may be advisable to compensate for the differences.

For example, a low vigor and a moderate vigor variety planted in the same orchard would require either different spacings (say 12' on the low vigor and 14' on the moderate vigor variety) or different rootstocks (say MM-111 on the low vigor and M-7 on the moderate vigor variety) with no change in spacing to yield equally per foot of row. If wider spacings are chosen compensation may not be necessary, but the lower vigor variety will take a few years longer to fill its space and some production will be sacrificed until it does.

Please keep in mind that these ratings are based on average variety and rootstock performance across different geographical regions. Some variations should be expected due to variations in overall tree precocity, soil fertility, growing conditions and grower management.

Notes:

High density tree training

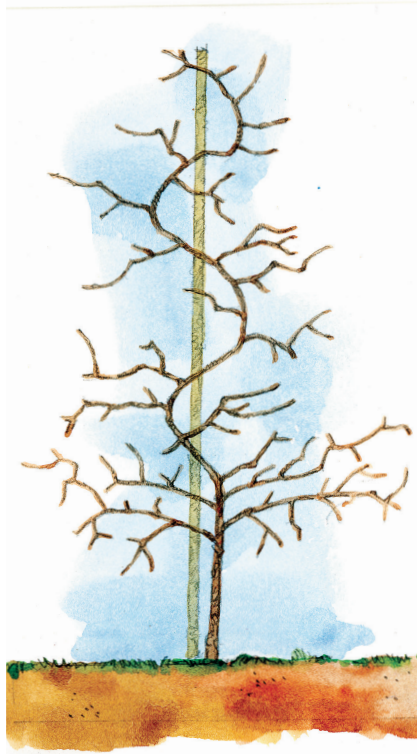
With medium to low density orchards on semi-dwarfing rootstocks, the first 3-5 years are devoted to growing a tree structure to support future crops.

Fruiting is discouraged and strong, stiff limbs are encouraged to assure a long, productive life of the orchard.

Because the support structure (a stake or trellis) is planted with the tree, the opposite is true in training a high density orchard. Dwarfing rootstocks of the M-26 size and smaller are the only ones suitable for this type of planting. Generally no more than one year is devoted to tree development before production is encouraged. This is done by encouraging non-vigorous limbs and controlling them by spreading or tying down rather than pruning. With this method, production will begin almost immediately while the tree is still small and limbs and central leader are still very limber. As a result, support of the central leader and perhaps some branches is essential. Without support, heavy cropping of young trees will result in an "apple bush" only 4-6' tall and incapable of producing volume crops. In addition, breakage and tipping will occur since many of the most desirable rootstocks for high density plantings are poorly anchored and brittle. Support can be by stake or trellis, whichever is most economical. The important thing is that the structure is strong enough to support the crop weight and resist winds and storms.

There are many training systems being developed for high density plantings and all of them have good points. We have chosen to describe two well known systems. Both will work best on tree densities between 350 and 800 trees per acre and require a strong grower commitment to timely and detailed training while the tree is young. Once the system and production are established, training costs are much less than those of larger semi-dwarf orchards.

Common high density tree training systems



Slender Spindle Unique Traits and Practices

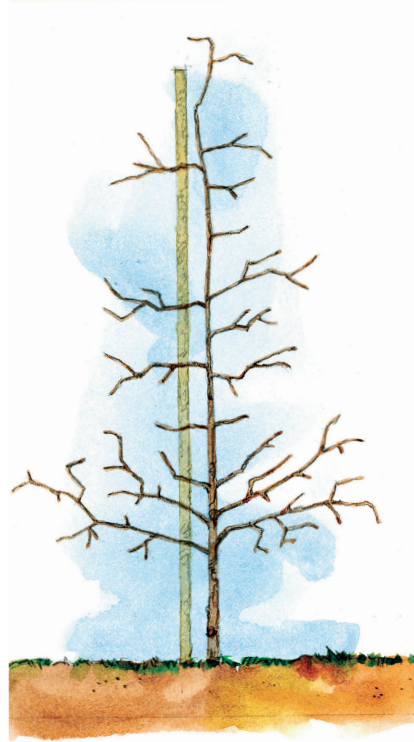
- Best for mature tree height of 6-10'
- Works well for tree densities of 600-1400 trees per acre.
- Height is controlled by both bending and/or replacing the central leader:

METHOD 1:

Central leader may be tied down until side branching forms, then tied or taped up to form an "S" shaped leader.

METHOD 2:

Central leader may be removed to a weaker side branch which is tied up or taped up to form a new central leader.



Vertical Axis Unique Traits and Practices

- Sometimes called the French Axe.
- Best for mature height of 8-14'.
- Works well for tree densities of 350-800 trees per acre.
- Occasionally used at lower density on more vigorous rootstocks.
- Central leader should never be cut after the first year.
- Tree height will be controlled by "natural means" due to bending under the weight of fruit load after height of support is exceeded.

Practices common to both systems

Establishment

1. The tree must be supported by stake or trellis.
2. Precocious rootstocks of M-26 size or smaller must be used.
3. Planting early and irrigating immediately to reduce stress the first year is essential for early production.
4. The central leader may be tipped at planting time, but limbs should generally be trained (bent and tied), rather than pruned during the establishment period.
5. A tier of permanent branches called the "fruiting table" is developed between 20-30" above the ground. These branches are tied down to a horizontal position, if necessary, once space is filled in the first two years.
6. Very vigorous growth may be "pinched" when less than 6" long, leaving a short stub.
7. Less vigorous limbs should be bent down to control vigor and encourage fruit bud formation.

Management of Fruiting Tree

1. The fruiting table should be maintained to desired space by cutting into two year wood at a weak side branch.
2. Above the fruiting table, branches should be selectively removed, leaving a short stub, in late dormant or semi-dormant season after one or two years of fruiting.
3. Branches above the fruiting table should never be pruned, but instead are removed, allowing new branches to constantly replace the fruiting area.
4. Any branch that becomes greater in diameter than 1½ the diameter of the central leader, at its union to the central leader, should be removed.
5. Any branch, except those in the fruiting table, which becomes too pendulous or has cropped three or more years should be removed.