

SIZE CONTROLLING STOCKS FOR FRUIT TREES

DWARF AND SEMI-DWARF

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General Statement

The possible use of size-controlling stocks for tree fruits has been a popular subject for home owners, both suburban and urban for some time. Writers for the garden page or section of newspapers and magazines have annually expounded on their advantages. Much of this information has been overly optimistic. Frequently research workers fail to present realistically the advantages and disadvantages of dwarf and semi-dwarf trees. Recommendations from various states are occasionally alarmingly contradictory. Nurseries often present only a one-sided picture. Probably the difficulty largely arises in the fact that few experimental plantings of semi-dwarf trees have yet exceeded 20 years of age in this country. As a result such factors as distance of planting, comparative growth of various varieties on such stocks, as well as longevity of the trees cannot be satisfactorily evaluated as yet.

This outline is designed to present information concerning the use of dwarf and semi-dwarf trees for the home garden as well as for commercial plantings. Different amounts of dwarfing are induced when certain varieties or types are used either as rootstocks or interstem segments. As a group such stocks are often termed size-controlling.

In this presentation apples will be largely considered, although brief attention will be given to other tree fruits.

Experience in Ohio

The material presented herein has been compiled as a result of experimental work being conducted at The Ohio Agricultural Experiment Station with dwarf and semi-dwarf stocks as well as from data available from other sources where similar experiments are being conducted.

Semi-dwarf plantings were established at The Ohio Agricultural Experiment Station at Wooster in 1940, 1941, 1943, 1944, and 1955. Dwarf trees were planted in 1952, 1956, 1957, 1958, and 1960. At outlying farms semi-dwarf plantings were laid out in 1959 and 1960. Many data have therefore become available from these experimental plots.

APPLE

Size controlling apple stocks may result in various degrees of dwarfing. Usually the most dwarfing stock results in what have been termed "dwarf" trees. Those stocks resulting in less size reduction have been referred to as "semi-dwarfing." Occasionally a stock resulting in a small reduction in size compared to standard-sized trees is termed "sub-standard" in its effect.

Examples of these would be:

A. Dwarfing Stocks

Malling VIII (also Clark's dwarf)
Malling IX

B. Semi-dwarf Stocks

Malling VII
Malling-Merton 106

C. Semi-Dwarf to Sub-standard

Malling I
Malling II
Malling-Merton 104

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General Principles with Respect to Dwarfing

Experimental work conducted over the years on both standard size as well as trees restricted in their growth as a result of rootstock influence has emphasized certain important points. Several of these are:

1. Any tree will make less annual growth, i.e., be dwarfed, by fruit bearing.
2. The amount of growth reduction seems to be positively correlated with the amount of fruit produced. The corollary is that standard size trees on non-dwarfing seedling rootstocks are constantly being dwarfed by heavy production. Apart from the genetic effect of a dwarfing rootstock on tree size, the earlier yields act to reduce the rate of growth and thus result in dwarfing.
3. Restricted root growth tends to reduce the amount of water available to the tree and thus in itself contribute to the dwarfing effect.
4. With less root extension laterally and vertically trees on dwarf or semi-dwarf rootstocks tend to be more easily affected by winds or heavy crops on one side of the tree. In consequence it is usually recommended that such trees be staked immediately after planting.
5. All of these factors result in a marked variation in growth and yield of a dwarf or semi-dwarf tree. This includes the type of care given by the owner of such trees. All dwarf trees require more precise attention to the soil management system, including the fertilizer applied, pruning, and the like.

Discussion of Each Type of Size-Controlling Stocks

Very Dwarf

Malling IX
Malling VIII

Malling IX

This rootstock was first described by the East Malling Research Station in 1930. Experience in England and America has shown that it produces the smallest tree with the exception of Malling VIII of any variety or type when used as a rootstock. It may be utilized as a single tree in plantings similar to standard sized trees, but of course the planting distances are much less. It may also be used in the so-called hedge row. In the latter case the trees are planted in rows with the primary branches attached to wires as in the practice with grapes.

Malling IX may be propagated by rooting the shoots in a stock bed. The young rooted shoots are removed from the parent plant and established in a nursery row. The scion variety is then budded or grafted on the stem of this rooted plant.

Malling IX may also be established as on intermediate segment of 6 to 8" length on a standard seedling rootstock. The scion variety is then budded on the Malling IX interstem piece.

Malling IX produces a rather hard, brittle wood and is propagated with only fair success in the nursery.

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Trees on Malling IX may be planted as close as 8 to 10 feet apart in the row but the rows should be at least 15 feet if they are to be grown in commercial plantings. In the hedge row the trees may be planted 8 feet apart, with 3 to 5 wires used between strong wooden posts.

Advantages of Malling IX:

1. Bears fruit at an earlier age.
When planted as a whip fruits will be borne the third growing season.
2. Orchard operations may be more easily performed.
3. High yields per acre may be obtained because of large numbers of trees per acre.
4. Well colored large fruits are usually obtained.
5. Small trees may be more attractive with their red and yellow colored fruits.

Disadvantages of Malling IX:

1. Original acreage cost of trees is high.
2. Root growth is greatly reduced in rate resulting in poorly anchored trees.
3. Greater care must be given to the trees.
Unfavorable environmental conditions, such as low nutrient element content in stock, weed growth, tall grass, low water have a greater effect upon tree growth than is the case with standard-sized trees.
4. Trees must be continuously staked or attached to wire - hedge row.
5. Wind damage may have greater effect in uprooting trees with heavy crop.
6. Bird (crows) damage may be more severe.
7. Equipment for controlling pests must be adapted to such trees.
8. Not all varieties are equally adapted to such stock.
9. Rooting of Malling IX in the nursery is somewhat more sparse than in Malling VII and in apple seedlings.
10. Wood of Malling IX is rather brittle and not so easily topworked.

Malling VIII

Malling VIII produces a slightly smaller tree than Malling IX. It is believed to be identical with "Clark's Dwarf" which has been used as one of the four components in the Clark Dwarf trees propagated by Stark's Nurseries. Malling VIII is not recommended as it has no advantage over Malling IX which produces a sufficiently small tree for any purpose.

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Semi-Dwarf Trees

Malling VII
Malling II
Malling I

Malling VII

Malling VII is the type which has been more generally used in this country for the production of semi-dwarf trees. Adoption of this particular stock has become about because of the generally favorable results obtained with it in the various experimental plantings established in the United States after importation of these stocks from England in the early thirties.

Advantages of Malling VII:

1. Trees will begin bearing (depending upon the variety) the fourth or fifth growing season following planting as a whip.
2. Higher yields per acre will be obtained than with standard sized trees. The difference, however, will depend upon (a) distance of planting of the standard sized as compared to the semi-dwarf trees and (b) extent of delay in bearing of the standard sized trees.
3. Cultural operations such as pruning, control of pests, thinning, and harvesting more easily performed.

Disadvantages of Malling VII:

1. The cost of establishment of the planting will be greater than with standard sized trees. The greater number of trees required per acre and the added cost of tree supports and staking obviously is responsible for this greater expenditure.
2. Trees need to be supported by means of stakes for the first six or more years. Certain varieties such as Delicious (and its mutations) seem to be less well anchored on this rootstock than some other varieties.
3. The trees require greater care because root growth is less well developed than is the case with non-dwarfing apple seedlings. The soil management system must be given particular attention. Under unfavorable environmental conditions such as drought, low nutrient element supply, and the like trees on Malling VII will be more adversely affected.
4. Trees reach maturity at a size too close to that of trees on non-dwarfing apple seedlings. Thus, size may be two-thirds or more of the standard sized tree depending upon the variety combination.
5. Longevity of trees on this stock under American conditions is not yet known.
6. Trees do not fit well into an interplanting system between standard sized trees after the latter have become established.

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Malling II

Advantages of Malling II:

1. Malling II produces usually a more firmly anchored tree than Malling VII. It still may have to be staked.
2. Malling II may be more suitable than Malling VII in the case of certain varieties.
Rome Beauty would obviously be larger on Malling II than on Malling VII (If this is desirable).
3. Trees propagated on Malling II compared to those on non-dwarfing apple seedlings will still be somewhat smaller.

Disadvantages of Malling II:

1. Tree size is larger than desired in many situations.
2. Differences in yield between standard sized trees and those established on Malling II will be less than often stated if the recommended planting distance in Ohio for each are followed. These are:

Malling II 25' by 25'
Standard sized trees 30' by 30'

Malling II is being used to propagate trees in some nurseries in this country and consequently offer this nursery stock for sale to growers interested in size-controlling stocks. Growers who are interested in semi-dwarf trees of the smallest possible size (exclusive of Malling IX) should not plant trees on Malling II. If only a relatively smaller tree than a standard-sized one is acceptable Malling II may be satisfactory. Undoubtedly trees on this stock are more firmly anchored but it is still wise to stake such trees if located on wind-swept sites. Malling II is not recommended in Ohio as the experimental work at the Ohio Agricultural Experiment Station has shown that its size too closely attains that of standard sized trees. The Ohio recommendation is a planting distance of 30' by 30' for standard sized trees.

Malling I

Some nurseries are offering for sale apple trees propagated on Malling I. Such trees will presumably be larger at maturity than those on Malling II. Only where such large trees are preferred should such be purchased.

The advantages and disadvantages of trees on Malling I are similar generally to those for trees on Malling II.

Malling-Merton Stocks

These stocks were first released for use abroad in 1952. They were produced by crossing Northern Spy with certain Malling types and English varieties. The preferable ones now seem to be:

Malling-Merton 104 - Malling II X Northern Spy
Malling-Merton 106 - Northern Spy X Malling I

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Malling-Merton 109 - Malling II X Northern Spy
Malling-Merton 111 - Northern Spy X Merton 793
Malling XXV - Northern Spy X Malling II

These stocks were produced originally for the purpose of obtaining material much more resistant to woolly aphids than the Malling types. These latter stocks may become quite severely affected with this pest in the nursery.

As soon as the stock became available English research workers initiated experiments to indicate the degree of dwarfing produced as compared with the Malling types.

Of these stocks, Malling-Merton 104 and 106 seem more useful as size-controlling stocks than the remaining ones in this series.

Malling Merton 104 has recently been reported in England to produce trees somewhat larger than those obtained with Malling IV and to give a somewhat higher cumulative yield at end of 13 years from budding. The trees are reported to be well anchored and free from suckering.

Malling-Merton 106 has produced trees similar in size and in bearing to Malling VII in a loam soil. In a sandy loam soil the trees on Malling-Merton 106 were smaller than those on Malling VII.

Trees on these stocks are reported to be more firmly anchored than those on the Malling types. Presumably, however, under Ohio conditions they should still be staked.

At least one nursery in this country now offers trees propagated on these stocks.

Recommendations for Planting Distance and Planting

The recommendations for planting distances obviously are dependent upon the projected growth of the various variety-stock combinations and the type of size-controlling stock. Certain apple varieties are naturally more vigorous and consequently adjacent trees on any stock will interfere more quickly than less vigorous trees on the same stock. Growers may adjust the planting distance somewhat upon this difference in rate of growth but obviously this is a disturbing factor if different varieties are included within the same planting. For example, Rome Beauty (and its mutations) and McIntosh on the same stock produce different sized trees and although it might be well to have a 5-foot greater planting distance with the latter variety than with the former this is obviously difficult in a mixed planting of these varieties.

The recommendations for distance of planting as given below are generally greater than are commonly listed by nurseries. The suggested distances are based upon the experience with various stocks at the Ohio Agricultural Experiment Station since the earliest planting in 1940. The exception is the recommendation for hedge row plantings. For trees on Malling IX in a hedge row, the recommendations are based on experiences in Canada and elsewhere.

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Malling IX

Single tree plantings

Garden-10 feet apart or from nearest obstruction.

Commercial planting.

No closer than 10 feet apart in the row and 15 to 20 feet between rows.

The distance between rows is based upon use of modern available spray equipment.

Hedge Row Plantings

No closer than 10 feet apart in the row with the rows 15 to 20 feet apart.

In Ontario two and four wires are used. In the latter case the topmost wire is placed at the top of the 5-foot posts, placed 24 feet apart. No. 9 wire is used.

Malling VII

Trees of Malling VII established in a home garden should be at least 20 feet apart.

In commercial plantings the minimum distance between trees would be 22.5 feet with 25 feet as the distance between rows. Even with those distances strongly-growing, vigorous trees will interfere before maturity and provisions will have to be made for fan type pruning when this occurs.

Obviously the length of time which will elapse before the trees interfere will depend upon such factors as variety-stock combination, soil management system utilized, amount of nitrogen fertilizer applied, amount of rainfall, type and amount of annual pruning and intensity of bearing.

Malling II and I

Obviously the distance of planting of trees on these stocks will be greater than on Malling VII.

The question is commonly asked as to the difference in yield of apple varieties upon the various size-controlling stocks. Experience at the Experiment Station at Wooster has indicated that for the first 15 to 20 years a greater cumulative yield will be obtained from trees on Malling VII than on standard non-dwarfing rootstocks. However, the difference depends largely upon the difference in bearing surface as produced by the difference in number of trees per acre.

Very flattering comparisons in favor of Malling VII, for example, may be developed if a short planting distance such as 15' by 20' is used for comparison with standard-sized trees planted 35' by 35' or 40' by 40'. Since in Ohio the planting distance recommended for large trees on seedling rootstocks is 30' by 30', obviously the comparison with trees on Malling VII at a 25' by 25' distance would be

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less spectacular. In other words comparative yields between standard-sized trees and trees on various Malling stock must be evaluated in terms of the differences in planting distance under contemplation.

Precautions at Time of Planting

Since Malling types give a somewhat restricted root development, trees on these stocks should be set sufficiently deep to enable as much and as favorable root growth as possible. Obviously the point of union between stock and scion must be 2-4 inches above the surface to prevent scion rooting. Since trees on Malling VII and particularly Delicious tend to lean badly, particular care must be used in planting this variety. Reasonably long roots should be insisted upon with all Malling VII trees.

Metal stakes should also be placed adjacent to the trees during the first year after planting.

Dwarf Trees of Other Tree Fruits

Although dwarf trees of various fruits are offered by a few nurseries, only the pear is commonly found in practically all nursery catalogs. Little experience is available in this country with dwarf peach, sweet cherry, plum and apricot trees.

Pear

Dwarf pear trees have been propagated for many years by budding or grafting the desired variety upon Quince. With the last two decades a vegetatively propagated strain of Angers Quince known as East Malling Type A has been preferred. Rooted cuttings of Type A are now available in this country at certain wholesale nurseries.

It is commonly stated that some pear varieties such as Bartlett should not be propagated directly upon Quince, but upon an interstem of some other variety. At the Experiment Station at Wooster Old Home pear variety has been utilized for both standard sized as well as dwarf trees. Thus, in the case of dwarf trees, Old Home is budded on rooted cuttings of Angers Quince Type A and the scion or desired variety is then topworked on the lateral branches of Old Home. This has been a successful procedure.

Unfortunately dwarf trees of Pear produced in a similar way are not available from any nursery as yet. As soon as such are offered for sale they should be purchased. In the meantime the only dwarf trees available are propagated directly on Angers Quince.

Dwarf pear trees may be planted 10-15 feet apart in rows 15 to 20 feet apart.

Peach

Peach trees are offered for sale as a dwarf tree by an occasional nursery. The size controlling stock utilized to produce such trees is not stated. Prunus Besseyi (Western Sand Cherry has been found at Geneva, N.Y. to produce satisfactory dwarf peach trees. Again virus-free seedlings of Western Sand Cherry must be used in propagating such trees. Whether the available sweet cherry trees are on virus-free stock is unknown.

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Sweet Cherry

Dwarf sweet cherry trees are occasionally offered for sale by nurseries. The rootstock which is utilized to produce such trees is not stated and no information is given as to its compatibility with the variety.

Sweet cherry on Mahaleb stocks tend to make shorter lived dwarf trees which may not be satisfactory after 10 to 15 years. Trees on Mazzard seedlings are preferred for large, long-lived trees.

Western sand cherry (*Prunus Besseyi*) has been used as a dwarfing stock for sweet cherry as has also Stockton Morello red tart cherry.

Anyone contemplating the purchase of a dwarf sweet cherry should attempt to ascertain the precise dwarfing stock used by the nursery offering the dwarf trees for sale. Apparently Stockton Morello will be reasonably satisfactory if a virus-free source can be found.

Plum and Prune

Dwarf plum and prune trees are offered for sale occasionally by a nursery. The dwarfing rootstock is usually not given. Not all varieties are equally compatible on the various stocks which have been used experimentally for dwarfing. Seedlings of Western Sand Cherry (*Prunus Besseyi*) which are virus-free are presumably the best for this purpose.

Nurseries Offering Dwarf and Semi-Dwarf Trees - March 1961

1. Adams County Nursery & Fruit Farms, Aspers, Pennsylvania
2. Bountiful Ridge Nurseries, Princess Anne, Md.
3. Clyde Nursery, Co., Clyde, Ohio
4. Columbia and Okanogan Nursery, Wenatchee, Wash.
5. Lorne J. Doud, R 1, Wabash, Indiana
6. Hill Top Nurseries, Hartford, Michigan.
7. Kelly Bros. Nurseries, Dansville, N.Y.
8. Kellsey Nursery Service, Highlands, N.J.
9. Knolview Nursery, Monitor, Oregon
10. Claire Lewis, Willoughby, Ohio
11. May Nursery Co., Yakima, Wash.
12. J. E. Muler Nurseries, Canandaigua, N.Y.
13. Mount Arbor Nurseries, Shenandoah, Iowa (wholesale)
14. New York State Fruit Testing Association, Geneva, N.Y.
15. Shenandoah Nurseries, Shenandoah, Iowa (Wholesale)
16. Spring Hill Nurseries, Tipp City, Ohio
17. Stark Bros. Nursery, Louisiana, Mo.
18. Van Weil Nursery, Wenatchee, Wash.
19. Waynesboro Nurseries, Waynesboro, Virginia
20. Wheelock Wilson Nursery, Marshalltown, Iowa

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