

DWARFING ROOTSTOCKS FOR APPLE (*MALUS*)

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Throughout the major apple producing areas in the world propagation of cultivars was carried out on seedling stocks for many years. An example of this is the use of French crabapple seedlings (*Malus sylvestris*) that were used widely in Europe and North America until the early 1930's. Since then, numerous clonal asexually propagated apple rootstocks have been developed. Popularity of the more dwarfing rootstocks has increased dramatically in the last 25 years. Financial constraints on the modern apple producer has necessitated earlier, higher yields per acre. One of the ways to achieve this has been to plant trees at higher densities on dwarfing rootstocks. Clonal rootstock selection now enables a grower to select a rootstock suitable for his soil, climate and cultivar.

HISTORY

Many clonal rootstock selections have been made throughout the world, the most notable being the "Malling" and "Malling Merton" series.

In 1912 work began at East Malling Research Station in England to select and classify a series of vegetatively propagated apple rootstocks, which ranged from very dwarfing to very vigorous in their effect on the scion cultivar. The fruit harvested was not affected by the dwarfing influence and in many cases was found to be larger, particularly on younger trees. The Malling stocks have been planted in many parts of the world, proving to be very hardy except in regions with extremely severe winters. They perform well on both light and heavy soils but are not resistant to woolly aphids (*Eriosoma lanigera*).

In 1928 a joint breeding programme between The John Innes Horticultural Institution and East Malling Research Station began to produce a series of rootstocks resistant to woolly aphids, and a new range in tree vigor. This series of rootstocks are known as "Malling Merton." The most widely used stocks of this group are M.M. 104, M.M. 106, and M.M. 111. Other improved characteristics include higher yields, freedom from suckering and good propagation qualities.

Both the "Malling" and "Malling-Merton" stocks are readily propagated by stooling or mound layering. However some rootstock clones have responded well or even better to being propagated by hardwood cuttings.

Today in modern apple production there are two categories of rootstocks which are of importance: (1) dwarfing stocks, and (2) semi-dwarfing stocks.

DWARFING STOCKS

'Malling 27' This is the most dwarfing of all the Malling stocks. At maturity it reaches about 4 ft. tall. It is a cross between 'Malling 13' and 'Malling 9.' It has obvious use in very high density plantings. Suckering is not a problem. Virus-tested propagating material was released from East Malling Research Station in 1970.

'Malling 9' ('Jaune de Metz') This was a chance seedling which originated in France in 1878. Today virus-free selections are widely used as a dwarfing rootstock for high density orchard plantings and home garden situations. At maturity it reaches about 10 ft. tall and will start bearing fruit in the first and second year after planting; however, as with 'Malling 27,' it requires staking as the roots are very brittle. A fertile soil is required in addition to some form of irrigation if grown in a dry climate. It is resistant to crown rot (*Phytophthora*), but tends to sucker under some circumstances.

In recent years further selections have been made, i.e., EMLA 9 (East Malling-Long Ashton). Such stocks have undergone heat treatment and virus indexing and naturally tend to be slightly more vigorous than 'Malling 9.'

'Malling 26' This stock originated from a cross between 'Malling 16' and 'Malling 9' and was introduced by East Malling Research Station in 1959. It produces a tree which is slightly larger than 'Malling 9' and smaller than 'M.M. 106,' but still requires some form of support. It has been found to be a poor producer in the stool bed but is easily propagated by softwood cuttings under mist, or by hardwood cuttings. Some growers have also claimed that it produces a lot of blind buds along potential fruiting laterals.

SEMI-DWARFING STOCKS.

'Malling Merton 106.' This rootstock is the most widely used today. It produces a tree larger still than 'Malling 26' but half the size of a standard seedling. It has a vigorous root system and does not require staking. It tends to crop earlier and heavier and is popular in Europe and the United States. It does not sucker but the only slight drawback is that some growers claim it is more susceptible to crown rot (*Phytophthora*).

PROPAGATION METHODS

Today clonal apple rootstocks are propagated by three methods: stool or mound layering, hardwood cuttings, and micro propagation.

1. **Stool or Mound Layering** is commonly used today for most dwarfing rootstocks except, perhaps, 'Malling 26.' In the first year the mother stock is planted out and allowed to grow on for one year. Before growth commences the following year the stock is cut back to 1 in. above ground. Stock plants are spaced 12 in. apart with the rows a minimum of 4 ft. apart, depending on what mechanical aids are used, if any. When the new shoots are 5 to 6 in. high, the soil should be mounded up to half their height. Timing is fairly critical. If done too late then poor rooting can result. The addition of sawdust to the soil can help to make it more friable. The hilling-up process should be done three times during the summer in order that the base of the shoots are covered with 6 to 8 in. of soil. It is important to ensure the soil surrounds each shoot properly. At the end of the growing season the layered shoots should have rooted sufficiently and can then be separated from the mother plant and lined out in nursery rows. Well-cared-for stool beds can be used for 15 to 20 years. It is essential, therefore, that insects, diseases, and weeds are kept under control.

2. **Hardwood Cuttings.** This method is used for the more difficult to root subjects, such as 'Malling 26.' Today heated bins are used for the establishment of roots. This method was pioneered by R.J. Garner and further developed by B. H. Howard of East Malling Research Station, Kent, England.

There are three procedures that one must adopt for successful rooting of cuttings in heated bins:

- a) The pre-conditioning of one-year-old shoots from heavily-pruned stock plants.
- b) The provision of an environment to reduce stem decay so as to maximise root initials and to reduce vegetative buds from growing out.
- c) To encourage the successful transplanting of the cuttings into the open ground.

For apple rootstocks the months of August and September are preferable for taking hardwood cuttings. The optimum cutting length is 24 in. They are then dipped into a liquid rooting hormone solution containing 2,500 ppm of indolebutyric acid (IBA) for five sec. The solvent is allowed to evaporate for 20 to 30 min. before the cuttings are placed into the rooting medium in the bin. The optimum basal temperature is 21 °C (70 °F) for 2 to 3 weeks. The hardening-off process is carried out by lowering the temperatures

5 °C (9 °F) every two days and turning the heat off completely after two weeks. The air temperature should be kept at a constant 5 to 10 °C (41 to 50 °F) in order to delay bud break. For apple rootstocks it is preferable if they are grown on for a further year to establish a strong root system before being lined out ready for budding the following autumn.

3. Micropropagation. This is the newest of all techniques used for raising apple rootstocks today. For an industry requiring virus-free stock it has many advantages. Some of these are:

- a) A means to remove viruses from a plant. i.e. The removal of the meristem from a heat-treated plant and its subsequent culture under sterile conditions. This led to the virus-free programme for apple rootstocks such as the E.M.L.A. Scheme in England.
- b) The bulking-up of plants rapidly.
- c) The selection of a seedling or mutation in a plant breeding programme to permit an earlier release date.
- d) A means by which to propagate the year around.
- e) A means by which to export plants to other parts of the world.
- f) A reduction in the area required to raise stock plants and plant beds.

A disadvantage can be the initial capital required to establish a laboratory and its equipment and to find suitably qualified staff.

CONCLUSIONS

Dwarfing apple rootstocks are going to play an ever increasing role in modern apple production. The necessity to get earlier, higher production will involve planting trees at high densities per acre on dwarfing stock. With the cost of labour increasing all the time, the introduction of mechanical aids will become a necessity. Fortunately in the commercial production of apples, growers have a wide range of cultivars and rootstocks to choose from.

REFERENCES

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