it produces a good number of runner plants and has been a very profitable variety.

Gemzata produces a larger June crop than Gem but is not nearly as good for the fall crop.

Mastodon produces a fairly good June crop but the berries in late summer are usually small and knotty.

Green Mountain produces an exceptionally large June crop, frequently is as productive as Premier, but is a shy bearer in the fall.

Evermore (Minn. 1166) is a vigorous growing plant and forms a good number of runners but the berry is soft and tart.

The Malling Apple Rootstocks

By H. B. Tukey,
Michigan State College

Associated with advertisements and stories about dwarf fruit trees there frequently appears the name "Malling". Questions are naturally raised as to what they are, from where they have come, how they derived their names, and what is their value.

Briefly, the Malling rootstocks are rootstocks which were standardized at the East Malling Research Station, East Malling, Kent, England, just prior to the first World War. They are of special interest because they offer improved dwarf fruit trees for garden planting, smaller than standard fruit trees for commercial orcharding, and understocks which adapt fruit trees to various soil and climatic situations.

Derivation of Malling Rootstocks

The story behind the Malling rootstocks goes back to the use of special dwarfing rootstocks in England and on the Continent. There, dwarfing rootstocks have been widely used, especially for the apple and the pear. Roughly, the dwarfing rootstocks for the apple were divided into the very dwarfing forms, called Paradise, and the semi-dwarfing forms, called Doucin, but the designations are by no means accurate.

In an examination of these rootstocks

Baldwin/Malling IX in its seventh growing season, still a small tree.

in European nurseries, Director R. G. Hatton of the East Malling Research Station observed that they were badly mixed and that there were several types masquerading under the name of Doucin and of Paradise. He separated these into pure lines or "clones." It is something as though all apple varieties had been jumbled together into the two classes "red apples" and "green apples", and then as though somebody had separated them into individual varieties, as McIntosh, Northern Spy, Rhode Island Greening, and so on. It sounds like a simple and obvious sort of thing, but, like many other important steps, its very simplicity may have been why it was overlooked for so long. Further, it was a more difficult operation than may appear on the surface.

Selection of Malling Rootstocks

From various sources, Doctor Hatton selected 16 types of rootstocks for the apple, propagated them, and worked various varieties of apples upon them. He designated the types by number, using Roman numerals. The prefix "Malling", "M", or "EM" is now used with the numbers to identify them further, and refers to the location where the standardization work was done.

Most interestingly, the performance of varieties on these rootstocks varied appreciably. Some rootstocks were extremely dwarfing, some were slightly less dwarfing, and some were not dwarfing at all. In a general way, Doctor Hatton grouped these stocks into (A) very dwarfing, (B) semi-dwarfing, (C) vigorous, and (D) very vigorous. American terminology has used a somewhat similar grouping but has referred to them as (A) dwarfing, (B) semi-dwarfing, (C) semi-standard, and (D) standard.

Here, then, are a series of apple rootstocks which are relatively 'old" in that most of them have been known for many years—some of them several centuries—but which are at the same time relatively "new" to American horticulture. They are now under trial and being studied for what use they may be.

The Malling stocks are not propagated from seed, as are the apple rootstocks now used in American nurseries, but by layers and cuttings in a manner similar to grapes and currants. Accordingly, all of the individual plants of a given numbered type are identical in genetic make-up and their performance can be definitely foretold. For example, if the McIntosh apple variety is budded onto a Malling I rootstock, the resulting tree is a combination of a known variety and a known rootstock, and it can be said definitely from previous experience just how the tree will behave. A useful terminology for such a tree is "McIntosh/Malling I."

Results With Malling Rootstocks

In general, the rootstocks have given a good account of themselves wherever they have been grown in the more favored horticultural sections of the country. How they will behave under difficult conditions, as extreme heat or cold, remains to be seen. They have succeeded in the relatively heavy soils of western New York, and they have been surprising in their adaptability to light, droughty conditions in Michigan—considering the fact that many of them are considered shallow-rooted. In addition, they have

succeeded in 210 combinations with 40 varieties of American apples, indicating a general tendency towards compatability.

The chief deterrent to their use is the limited quantity of stocks which are found in the nursery trade. American nurseries have not yet built up sufficiently large stool blocks nor become sufficiently well acquainted with how to propagate them. While this situation seems annoying at times, it may be just as well, since a more complete record of performance will be available before any large plantings can be made. Within the next 5 years reports should be published from many parts of the country where they have been planted in an experimental way.

Characteristics of Malling Rootstocks

Following is a brief summary of the 16 Malling apple rootstocks, their origin, and something about their performance from first-hand observation since the season of 1928.

Malling I. Broad-leaved English Paradise (of Rivers).—Of English origin, selected by T. Rivers as a chance seedling about 1860. Makes semi-dwarf tree, well anchored, early fruiting. McIntosh does well on it. One of the most promising.

Malling II. Doucin, of the best French nurseries; often called English Paradise. —At least two centuries old. Has one-sided root system; makes semi-dwarf tree, slightly smaller than Malling I, but not with all varieties. Well-liked in Europe. A promising rootstock but may be of limited usefulness because it is difficult to propagate.

Two-year-old Northern Spy/Malling IX, a real dwarf.

Malling III. Unnamed.—A common stock, widely distributed in Europe. Makes semi-dwarf tree, but smaller than Malling I with most varieties, fruits early but suckers badly. Not recommended.

Malling IV. Holstein Doucin, or Dutch Doucin. — Originally identified as *Malus pumila;* common in Holland and Germany. Makes semi-dwarf tree with most varieties; smaller than Malling I but larger than Malling IX and VII; shallow-rooted, not well anchored, inclined to blow over, early fruiting. May have a place but needs further testing.

Malling VI. Nonsuch Paradise (of Rivers); also known as Rivers' Paradise. —Selected by T. Rivers in England as a chance seedling about 1860. Makes semi-dwarf tree, smaller than Malling I, early-fruiting, shallow rooted, leans, suckers badly. Not recommended.

Malling VII. Unnamed.—Long known in English nurseries as a mixture in Doucin stock. Makes dwarf tree, but larger than Malling IX, early fruiting, useful where Malling IX produces too small a tree. Promising.

Malling VIII. French Paradise. — Common on the Continent. Makes very dwarf tree, nearly as small as Malling IX, early fruiting, weak. Not recommended.

Malling IX. Jaune de Metz (of Dieudonne); also called Yellow Metz.—Selected as a chance seedling in France about 1879. Makes very dwarf tree, bears very early, first or second year after planting, shallow rooted, likely to lean unless supported, easily broken. Valued as a garden plant; recommended.

Malling X. Selected and named Doucin U.1 by Spath of Berlin. — Makes semi-dwarf tree, larger than Malling I. Might be thought of as slightly less vigorous than Malling XIII. Needs further testing.

Malling XI. Unnamed.—Seedling selected from crab stock at East Malling, England. Makes semi-dwarf tree or larger. Needs further testing.

Malling XII. Unnamed.—Seedling selected from crab stock at East Malling, England. Makes standard tree, roots sparse but tough, spreading, deeply penetrating, quite unlike most of the other Malling types. Limited by difficulty in propagation. Promising as standard stock.

Malling XIII. Selected and named Doucin U.2 by Spath of Berlin.—Makes strong, well-anchored, semi-standard tree, smaller than Malling XII and larger than Malling I with most varieties. Has done well on heavy soil though reported by some to be shy in bearing. Has done well for Cortland, Golden Delicious, Turley.

Malling XIV. Selected and named Doucin U.5 by Spath of Berlin.—Makes semi-dwarf tree larger than Malling I. Needs further testing.

Malling XV. Selected and named Doucin U.6 by Spath of Berlin.—Makes semi-standard tree, smaller than Malling XII. Needs further testing.

Malling XVI. Selected and named Doucin U.3 by Spath of Berlin; also called Ketziner's Ideal. Makes strong, well-anchored, semi-standard tree, slightly smaller than Malling XII. Very promising for near standard-size tree; needs further testing.