

mite is common in the Gainesville area. The symptoms are quite striking; affected leaves are shorter and much thicker at the base and are misshapen and the length of the internodes is considerably reduced. Growth of young plants virtually ceases during certain periods of the year when infested with these mites. Severe infestations, combined with poor growing conditions, may bring about death of young plants. The mites are always found on the new growth feeding in the tissue between the base of the leaf

and the stem with the deformed leaves affording them considerable protection. They are most active during periods when the plant is producing new growth. Several miticidal treatments were evaluated for effectiveness in controlling the mite. Carbophenothion and a combination of dimethoate plus tetradifon provided the best results.

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## ROSA FORTUNEANA COMPARED WITH OTHER ROSE ROOTSTOCKS GROWN IN FLORIDA

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In subtropical regions such as Florida, *Rosa x fortuneana* Lindley, also known as the Double White Cherokee or the Evergreen Cherokee Rose, has proved an exceptionally good rootstock for many varieties established on a wide range of soil types. This rose was found growing in China and was sent to the Chiswick garden of the Horticultural Society of London by Robert Fortune in 1850. He considered it to be one of the most beautiful climbing roses in the gardens around Ningpo and Shanghai. It was named in his honor by the English botanist Lindley in 1851.

Confusion in the proper specific name for this rose began during the last century. This was partly resolved by the publication of Willmott's monograph of the genus *Rosa* (7). She clarified the distinction between 2 roses introduced from China by Robert Fortune, both of which had been named in his honor. An original spelling error was later corrected by Rehder whose revision of *Rosa* classification has been adopted by the American Rose Society (6). The confusion is currently resolved in favor of the name used here.

*Rosa x fortuneana* is thought to be a first generation hybrid of *R. banksiae* x *R. laevigata* (Lady Banks Rose x Cherokee Rose). Like both of the supposed parent species it has a rampant climbing growth habit; mature plants produce many canes 15 feet or longer. In cultivation, 8 feet or wider spacing between plants trained on a fence or trellis is suggested; closer spacing (4 to 6 feet) is suggested for plants kept pruned

to form a hedge. Double white flowers are produced during one season only—February and March in Florida. Like the Lady Banks Rose it is relatively resistant to the fungus causing black-spot, but regular application of an effective fungicide are needed to obtain optimal growth and to insure healthy condition of canes cut for propagation.

The susceptibility of *R. fortuneana* to crown gall is being investigated by plant pathologists at the Florida Agricultural Experiment Station. Infection of wounds on stem parts with the bacteria causing crown gall results in the same kind of tumorous growth as on other roses. Infection of wounds on root parts with this organism has not produced tumors at the inoculated root wound site.

One endoparasitic species of nematode, *Pratylenchus penetrans*, reduced the flower yield of roses on *R. fortuneana* rootstock (5). Other parasitic nematode species have been found associated with the roots of this rose, but amount of injury to the host plant caused by these organisms has not been determined.

This rose has been used as rootstock in the commercial production of rose bushes in southern France, warmer parts of Australia and in southeastern United States. The plant was introduced into the latter area by Fruitland Nurseries at Augusta, Georgia, and from there to the Glen St. Mary Nursery at Glen Saint Mary, Florida. Its adaptation in warmer climates is well established. In colder climates, such as the northern parts of the United States, its use is limited because of susceptibility to winter injury.

The superior vigor of *R. fortuneana* rootstock for Noisette, Tea and Hybrid Tea roses as com-

pared with two other rootstocks, *R. noisettiana manetti* and 'Mme. Plantier,' was described by Hume in 1921 (1). His observations were based on roses grown at Glen Saint Mary in north central Florida under field nursery conditions. Difficulties he encountered in vegetative propagation of *R. fortuneana* which limited its use in commercial production have been resolved in recent years by use of mist propagation. Interest in using this stock in the production of container grown roses for Florida markets has increased. Further evaluation of its performance as a rootstock under Florida growing conditions in comparison with other possible root systems is needed.

'Dr. Huey' (also called Shafter or Shafter Robin) is a large flowered climber currently used as stock for grafting roses in western parts of the United States. 'Mme. Plantier' (a climbing hybrid of *Rosa alba*) was formerly used as stock in southeastern United States. Both of these roses produce vigorous vegetative growth in Florida. Both are highly susceptible to black-spot, and require regular fungicidal applications. 'Dr. Huey' regularly produces semi-double red flowers during February in the Gainesville area, whereas 'Mme. Plantier' fails to produce its double white flowers unless an unusually severe winter is experienced as in 1957-58.

The climbing bourbon rose 'Eugene E. Marlitt' produces very double red flowers recurrently throughout the year. This rose has been used as grafting stock in Honduras and on islands of the Caribbean area. It is known as the rock rose in South Florida where it has been used as an ornamental shrub on alkaline coastal soils for many years.

Leafy stem cuttings of most rose varieties are relatively easy to root. It is evident that the representatives of older horticultural classes that are still in cultivation are capable of surviving on their own roots. Bourbon, Noisette, Tea and China rose varieties have been perpetuated by "slips" passed from one gardener to another. Among the modern roses, Floribunda varieties are more often grown on their own roots than are Hybrid Tea varieties. The question of whether rose plants grown on their own roots perform as well as when they are grafted on another rose to supply the root system was considered in this investigation.

An experiment reported in 1956 (2) showed that yield of salable flowers from 2-year-old plants of 'Happiness' rose was increased by use of *R. fortuneana* rootstock as compared with *R. odorata*, *R. multiflora* and 'Dr. Huey' rootstocks.

This experiment was conducted to obtain additional information on the effects of rootstock on longevity and growth of roses.

#### MATERIAL AND METHODS

The Hybrid Tea rose 'Happiness' and the Floribunda rose 'Spartan' were used in this comparison of *R. fortuneana* with 4 other kinds of root systems. The test included plants of 'Happiness' and 'Spartan' grown on their own roots and grafted on 'Dr. Huey,' 'Mme. Plantier,' and 'Eugene E. Marlitt.' Propagation by a method described earlier (3) was completed in September 1956, and the plants were placed in field nursery culture. In November 1957, 2 plants of each root and top combination were selected and transplanted to the test planting. The single plant units were randomly assigned to their field locations within each of two blocks.

The test location on Arredondo soil furnished full daily sunlight. Prior to planting, topsoil was amended by mixing a 2 inch layer of native peat and superphosphate at the rate of 4 pounds per 100 sq. ft. to 8 inch depth. A single row of plants was placed in the center of curbed beds 4 feet wide and spaced 4 feet apart. Row centers were spaced 7 feet apart. A 2-wire trellis was erected over each row center to provide anchorage for taller canes.

In planting, the graft unions were located 2 to 5 inches above ground level to facilitate maintenance and to prevent roots developing from scion parts. Practices recommended by the Florida Agricultural Experiment Stations in maintenance of the top growth, soil fertility and moisture were followed. No nematode control practices were used in this experiment.

#### RESULTS

Plants in the test have been maintained for 6 years. Differences in size of top growth related to differences in root systems have been evident since the second year of cultivation. Grafted plants have performed better than those on their own roots with respect to the amount of dead wood infected with stem canker and die back organisms that has developed. Plants of 'Happiness' on their own root showed an earlier decline in vigor than those of 'Spartan' on their own root.

The relative condition of the plants 6 years after propagation is described in Table 1. The graft combinations described as "satisfactory" have continued to increase in size through the sixth year of cultivation. Those described as

TABLE 1. COMPARISON OF 'HAPPINESS' AND 'SPARTAN' ROSE PLANTS WITH 5 ROOT SYSTEMS; EACH YIELD ITEM IS NUMBER OF SALABLE FLOWERS CUT FROM TWO PLANTS.

Plant material top/root combination	Fall 1961 yield of salable flowers (10 week sample); age: 5 years	Fall 1962 description of growth condition; age: 6 years
'Happiness'/' <i>R. fortuneana</i>	105	Satisfactory
'Happiness'/'Mme. Plantier'	87	Satisfactory
'Happiness'/'Dr. Huey'	81	Satisfactory
'Happiness'/'E. E. Marlitt'	52	Fair
'Happiness'/'own root	10	Poor, nearly dead
'Spartan'/' <i>R. fortuneana</i>	446	Excellent
'Spartan'/'Dr. Huey'	273	Very good
'Spartan'/'Mme. Plantier'	127	Satisfactory
'Spartan'/'E. E. Marlitt'	97	Satisfactory
'Spartan'/'own root	83	Satisfactory

"very good" or "excellent" produced a greater quantity of new growth and developed lesser amounts of dead wood. Plants described as satisfactors, very good, or excellent required more than one yearly pruning to keep the maintenance aisle between the row centers passable. Plants described as "fair" or "poor" did not require more than one yearly pruning to keep them confined within the 4 foot width of the curbed beds.

Flower yields from each of the test plants were recorded during a 10 week period—September 1 to November 10, 1961. Well formed flowers cut with 12 inch or longer stems were rated as salable quality. The number of salable flowers produced by each of the 10 top and root combinations is shown in Table 1. Each yield item is the total cut from 2 plants during the 10 week period. Most of the flowers discarded as unsalable were 'Spartan' cut with stems shorter than the 12-inch standard length.

In this fifth year sample (Table 1) a higher yield of salable flowers was obtained from both scion varieties grafted on *R. fortuneana* than on any of the 4 other kinds of root systems. 'Happiness' and 'Spartan' on their own root produced a lower yield of salable flowers than on any of the grafted plants.

#### DISCUSSION

Results obtained in this experiment and in a previous comparison of rootstocks (2), favor the

use of *R. fortuneana* stocks in Florida. Evidence of superior growth produced by this rootstock with a wide range of garden roses was obtained in Florida more than 40 years ago (1). Similar observations were made by nurserymen in southern France more than 50 years ago (7). Despite this early knowledge of its potential usefulness as rootstock in warmer climates, relatively few plants on this stock have been marketed in any subtropical region.

An explanation for the lack of use of this stock in commerce is that the plant proved difficult to propagate by conventional methods. Its use was abandoned because survival percentages in rooting and in grafting were too low for economical production of grafted rose bushes.

Recent improvements in techniques of propagating roses on *R. fortuneana* rootstock have made it possible to obtain 80 percent or greater survival of grafted plants. This percentage is high enough for economical production of grafted roses. These improvements in technique include a change in the kind of scion used. This differs from previously described methods of budding scions on leafy stem cuttings of *R. fortuneana* (3) or on stock plants after they are rooted under mist (4). The modification consists of joining a leafy stem cutting from the scion variety to a leafy stem cutting from the rootstock. The 2 pieces joined are similar in diameter. The combination is then rooted under mist and the

graft union is completed during the period of about 35 days required for rooting.

Factors responsible for the increased growth of roses produced by *R. fortuneana* rootstock are not well defined. Resistance to some soil borne parasites has been postulated as a contributing factor, because of the generally healthy appearance of *R. fortuneana* roots. The greater ability of this rose to obtain iron available in soil surrounding roots during periods of high temperature was indicated by comparisons of the coloration of scion foliage of test plants in the summer months.

A further possible explanation of the exceptional growth associated with *R. fortuneana* roots is that related to its origin. Many examples have been described by plant geneticist of the phenomenon of "hybrid vigor" resulting from cross pollination between species or between other separate, long inbred taxa. The supposed origin of *Rosa x fortuneana* suggests that it may be another example of this phenomenon, but comparisons with the parental species used as rootstock would be needed to verify this analogy.

This experiment showed that the choice of root system does have an effect on the longevity of the plant. The yearly increase in size of the plants indicates that those with *R. fortuneana* roots do not necessarily attain maximum production before their sixth year of cultivation. The period of greatest flower production for these

plants may be regulated by the amount of space allotted to each plant and by other cultivation practices. Chemical controls of parasitic nematodes, which were not applied in this test, may extend the productive life of the plant and place its peak of flower production well beyond the sixth year of cultivation.

#### SUMMARY

A field comparison of 5-year-old 'Happiness' and 'Spartan' roses showed a greater number of salable flowers cut from plants grafted on *R. fortuneana* than from those grown on their own roots and those grafted on 'Dr. Huey,' 'Mme. Plantier' and 'Eugene E. Marlitt.' The yield of salable flowers obtained from 'Happiness' and 'Spartan' on their own roots was lower than any of the grafted plants. Notes are included on the history of *R. fortuneana* cultivation in Florida.

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