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The idea of utilizing an exotic rose, popularly known as the multiflora rose, to make living fences has caught the fancy of farmers, sportsmen and conservationists in general, specialists as well as laymen. Possibly because this Asiatic rose furnishes the entire fence rather than only the posts, is apparently easy to establish and seems to be the ideal escape and nesting cover for wildlife as well as a panacea for many soil erosion ills, it is being planted even more generally than was the black locust in the past decade without benefit of research to provide answers to questions of when, where, how and why.

The "literature" on the subject of the establishment, growth and utilization of the multiflora rose is made up chiefly of colorful articles in popular magazines, references to its value in a book or two, a large number of leaflets, mimeographed statements and brief farm news releases. One experiment station bulletin (4) is available which gives detailed directions for its propagation, establishment, culture and use without presenting the data on which these recommendations are based.

The first question that arises is whether the authors of all of these stories are describing the same multiflora rose. Three or four of them indicate that the multiflora rose to which they refer is *Rosa multiflora.* This statement is of little value in answering the question because, although only one species is recognized, *Rosa multiflora* Thunb., there seem to be several varieties (2, 3). The source of these varieties covers a considerable area in China, Korea and Japan which would at least indicate the possibility that more than one species is involved. The fact that several forms of *Rosa multiflora* Thunb. have been introduced into the United States from the middle of the 19th century to the present time, would make it seem very unlikely that only one form of this plant is now being used and publicized.

Therefore it would appear that the taxonomy as well as the ecology of the so-called multiflora rose requires further investigation. The typical form which has become so popular for planting in the United States as a living fence is a variety of *Rosa multiflora* Thunb. with small white flowers, recognized by most authorities as

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Rosa multiflora thunbergiana Thory (2, 3). It is a deciduous, prickly shrub with vigorous, long reclining or climbing branches; pinnate leaves of usually 9 leaflets which are oblong to obovate, ¾ to 1⅓ inches long, acute or obtuse at the apex, serrate and pubescent; flowers usually white, ¾ inch in diameter with abruptly acuminate ovate sepals, borne in many-flowered pyramidal corymbs; fruit small globular on slender pubescent pedicels. It seems likely that this form was introduced into the United States from Japan or Korea before 1868.

The occurrence of pinkish or pink, single-flowered plants in the planting stock of the above white, single-flowered form in some of the plantings, as reported in popular articles, may be attributed to variation within the variety or to the inclusion of two other varieties: *Rosa multiflora calva* French and Sav. (3) with white or pinkish flowers, leaflets pubescent beneath only on the midrib and with glabrous pedicels; and *Rosa multiflora cathayensis* Rehd. and Wils. with pink flowers ¾ to 3⅓ inches in diameter, borne in few to many flowered, flattish corymbs on glabrous, sometimes glandular pedicels. There is also a wide variation in the degree of thorniness of introduced plants which is difficult to explain.

The purpose of this paper is to present a few data obtained from experiments with one form of multiflora rose planted at the Floris research station in southern Iowa. Gully plantings of 50 plants each, obtained from the Soil Conservation Service nursery at Tully, N. Y., were made in the early spring of 1938 and 1939. These plants were identified as *Rosa multiflora thunbergiana* Thory. Both survival rate and growth response of the plants were satisfactory but they were not planted in rows to form a fence.

The first plantings of the multiflora rose in rows to form a living fence at the Floris station were made in May, 1941. These plants obtained from the Elsberry, Missouri nursery of the Soil Conservation Service, were also identified as *Rosa multiflora thunbergiana* Thory. There were no variations in flower, fruit, leaf or stem among the plants that would indicate that any other form or variety of multiflora rose was included.

Three row plantings of the rose were made on eroded Lindley silt loam on three different sites (Table 1). The planting stock was of good grade, selected from 500 plants for even size and both top-pruned and root-pruned to 1 foot. Each row was planted down the middle of a 4-foot bench terrace constructed on the contour by plowing 4 furrows all one way, preferably down the slope, with the furrows successively more shallow toward the uphill side. After

levelling, the bench was marked down the middle with a walking plow and the plants set at 1½ foot spacing and foot-planted. The rows were cultivated with a one-row corn cultivator for the first season.

Table 1

Location and site characteristics of 3 contour row plantings of *Rosa multiflora thunbergiana* Thory. 1941.

Site	Slope		Elev. above site 1. ft.	Top soil depth in.	Direct. of row	Number plants
	Aspect	percent				
1	s. e.	3		6—8	e. to w.	126
2	n. w.	30	35	4—6	s. e. to n. w.	95
3	south	20	90	2—4	e. to w.	160

The rate of growth and mature size of the plants (Figs. 1, 2) on the 3 sites were almost exactly proportional to the depth of top-soil. The average top-soil depths of sites 1, 2 and 3, in inches, were 7, 5 and 3 respectively. The ratio of growth in volume of the plants seemed also to be 7, 5, 3, although the plants on site 2 and 3 were slightly more slender, resulting in an average height in feet of the three fences of 7½, 5½ and 4 respectively. Based on other experiments the productivity ratio of the three sites, in bushels of corn per acre, was approximately 70, 50, 30. Neither depth of top-

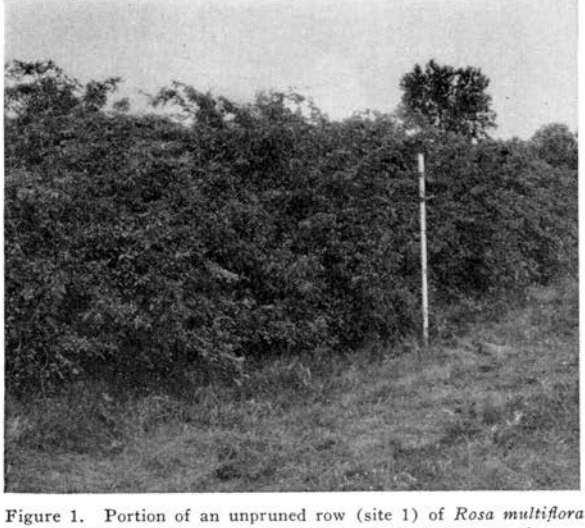

Figure 1. Portion of an unpruned row (site 1) of *Rosa multiflora thunbergiana* Thory, planted on a bench-terrace on the contour in May, 1941. Mid-July, 1944.

soil nor productivity level seemed to limit the development of a comparatively tight fence by the plants on the three sites although the plants on sites 2 and 3 were reduced in volume and height.

The high degree of correlation between soil depth and plant response may be attributed in part to the fact that no crops had been taken from any of the 3 sites for four years preceding planting in 1941. This idle period following abandonment gave the soil of the sites the same length of time for recovery under the natural vegetative cover which the soil of each site could support. The climatic factors of the three sites during the growing seasons from 1941 to

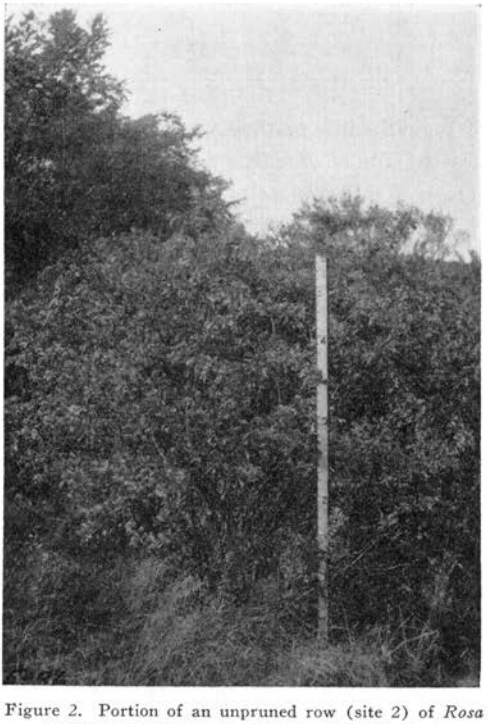

Figure 2. Portion of an unpruned row (site 2) of *Rosa multiflora thunbergiana* Thory, planted on a bench-terrace on the contour in May, 1941. Late September, 1945.

1948 were more similiar than would be expected on the basis of slope and elevation differences because of adequate protection from drying winds from the south and west at all of the sites.

There was one very important difference in the relative response of the three plantings which was not anticipated by the author. All of the plants in the fence row on site 1 were injured by freezing

during the winter of 1946-1947 to the extent that they did not leaf out and resume growth at the beginning of the 1947 growing season. All of the plants in the row, except 2 near the east end recovered by the growth of uninjured branch buds. Many of the plants, however, were killed back for almost their entire height and showed recovery only by the development of buds at the ground level. By the close of the 1947 growing season the fence had its usual green appearance but careful examination disclosed the large proportion of many of the plants made up of dead stems.

Explanation of winter-killing of one fence planting during the 1946-1947 winter season and of no winter-killing in previous seasons is difficult. Two factors would seem to be involved: luxuriant growth with no marked frost check till November 12 and the severe freeze on January 4 following a period of mild weather. The minimum temperature at the nearest U. S. Weather Bureau station at Bloomfield, Iowa in January was — 18 degrees F. The Bloomfield station is located on the upland at approximately the same elevation as the highest (hilltop) weather station at the Floris experiment station, compared to the elevation of site 1 which is approximately the same elevation as the lowest weather station at Floris. Comparison of minimum temperatures at Bloomfield and Floris in previous years (1) shows that the average depression of the minimum temperature at site 1 below that at Bloomfield is 9 degrees F. (Table 2). It is probable therefore that the minimum temperature at site 1 on January 4, 1947 was approximately — 27 degrees F. compared to approximately — 23 at site 2 and — 20 at site 3. Although a minimum temperature of approximately — 27 degrees F. would seem to be sufficiently low to cause winter-killing of the rose plants at station 1, it is difficult to explain why there

Table 2

Comparison of minimum temperatures in degrees F. during winter storm periods at three elevations at the Floris station and at the 2 nearest U. S. Weather Bureau stations. 1943-1944

Date	Ottumwa	Bloomfield	Hilltop	Mid-slope	Bottom of slope
Dec. 16	— 7	— 9 (Dec. 15)	—10	—13	—16
Dec. 23	— 3	— 3	— 5	— 9	—10
Jan. 8	— 3	— 6	— 5	— 7	—10
Jan. 13	— 2	— 6	— 3	— 8	—10
Feb. 12	—12	—15	—15	—18	—22
Feb. 18	— 4	— 5	— 6	— 9	—17

was no injury at stations 2 and 3 where the minimum temperature readings were probably not higher on January 4 than —23 and —20 degrees F. The reduction of several degrees in minimum temperature readings at lower elevations as compared to readings at U. S. Weather Bureau stations, which are usually located at higher elevations, would seem to indicate that multiflora rose plantings made throughout the state independent of elevation, are no doubt subjected to minimum temperatures much lower than those reported in the U. S. Weather Bureau monthly reports.

At site 3 an additional comparison was made. In 1941 the author was of the opinion that *Rosa setigera* Michx., a native rose adapted to the region, had possibilities as a fence plant. This is not the prairie rose as indicated in some manuals (2, 3) but a rose of oak-hickory woods and upper floodplains. Its habit of growth is comparable to that of *Rosa multiflora thunbergiana* Thory except that it has heavier canes and showier flowers. At site 3, with the highest elevation and the thinnest soil, the row of roses on the bench-terrace was composed of alternating segments of 20 setigera rose plants and 20 multiflora rose plants. At the 1½ foot spacing, the component segments of the row were 30 feet long. There were five replications. Compared to approximately 100 per cent survival of the multiflora rose, survival of the setigera rose was 80 per cent. Compared to practically no killing back of the multiflora rose at this site, about half the stems of the setigera rose were dead following the first growing season.

In 1945 an experiment was initiated to compare the direct seeding method with transplanting in establishing multiflora rose with and without site preparation and cultivation. The site selected was a 20 per cent south-facing slope near the top of the hill, close to site 3. This direct-seeding site closely resembled site 3 except that practically all of the top soil of the Lindley silt loam of the new site had been removed by erosion. Each of the 3 contour rows of the experiment was divided into 4 segments, two of which were bench-terraced and two left untreated. The former were cultivated 3 times in 1945 and the latter were not cultivated. In each row, half the length of each 33-foot segment was planted at 1-foot spacing to small, emergency grade multiflora plants of the Thunberg variety and the other half was direct-seeded at the rate of 10 cleaned, unscarified seed to a foot. The direct-seeded plants were later thinned to appropriate 1-foot spacing.

Table 3 shows the average results obtained from the transplanted and direct-seeded plants grown on the contour with no site prepara-

tion and no cultivation as compared to those grown on prepared, narrow, bench-terraces with cultivation. Although no exact measurements were made the second year, the average height of the plants was slightly more than doubled with the bench-terraced,

Table 3

Survival rate and height growth (one-year) of small, emergency grade 1-0 stock and of direct-seeded plants of multiflora rose on severely eroded Lindley silt loam. 1945.

Plants	Survival, percent		Average height, inches	
	Bench-terrace	Scalp-planted	Bench-terrace	Scalp-planted
Nursery stock (1-0)	92.8	87.5	15.7	10.4
Direct seeding	60.0	38.0	6.2	3.4

cultivated plants showing an increased rate of growth over the untreated, seeded and transplanted plants. The untreated transplanted plants still showed a height advantage over the treated seeded plants but did not give as good promise of final survival. These latter were definitely established although the untreated seeded plants were in poor condition and had practically failed.

The results of this experiment indicate that entirely denuded Lindley silt loam is too low in productivity to grow a well-formed multiflora rose fence but that under bench-terrace preparation and cultivation a very useful wildlife planting may be grown. The fact that under site preparation and cultivation a direct-seeded row of the rose became established under so adverse soil conditions would indicate the possibility of direct seeding of multiflora rose on favorable soil with possible use as a fence.

The natural migration of plants into new areas, and their ecesis or successful establishment there, is a long-time process but a relatively sure one, once it is accomplished. Barriers to migration are usually mountains, deserts, large bodies of water and the like. Barriers to successful establishment and growth are chiefly the factors of the new habitat as temperature, moisture supply and soil productivity. When man takes a hand in introducing plants into new areas, he makes many mistakes. Although he can be independent of barriers to migration, he is dependent on the barriers to establishment and growth, the factors of the habitat.

On the basis of the limited data presented in this paper, questions are raised as to minimum winter temperature and low soil productivity as barriers to the establishment and growth of multiflora

rose. Moisture supply was not an independent factor at this location but it would seem advisable to evaluate this factor in any contemplated westward extension of multiflora rose as far as the 98th meridian and certainly beyond it. Especially should extension of its range to the northwest be based on many experimental plantings because of the effectiveness as barriers of a combination of the factors of moisture supply and low winter temperature.

If other conditions are favorable, productivity of the soil does not seem to be a serious barrier. Our results would seem to indicate that a fence 4 to 5 feet high can be established on 30 bushel an acre corn land. On the other hand, the winter-killing of an entire well established fence planting located in the southern-most tier of counties in Iowa raises some doubt of the advisability of unlimited planting of multiflora rose in Iowa. In 1948 plantings were made in 60 or more counties of Iowa, 4 of which are located on the northern border. Quantitative data will be obtained on the response of as many of these plantings as possible as a basis for more definite recommendations on multiflora rose planting in Iowa. Evaluation of the effect of elevation in relation to possible cold air drainage and an examination of the planting stock for varietal differences will be included in the investigation.

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