Response of Different *Syringa* (Lilac) Species and Hybrids to Renovation[1]

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Abstract

Eighteen species and hybrids of *Syringa* were renovated by removing all stems. At the end of 4 years, shoot growth, shoot diameter, and numbers of lateral shoots produced were evaluated to assess species differences in growth response. In most species, there was an initial rapid growth rate followed by a decline. The decline in growth rate may be related to increasing architectural complexity as the shoot system develops. Genotypic differences in stem diameter, height growth progression and the number of lateral shoots have a principal role in plant form development and should be considered when selecting plants with particular textural characteristics for landscape plantings. In addition, these response patterns may be a useful guide for predicting growth and development after renovation of a particular species and hybrids.

Index words: *Syringa*, Lilacs, renovation, architecture

Species used in this study: Chinese lilac (*Syringa x chinensis* (Willd.)); Henry lilac (*S. x henryi* (Schneid.)); Early flowering lilac (*S. x hyacinthiflora* (Lemoine) Rehd.)); Josiflexa lilac (*S. josiflexa* Preston); Hungarian lilac (*S. josikaea* Jacq.); Komarof lilac (*S. komarowii* Schneid.); Feathered Persian lilac (*S. laciniata* Mill); Meyer lilac (*S. meyeri* Schneid.); Little leaf lilac (*S. microphylla* Diels.); Preston lilac (*S. x prestoniae* McKelvey); Hairy lilac (*S. pubescens* Turcz.); Nodding lilac (*S. reflexa* Schneid.); Japanese Tree lilac (*S. reticulata* (Blume) Hara); Amur tree lilac (*S. reticulata mandshurica* (Maxim.) Hara); Skinner lilac (*S. x skinneri* F. Skinner); Chengtu lilac (*S. sweginzowii* Koehne & Lingelsh); Late lilac (*S. villosa* Vahl.); Common lilac (*S. vulgaris* L.).

Significance to the Nursery Industry

Lilac species are commonly used as landscape plants. Many woody plants including lilacs may require extensive renovation as a management practice to promote vigorous new growth. All 18 species studied, successfully regenerated following renovation. By the end of the study period all plants were producing flowers and returning to typical forms for the species. However, our results indicate that species differ in their response to renovation. These response patterns may be a useful guide for predicting growth and development after renovation of a particular species.

Introduction

The genus *Syringa* (lilac) has approximately 30 species of shrubs and small trees, all of which occur in the northern hemisphere. In addition, many interspecific hybrids are known (2, 5, 6, 8, 12). Rogers (11) lists over 900 cultivars involving many species, but only a small proportion are common in the landscape industry.

Removal of all or a large part of the above ground vegetative growth is a horticultural practice commonly referred to as renovation. It involves the removal of larger stems to rejuvenate plants. Renovation may also be useful in promotion of flowering. The rejuvenation growth response has been studied in many angiospermous plants. Initial growth rates are more rapid in renovated plants than growth rates of seedlings (7, 13). Moreover, plants which are cut back in the dormant season often produce taller shoots than those cut back during the growing season (14).

The collection of *Syringa* at the Morden Research Station, Manitoba, Canada is extensive with over 500 accessions established. In 1984, a major portion of the planting was renovated to promote new growth and allow easier access. The present study was undertaken to investigate the renovation growth response of 18 different species and hybrids, and to assess the relative suitability of this practice.

Materials and Methods

All *Syringa* representatives studied were established at least 20 years ago in the Morden Arboretum, Agriculture Canada Research Station, Morden, Manitoba, Canada. In the spring of 1984, all aerial stems were cut off approximately 20 cm (8 in) above the ground with a chainsaw. For complete details see Davidson and Enns (1).

A listing of accessions selected for study is presented in Table 1. These plants represent the major species that are grown in urban and rural landscapes. At the end of the fourth growing season after renovation, three stems from each plant were randomly selected for measurement. These stems were removed from the mother plant in late October and placed in cold storage until detailed measurements were made. All stems originated from buds arising at the base of the original mother plant and were selected to represent the overall performance in that they were considered to be influential in extending the canopy. All plants were grown in an open field situation and were exposed to very similar growing conditions (soil moisture, weed competition, weed control, and light). Measurements obtained included height growth increments (4 seasons), diameter at the mid point of each shoot, and the number of lateral shoots produced per year on the last 2 years of extension growth. A shoot was defined as an annual increment of growth (10). There are differences in the branching patterns among *Syringa* species in that some demonstrate monopodial growth from a true terminal bud while the terminal shoot tip of others

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Table 1. A listing of Syringa species and hybrids utilized in the investigation of the response to renovation.

Species	Common Name	Native Range	Parents of Hybrids[1]
S. x chinensis Willd.	Chinese lilac		S. persica x S. vulgaris
S. x henryi Schneid.	Henry Lilac		S. josikaea x S. villosa
S. x hyacinthiflora (Lemoine) Rehd.	Early flowering lilac		S. vulgaris x S. oblata
S. josiflexa Preston	Josiflexa lilac		S. josikaea x S. reflexa
S. josikaea Jacq.	Hungarian lilac	S.E. Europe (Hungary)	
S. komarowii Schneid.	Komarof lilac	W. China (Szechuan)	
S. laciniata Mill	Feathered Persian lilac	NW. China (Konsu)	
S. meyeri Schneid.	Meyer lilac	N. China (Henan)	
S. microphylla Diels.	Little leaf lilac	N. China (Shensi-Hunan)	
S. x prestoniae McKelvey	Preston lilac		S. reflexa x S. villosa
S. pubescens Turcz.	Hairy lilac	N. China (Chilhi)	
S. reflexa Schneid.	Nodding lilac	China (Hupeh)	
S. reticulata (Blume) Hara	Japanese Tree lilac	Manchuria, Korea, SE. Siberia	
S. reticulata mandshurica (Maxim.) Hara	Amur tree lilac	N. China	
S. x skinneri F. Skinner	Skinner lilac		S. patula x S. pubescens
S. sweginzowii Koehne & Lingelsh	Chengtu lilac	NW. China (Szechuan)	
S. villosa Vahl.	Late lilac	China	
S. vulgaris L.	Common lilac	Europe	

[1]Information Source: 2, 3, 4, 9, 10

aborts resulting in sympodial growth (3, 8). For the purposes of this study, extension of an axis resulted from either a true terminal shoot or a lateral shoot considered to be replacing the terminal shoot. To assess and compare responses to renovation, the morphometric data were statistically analyzed utilizing Statistical Analysis Systems (SAS 1985) statistical packages.

Results and Discussion

There were highly significant differences in how the various species responded to renovation. Cumulative shoot extension at the end of 4 growing seasons varied from 110.3 cm (43.4 in) in *S. reflexa* to 240.8 cm (94.8 in) in *S.* x *hyacinthiflora* (Table 2). *S.* x *hyacinthiflora*, the most vigorous plant, demonstrated very rapid growth the first year followed by considerably less growth in subsequent seasons.

Most of the species demonstrated a similar growth pattern but with notable year to year variations. Since the plants were grown in relative proximity to each other, differences due to site conditions are not expected. Analysis of the weather data over the course of the study suggests that growing conditions were similar to normal values (Table 3). Extremes of moisture or temperature did not have a major effect on plant growth. For many species (e.g. *S.* x *prestoniae, S. josikaea*), extension growth remained relatively constant or gradually declined from the second season on-

Table 2. Mean shoot growth increments (1984–1988) and cumulative shoot growth for renovated *Syringa* species. Species listed in descending order of cumulative shoot growth.

Species	Mean Shoot Growth (cm) by Year 1984	1985	1986	1987	Cumulative Shoot Growth
S. x hyacinthiflora	167.4	14.5	38.1	20.9	240.8
S. reticulata mandshurica	85.2	25.7	59.4	60.5	230.7
S. x chinensis	10.0	166.5	18.0	34.1	228.5
S. microphylla	36.5	75.7	63.0	52.5	227.7
S. x prestoniae	152.9	27.9	19.7	19.3	219.7
S. villosa	99.1	20.3	56.8	34.1	210.7
S. reticulata	83.5	26.2	61.7	36.4	207.8
S. pubescens	128.6	24.4	28.7	19.7	201.4
S. vulgaris	105.6	12.9	42.1	34.3	194.9
S. sweginzowii	91.1	16.9	34.9	40.8	183.8
S. meyeri	87.4	21.6	28.1	27.4	164.5
S. laciniata	53.3	22.0	26.6	47.2	149.2
S. x henryi	49.9	22.3	39.3	36.6	148.1
S. x skinneri	73.6	31.8	18.8	16.7	140.8
S. x josiflexa	50.7	44.0	27.4	16.1	138.2
S. josikaea	50.1	20.1	29.2	27.7	122.0
S. komarowii	57.3	16.2	18.1	20.1	111.6
S. reflexa	53.7	32.1	3.1	21.4	110.3
Overall Mean	79.8	34.5	34.1	31.4	179.5
Prob > F	0.0001	0.0001	0.0001	0.0008	0.0001
LSD[z]	43.5	34.7	25.8	14.6	33.3

[z]Least significant difference at 5% probability level.

Table 3. Summary of the agroclimatic statistics at the Morden Research Station, Morden, Manitoba, Canada, 1984–1987.

Climatic measurements	Year				Long term Average
	1984	1985	1986	1987	
Total precipitation (mm)	510.2	575.7	490.2	517.8	524.1
Degree days above 5°C (No.)	2021.4	1748.5	1937.0	2204.0	1961.4
Avg. high temp (°C)	9.6	8.2	8.6	10.8	9.3
Avg. low temp (°C)	−0.6	−2.2	−1.7	0.7	0.0
Frost-free Days (No.)	n/a	136.0	133.0	132.0	132.0

ward. On the other hand, in *S. reticulata* and *S. villosa* there was a significnt increase in shoot length in year 3 and a decline again in year 4. In another group, (e.g., *S.* x *hyacinthiflora, S. vulgaris, S.* x *henryi*), there was an increase in shoot length in the last two years of the study after a large decrease in year 2. In 2 of the species studied, *S.* x *chinensis* and *S. microphylla*, there was a distinctly different pattern of height-growth progression. In year 2, there was a large increase in shoot length followed by a large decline over the last 2 years.

The variation in the pattern of growth response may be attributable to genotypic differences in architectural development. Growth immediately following renovation is usually neoformed, since all leaves are formed during the current growing season (4, 7). In the first year, the species vary in their potential for shoot neoformation. It also appears that the species vary in their potential for neoformation in the second and subsequent years (e.g. compare *S.* x *chinensis* with *S. vulgaris*). Plants that responded vigorously in the first year may not have had sufficient time to develop large buds for the following year and therefore exhibited reduced growth the following season. However, the extent to which neoformation of shoots occurs in *Syringa* requires detailed developmental analysis, preferably under controlled conditions. The capacity for neoformation, may also be in part related to hybrid vigour (4). In relation to cumulative shoot growth, hybrids ranked among the top five accessions studied.

Our observation of initial rapid growth rate following renovation is consistent with that observed in other woody plants (7, 13). The general decline after the first year may be related in part to increasing structural complexity as the shoot system develops (9, 10). In addition shoot-tip abortion, common in *S. vulgaris* (3) was also observed in several other species (e.g. *S. pubescens, S. meyeri*, and *S. microphylla*). Shoot-tip abortion may increase the frequency of branching, resulting in greater structural complexity (Table 4).

Besides variation in height growth, there were significant differences in shoot diameter (Table 5). Interpretation of the diameters for the youngest shoots (1987) revealed plant types with fine textured shoots (e.g., *S.* x *josiflexa, S. meyeri*, and *S. microphylla*) and more coarsely textured examples (*S.* x *hyacinthiflora, S. reticulata mandshurica*). These observations are consistent with previous reports describing textural attributes of the various species (2, 6). Although shoot diameter is typically related to shoot length within a species, no such relationship was observed across the 18 species examined. For example, shoot diameters in *S. reticulata*, the seventh tallest plant, were very large (Table 5). In contrast, the fourth tallest plant, *S. microphylla*, had the smallest shoot diameter in three of the 4

Table 4. Mean number of lateral shoots per parent shoot for renovated *Syringa* species in descending order of 1987 values.

Species	Year Formed	
	1986	1987
S. microphylla	17.0	20.3
S. reticulata mandshurica	3.3	13.7
S. meyeri	6.7	13.3
S. pubescens	7.3	12.3
S. reticulata	3.3	11.7
S. x hyacinthiflora	3.0	10.5
S. sweginzowii	4.7	9.7
S. henryi	6.3	7.7
S. laciniata	11.0	7.7
S. x prestoniae	7.8	7.0
S. reflexa	2.5	6.5
S. villosa	4.0	6.0
S. vulgaris	4.7	5.7
S. x skinneri	7.3	5.7
S. josikaea	6.3	4.3
S. x josiflexa	6.7	4.3
S. x chinensis	25.0	4.0
S. komarowii	5.0	4.0
Overall Mean	7.3	8.7
Prob > F	0.0001	0.0001
LSD[z]	6.9	5.8

[z]Least significant difference at 5% probability level.

years examined. The limited secondary growth in *S. microphylla* resulted in stems which were cylindrical in shape. In *S.* x *prestoniae*, also with fine textured young shoots (Table 5), there was a much greater difference in diameter between shoots formed in 1984 and 1987 than in most species examined. This resulted in the development of an exaggerated tapered stem form. It should be noted that extension growth was particularly large in 1984 which could have contributed to this response. Interpretation of the results suggests that in addition to genotypic differences in stem diameter, height growth progression should also be considered when selecting plants with particular textural characteristics for landscape plantings.

The mean number of lateral shoots per parent shoot varied significantly among the species investigated (Table 4). Over the two years investigated, *S. microphylla* had the greatest number of lateral shoots while *S. komarowii* had the fewest. There appeared to be three general lateral shoot response patterns. First, lateral production increased between 1985 and 1986 (e.g. *S. meyeri* and *S. pubescens*); second, lateral production was similar between the two years (e.g. *S. laciniata* and *S. vulgaris*); and finally, there was a decrease in numbers of lateral shoots produced (e.g., *S. josikaea, S.* x *josiflexa* and *S.* x *skinneri*). A correlation between the

Table 5. Mean mid-shoot diameter (mm) by year shoot was formed for renovated *Syringa* species. Species listed in descending order of 1984 values.

Species	Mean mid-shoot diameter (mm) of shoots			
	1984	1985	1986	1987
S. x hyacinthiflora	18.6	8.75	8.5	6.8
S. reticulata mandshurica	17.8	14.7	11.2	6.8
S. reticulata	17.8	15.7	9.6	6.4
S. vulgaris	17.0	14.6	11.3	6.2
S. villosa	18.0	12.4	9.3	6.0
S. x henryi	13.8	11.3	9.5	5.7
S. sweginzowii	13.8	11.3	8.1	5.1
S. komarowii	10.4	8.2	6.3	4.3
S. reflexa	12.9	7.5	6.7	3.7
S. x chinensis	12.6	11.1	5.0	3.6
S. pubescens	11.8	6.8	4.6	3.2
S. microphylla	5.3	4.7	4.1	3.2
S. josikaea	10.1	8.4	5.5	2.8
S. laciniata	10.8	8.7	4.9	2.7
S. x skinneri	11.3	6.6	3.9	2.7
S. meyeri	12.3	7.6	4.7	2.6
S. x prestoniae	17.1	10.1	5.2	2.6
S. x josiflexa	10.7	8.7	4.4	1.9
Overall Mean	13.4	9.8	6.8	4.2
Prob > F	0.0001	0.0001	0.0001	0.0001
LSD[z]	4.7	3.6	2.1	2.1

[z]Least significant difference at 5% level of significance.

number of lateral shoots and parent shoot vigour as measured by length has been shown for many woody plant species (e.g. *Larix laricina* (10)). A similar trend was evident in some, but not all the *Syringa* species investigated. Nevertheless, the significant difference among species in lateral shoot production suggests that there is a strong genotypic component. Lateral branch numbers are known to vary among species of *Syringa* (2, 8). As in the case of shoot diameter, the production of lateral shoots influences the texture of the plant. In addition, such shoots form the basis for the development of the architecture of the plant.

It is clear that there is considerable variation in the growth related responses measured in the different species of *Syringa*. All species appear to be exhibiting neoformation of shoots, contributing to rapid shoot growth, particularly in the first year. Rapid growth may also be associated with hybrid vigour. Since environmental conditions were relatively normal during the study period, the variability appears to be related to genotypic response patterns. Finally, it should be noted that most commonly used lilacs (e.g., *S. vulgaris, S. villosa, S. meyeri* and S. x *prestoniae*) regenerated vigorously, suggesting that renovation can be utilized in commercial situations.

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