GARDEN PERFORMANCE OF FOUR ROSE CULTIVARS AS INFLUENCED BY FOUR DIFFERENT ROOTSTOCKS

MUHAMMAD ASLAM AND DAUD AHMAD KHAN*

The garden performance of four rose cultivars budded on four different rootstocks was studied. The plants on 'Edward' and 'Damascena' were at par and bigger in size than those on 'Gruss an Teplitz'. Maximum suckers were observed on 'Edward'. Suckering was less in hot and dry weather and more in spring and autumn. Longer flowering period was shown by 'Flamenco'. Among rootstocks the maximum output was recorded for the plants budded on 'Edward' stock.

INTRODUCTION

In rose culture, the rootstock is very important because it influences the vegetative vigour, flower yield, flower quality, longevity of the plants, susceptibility to diseases and pests and adaptability to environment. The rootstocks differ among themselves in respect of the morphological characters, growth vigour, compatibility with various scion cultivars, and their influence on different economic characteristics of the scion. Therefore, a knowledge of the influence of rootstocks on various characters of the scion can benefit the nurserymen in producing the best plants with the least cost.

REVIEW OF LITERATURE

Greater root growth and earlier root activity was found in one year old plants of 'Ami-quinard' (H.T.), budded on *Rosa multiflora* seedling stock (Brase, 1939). Flower production was closely related to the time of starting greatest shoot growth. Van Marsbergen (1952) reported that 'Happiness' produced a greater number of longer shoots on *Rosa canina* 'Brog' than on other *Rosa canina* strains. *Rosa multiflora* was found to be the best rootstock for plant size and flower production (Vander Harst, 1962). *Rosa canina* selections also showed promise. Danhardt and Kuhle (1962) reported that the yield of five scion cultivar was highest from plants on *Rosa canina*, 'Pollmer' and lowest on Schmid's ideal.

'Happiness' and 'Spartan' roses produced more saleable flowers when grown on *Rosa fortuneana* stocks than when grown on stocks of 'Dr. Huey', 'Mimo Plantier' or 'Eugene E', 'Barlitt', or on their own roots (Mcfadden 1962).

*Department of Horticulture, Faculty of Agriculture, W. P. Agricultural University, Lyallpur.

Buck (1964) stated that most readily visible influence of the rose under stock upon scion growth is that of vigour and that the earlier and heavier flower production is stimulated by grafting. He also stated that effect of the under stock, upon flower quality is associated with the former's effect on scion vigour.

In an evaluation study of 9 rose cultivars grown on sweet briar rootstock in respect of stem length, flower size, yield per plant and per sq. m. and sale price, Sutter's gold was found to be most productive cultivar. Nottingham, 'Rendezvous' and 'Virgo' also gave good yields. 'Baccara' had the longest stems and flower life (Vecera, 1965). In the studies of Van Derharst and Sparnasy (1966) on ten rootstocks budded with different cultivars, *Rosa canina* proved the most reliable rootstock under all conditions. Vecera (1967) used *Rosa rubiginosa*, *Rosa multiflora*, *Rosa coriifolia* and 6 selections of *Rosa canina* as rootstocks for 'Queen Elizabeth', 'Queen Burmuda', 'Marchenland', 'Christian Dior' and 'Rimosa' cultivars. *Rosa rubiginosa* and *Rosa multiflora* were least vigorous rootstocks, *Rosa canina* was moderately vigorous and the remaining rootstocks proved to be very vigorous.

Maarsch, (1967) reported that yield ranged from 1340 flowers per 100 plants in the cultivars 'Isabell de Ortiz' to 3134 flowers/100 plants in 'Bel Angle'. Leemans (1767) classified '*Rosa canina*' selections and other species of rootstocks in high, medium and low suckering groups.

Alam (1968) reported that on the basis of garden performance of rose rootstocks, 'Edward' is the best rootstock except that it suckers profusely. 'Damascena' is number two. He did not recommend 'Gruss an Tepfitz' and 'Gola' for their use as rootstocks. Tickhor and Roberts (1968) reported that bloom production is influenced by several factors : scion cultivar, rootstock, location and number of years the plants have been growing in a location.

MATERIALS AND METHODS

The studies reported in this paper were carried out on two sets of experiments during the year 1968-69 in the Horticulture Department of West Pakistan Agricultural University, Lyallpur. The experiments were laid out according to randomized complete block design. Set I was planted in February 1967 with four rootstocks, 'Edward', 'Rosa damascena', 'Gruss an Teplitz', and 'Gola' and four scion cultivars budded on them were 'Queen Elizabeth, 'Flamenco', 'Fashion' and 'McGredy's Sunset'.

Set II was planted in February 1968. It involved the former three rootstocks and all the four cultivars as used in Set I. There were 12 stock-scion combinations. All the plants received normal cultural operations.

The budded plants were transplanted in the middle of February 1969 in 4 blocks. Each block contained 12 rows (one row for each stock scion com-

bination) and in every row there were five budded plants. The experiment was laid out in randomized complete block design.

The data on size of the budded plants and output of the flowers were recorded weekly for both the sets. Suckers were counted at monthly intervals.

RESULTS AND DISCUSSION

1. **Suckering** —The data, in respect of Set I, on the number of suckers as produced by various rootstocks during different months are presented in Table 1. The statistical analysis revealed significant differences among the rootstocks as well as for the interaction of rootstocks and months. A detailed comparison revealed that maximum number of suckers were produced during September, which was significantly more than during the rest of the months. The minimum number of suckers were recorded during June.

Similar data on Set II revealed highly significant differences among rootstocks, months and their interactions. The number of suckers per plant for 'Edward' (43.12) followed by '*Rosa damascena*' (31.20) and 'Gruss an Teplitz' (13.58) were statistically significent from each other. The number of suckers per plant during March (31.83), May (31.25) and April (25.08), did not differ significantly. The number of suckers were significantly the lowest during June (13.58). Significant interaction between months and rootstocks showed that effect of rootstocks changed from month to month.

Alam (1968) reported maximum number of suckers in May and minimum in June. The largest number of suckers were thrown up by 'Edward' stock. 'Damascena', 'Gruss an Teplitz,, and 'Gola' stocks were at the same level. Leemans (1967) classified '*Rosa canina*' selections and other species of rootstocks in high, medium and low suckering groups.

It is also evident that suckering was low in hot and dry weather and it was high in spring and autumn. The reason is that during hot and dry months, the roses remain almost quiescent and grow and flower during the mild season.

2. **Size of the budded plants.**—The data on size of the budded plants are given in Table 2. There were highly significant differences among the rootstocks, cultivars and their interaction. The size of budded plant of 'Queen Elizabeth' was better on all the stocks, followed by 'Flamenco', 'McGredy's Sunset' and 'Fashion'. The differences among these were significant. For the rootstocks, it was seen that plants on 'Edward' and '*Rosa damascena*' were at par and significantly better than those on 'Gruss an Teplitz'. The interaction of rootstocks and cultivars showed that some cultivars behaved differently on various rootstocks. 'Fashion' and McGredy's Sunset' showed minimum size on all the rootstocks as compared to 'Flamenco' and 'Queen Elizabeth'.

TABLE 1. *Total number of suckers produced by different root stocks*

Rootstock	September	October	November	March	April	May	June	L.S.D. 5%	L.S.D. 1%
Set I									
Edward	51.0	20.0	22.6	29.0	29.0	24.3	21.0		
Damascena	57.0	26.6	20.6	30.6	17.3	25.3	23.3		
Gruss an Teplitz	50.3	24.6	24.3	26.6	23.6	22.6	19.6	12.3	14.7
Gola	43.3	19.3	21.3	28.0	17.0	23.3	19.3		
Set II									
Edward				53.5	48.5	52.2	18.2		
Damascena				21.5	15.0	22.7	11.0	5.39	7.24
Gruss an Teplitz				20.5	11.7	18.7	11.5		

Scion cultivars 'Queen Elizabeth' and 'Flamenco' were found to have a bigger plant size as compared to 'McGredy's Sunset' and 'Fashion'. Obviously these differences are due to their genetic make up as some cultivars are tall and others are dwarf or semi-dwarf.

From similar studies, Alam (1968) reported that scion cultivars 'Queen Elizabeth' and 'Flamenco' were found to have a bigger plant size followed by 'McGredy's Sunset', while 'Fashion' gave the lowest size irrespective of stock used. Strong varietal differences were observed as expected and were largely independent of the rootstocks.

It may be concluded that the rootstocks were more effective for the vigour of the budded plants. The differences among the rootstocks could be due to the differences in their differential root systems and adaptability to the environment obtaining at Lyallpur.

3. **Periodicity of flowering.**—The data on flowering period are set out in Table 2. There were significant differences among rootstocks and the cultivars. The interaction between rootstocks and cultivars was non significant. Maximum flowering period was observed for 'Edward' (73.6 days) followed by '*Rosa damascena*' (65.6 days) and 'Gruss an Teplitz'. Among the cultivars, maximum period was for 'Flamenco'. (74 days) which was significantly longer than 'Fashion' (61.7 days) and 'Queen Elizabeth' (58.7 days). Flowering period of 68.3 days for 'McGredy's Sunset' was not significantly different than either of the cultivars.

Alam (1968) stated that the maximum length of flowering period was observed for the scion cultivar 'McGredy's Sunset'. 'Edward' stock resulted in a longer flowering period than other stocks. Abrams (1962) reported that periodicity of flowering was significantly influenced by the rootstocks. In these studies, the plants on 'Edward' bloomed longer than those on 'Gruss an Teplitz' by 17 days, where as those on 'Damascena' bloomed lesser than 'Edward' by 8 days. With respect to scion, cultivar 'Flamenco' flowered about 15 days longer than 'Queen Elizabeth'.

4. **Flower yield (Number of blooms).**—The yield data for rootstocks and cultivars in Set I are given in Table 2. Analysis of variance for the three seasons, winter, spring and summer separately have shown that the rootstocks as well as interaction (Rootstock x cultivars) were significant for all the seasons. The differences among cultivars were significant for all the seasons. In spring 'Flamenco' gave the maximum yield (100) follwed by 'Fashion' (55.5). These were significantly different from each other and also better than 'McGredy's Sunset' (48.8) and 'Queen Elizabeth' (34.2), which were at par with each other.

TABLE 2. *Size of the budded plants, flowering period and flowering yield*

Rootstock Varieties	Plant size (cms.)	Flowering period (days)	Number of flowers Set I			Number of flowers Set II
			Autumn	Spring	Summer	
Edwards						
McGredy's Sunset	32.7	75.0	36	67	130	70
Queen Elizabeth	38.5	57.8	33	36	58	38
Flamenco	41.5	81.0	96	156	144	126
Fashion	27.7	80.4	30	44	80	79
Rosa damascena						
McGerdy's Sunset	36.7	73.2	19	25	60	69
Queen Elizabeth	42.2	62.2	32	31	64	41
Flamenco	36.7	76.2	60	98	155	101
Fashion	26.5	50.2	42	24	72	39
Gruss an Teplitz						
McGredy's Sunset	25.5	56.5	19	43	72	41
Queen Elizabeth	32.7	55.9	38	34	24	28
Flamenco	30.2	59.7	97	106	186	45
Fashion	24.0	53.9	86	82	144	42
Gola						
McGredy's Sunset	—	—	41	61	31	—
Queen Elizabeth	—	—	22	37	56	—
Flamenco	—	—	33	43	98	—
Fashion	—	—	34	70	127	—
L.S.D.						
5%	3.36	17.72	43.00	22.24	35.95	24.26
1%	4.51	23.81	57.91	29.95	48.42	32.50

In summer, 'Queen Elizabeth' gave the maximum yield (146) followed by 'Flamenco' (105.92) and Fashion (98.25). These were significantly different from each other and also better than McGredy's Sunset. In winter season, rootstock as well as cultivars were significantly different from each other. Queen Elizabeth gave maximum yield (101) and was better than Flemenco (56.2), Fashion (48.92) and McGredy's Sunset (34.33), which were at par with each other. Similarly, the rootstock 'Edward' and Gruss an Teplitz were significantly better and at par with each other than 'Gola' and *Rosa Damascena*.

The yield of blooms in Set II as recorded every week from middle of March till middle of June is shown in Table 2. The total yield data for the whole season were subjected to analysis of variance. Comparatively lower outputs were observed during March and April, which increased tremendously during May and June. The differences among rootstocks, cultivars as well as interaction were highly significant, for total yield. The mean output of 78.25 blooms for plants budded on 'Edward' was significantly the highest followed by those on '*Rosa damascena*' (62.75), and Gruss an Teplitz' (38.93). Regarding cultivars, 'Flamenco' gave the maximum yield (90.92) and was significantly better than 'McGredy's Sunset' (10.16) and 'Fashion' (53.08). The latter two were statistically similar to each other but better than 'Queen Elizabeth' (35.75).

Alam (1968) found highly significant differences among the stocks as well as scion cultivars for this character. Among the scion cultivars, 'Flamenco' and McGredy's Sunset' led in the output of flowers. 'Fashion' was at the tail and 'Queen Elizabeth' proved to be a mediocre. Maximum yield from all scion cultivars was recorded when 'Edward' was the rootstock and minimum with 'Gola'.

Dunhardt and Kuhle (1962) reported that the yield of five scion cultivars was the highest from plants on '*Rosa canina*' 'Pollmer' and lowest on Schmid's ideal. Mcfadden (1962) also found that 'Happiness' and 'Spartan' roses produced more saleable flowers when grown on '*Rosa fortuneana*' stock than when grown on stocks of 'Dr. Huey'.

Besides the rootstocks, the flower yield in roses depend on many factors such as type of the rose (floribunda or H.T.), number of flowers per branch, branching pattern, flowering period.

H. T. type roses bear one flower at the terminal branch, whereas Floribunda types bear in clusters. It can therefore, be understood that yield of flowers in the latter type of roses should be higher than the former types provided the flowering period is similar. Among these scion cultivars, 'McGredy's Sunset', 'Flamenco' and 'Fashion' were floribunda types while Queen Elizebth was floribunda type H.T. (grandiflora), therefore gave the lowest yield. Time of onset of flowering is an important character for the periodicity of flowering. In these studies, it was observed that 'McGredy's Sunset' started flowering much earlier than any other cultivar and because of favourable season produced much larger blooms than rest of the cultivars, which came in bloom in the order 'Queen Elizabeth,' 'Flamenco' and 'Fashion'.

Role of rootstocks, particularly in respect of periodicity of flowering was very interesting. 'Edward' and 'Damanscena' plants flower only during spring for a short period, while 'Gruss on Teplitz' plants flower almost throughout the year, but their influence on the scion cultivars has been found to be contrary to their own flowering habit. The scion plants on 'Edward' and 'Damascena'

stocks flowered longer than those budded on 'Gruss en Teplitz'. The reason for this type of behaviour on the part of rootstocks should be sought by further experimentation. Under the conditions of these experiments, 'Edward. has proved to be the best rootstock although it suckers profusely. 'Flamenco' is a good scion cultivar as it has produced the maximum number of blooms and flowered over a longer period as compared with other cultivars.

LITERATURE CITED

Abrams, G. J. Von. 1962. Rootstock. *Amer. Rose Ann.* 47 : 96-102.

Alam, Z., and D. A. Khan. 1969. Influence of different rootstocks on vegetative growth, productivity and flower quality in roses. *Pak. Jour. Agr. Sci.* 6 : 170-176.

Brase, K. D., 1939. Root growth and flower production of roses in soil and soil peat mixture of varying moisture contents. *Proc. Amer. Soc. Hort. Sci.* 37 : 963-972.

Buck, J. G. 1964. Stock scion relationship in rose. *Amer. Rose. Ann.* 49 : 159-163.

Danhardt, W., and G. Kuhle. 1962. The importance of rootstock in rose growing. A report on rootstock trials for glass house roses (German) *Dtsch. Gartenb.* 9 : 275-7, bibl. 7(*Hort. Abst.*, 33 : 3476).

Leehans, J. A. 1967. The relationship between the habit of growth and the quality of rose rootstocks. *Meded. Inst. Vered. Tuinbougew Wageningen.* 22 : 262.

Maarsch, R. 1967. Yield comparison of outdoor roses. *Gartwnwelt.* 67 : 248-9.

Mcfadden Jr., S. E. 1962. *Rosa fortuneana* compared with other rose rootstocks grown in Florida. *Proc. Fla. St. Hort. Soc.* 75 : 497-500.

Van Derharst, J., and L. D. Sparnaay. 1966. Rose rootstocks experiment and breeding. *Proc. 17th Int. Hort. Cong.* Md. 1 Abst.

Van Marsbergen, W. 1952. Onderstammen Proef. Iversl. Proef Stat. Bloom. Alalsmeer. 72-74. (A survey of rootstock for roses, by R. E. Edwards thesis, Univ. of Nottinghum 1955).

Vecera, L. 1965. Zkusenosti s Prirychlovanim Ruzi v Oknovem Skleniku. (Experiments on forcing rose in glass house). *Ved. Pr. Vyzk. Ust. Okrasn. Zahrad. v Pruhonicich.* 3 : 53-9 (*Hort. Abst.* 7096-1966).

Vecera, L. 1967. The behaviour of different standard rose varieties grown in the open on various rootstocks. *Gartenwelt.* 67 : 437-38.