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SALT TOLERANCE STUDIES IN ROSES

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Response of three rose rootstocks i.e. Surkha, Lahori and Gulkandi to various NaCl salinity levels (EC_e 5, 10, 15 dSm^{-1}) was studied. Sodium and chloride contents of leaves increased with increasing levels of salinity in all the rootstocks, however, the accumulation of sodium and chloride by rootstocks varied. Sprouting percentage of buds, plants, leaf area, fresh and dry weight of leaves, number of flowers and potassium contents decreased with an increase in salinity. The rose rootstock Surkha proved to be more salt tolerant than the others.

INTRODUCTION

Roses are rated as sensitive to salinity (McCall *et al.*, 1961). However, response of varieties to various salinity levels varies (Singh & Chitkara, 1983). Bernstein *et al.* (1972) found that rose growth decreased by 25 to 50% when water salinized with NaCl and Na_2SO_4 at electrical conductivities between 2.1 and 3.1 dSm^{-1}. Yaron *et al.* (1969) studied the response of Baccara roses at various salinity levels (0.4 to 7.8) and found that stem and leaf growth coupled with water uptake decreased with increased soil salinity. Hughes (1975) reported that salinity damage was obvious on rose plants receiving solution having total 48 mel^{-1} of salts and 6 mel^{-1} $HCO3^-$. He also observed fall in flowers yield. Singh (1982) observed that increasing salinity (EC_e 2 to 8 dSm^{-1}) resulted in reduction of rootstock growth, the growth of scions budded on rootstocks and leaf K^+ contents but increased Na^+ and Cl^- concentrations in leaves.

The present study was aimed to determine the influence of salinity on roses by monitoring changes in morphological characters and to establish an overall salt tolerance rating based on parameters that best described the salt response.

MATERIALS AND METHODS

Three rose rootstocks, i.e. Surkha (Gruss-an-teplitz), Lahori *(Rosa bourbomiana)* and Gulkandi *(Rosa demascena)* were planted in the field in March, 1988. A year after, plants of equal age and height were selected and transplanted into polythene lined earthen pots filled with 8 kg of air dried soil previously passed through a 2 mm sieve. Salinity levels of EC_e 5, 10 and 15 dSm^{-1} were developed artificially with commercial grade NaCl. The original soil having EC_e 2.5 dSm^{-1} was treated as the control. Single plant per pot was used as the experimental unit. Canal water used for irrigation.

Effect of different levels of salinity on sprouting of buds, plants survival of leaves, length of branches, leaf area, fresh and dry weight of leaves and number of flowers were studied. Leaf analysis for Na^+, K^+ and Cl^-

Table 1.--Morphological parameters measured for rose rootstocks at four levels of salinity

EC_e (dSm^{-1})	Sprouting of buds (%)	Plant survival (%)	Leaves per plant	Length of branches (cm)	Leaf area (cm^2)	Leaf weight (g) Fresh	Leaf weight (g) Dry	Fresh dry weight ratio	Flowers per plant
2.5	49.2 a	100.0 a	37.6 a	19.9 a	19.0 a	0.28 a	0.12 a	3.7^{NS}	4.4 a
5	47.7 b	44.4 b	28.4 b	15.1 b	16.3 ab	0.26 ab	0.09 ab	3.1^{NS}	3.3 b
10	33.8 c	22.2 c	14.0 c	9.0 bc	13.0 bc	0.20 bc	0.07 bc	2.8^{NS}	1.4 c
15	24.2 d	22.2 c	10.4 c	4.5 c	9.5 c	0.18 c	0.05 c	2.4^{NS}	0.3 c
Rootstocks									
Surkha	54.1 a	33.3 b	22.1 ab	15.2 a	15.6 b	0.29 a	0.10 a	3.4NS	4.5 a
Lahori	45.7 b	75.0 a	25.8 a	10.1 b	9.5 c	0.14 b	0.05 c	2.7NS	0.0 c
Gulkandi	34.6 c	33.3 b	16.7 b	11.1 b	18.1 a	0.26 a	0.09 b	2.8NS	2.6 b

NS = Non-significant

Figures bearing same letter(s) are non-significantly different.

was made. Average treatment values were compared following Duncan's Multiple Range (DMR) test (Steel & Torrie, 1980).

RESULTS AND DISCUSSION

Sprouting of buds decreased significantly to 24.2% at EC_e 15 dSm^{-1} and 49.2% at EC_e 2.5 dSm^{-1}. Rootstock Surkha gave the maximum (54.1%) sprouting which was significantly different from other rootstocks (Table 1). At EC_e 5 dSm^{-1}, survival was 44.4% and at EC_e 15 dSm^{-1}, it was 22.2%. Rootstock Lahori exhibited the maximum (75%) survival while the Surkha and Gulkandi differed non-significantly. As salinity increased from 2.5 to 15 dSm^{-1}, the number of leaves decreased significantly from 37.6 to 10.4. The results are similar to the findings of Yaron *et al.* (1969). Lahori outclassed other rootstocks with 25.8 number of leaves.

Length of branches was 15.1 cm at EC_e 5 dSm^{-1} and 4.5 cm at EC_e 15 dSm^{-1} after 8 months. Rootstock Surkha had the maximum growth of branches while Lahori and Gulkandi differed non-significantly. Reduction in leaf area was observed from 16.3 cm^2 at EC_e 5 dSm^{-1} to 9.5 cm^2 at EC_e 15 dSm^{-1}. Rootstock Gulkandi yielded maximum (18.1 cm^2) leaf area while was minimum (9.5 cm^2) for Lahori. Leaf fresh and dry weights decreased significantly to 0.18 and 0.05 g, respectively at EC_e 15 dSm^{-1} compared to that at EC_e 2.5 dSm^{-1} which differed non-significantly with EC_e 5 dSm^{-1}. Rootstock Surkha gave the highest values with 0.29 g fresh and 0.10 g dry weight. Fresh and dry weights ratio of leaves varied non-significantly for different rootstocks. Number of flowers per plant was 3.3 at EC_e 5 dSm^{-1} and 0.33 at EC_e 15 dSm^{-1}. The observation is in line with the findings of Hughes (1975). Surkha produced

Table 2. Concentration of Na^+, K^+ and Cl^- in leaves of rose rootstocks as influenced by levels of salinity

EC_e (dSm^{-1})	Ionic concentration (meg^{-1})		
	Na^+	K^+	Cl^-
2.5	6.0 c	116.0 a	665 c
5	42.0 b	101.0 a	885 c
10	105.0 a	66.0 b	1555 b
15	130.5 a	59.5 b	2055 a
Rootstocks			
Surkha	104.0 a	120.0 a	1245NS
Lahori	55.5 b	65.0 b	1455NS
Gulkandi	53.0 c	70.0 b	1165NS

NS = Non-significant.
Figures bearing same letter(s) are non-significantly different.

the maximum (4.5) number of flowers per plant while the Lahori did not produce any flower.

Sodium concentration was 42 meg^{-1} at EC_e 5 dSm^{-1} and 130.5 meg^{-1} at EC_e 15 dSm^{-1} (Table 2). Rootstock Surkha had significantly the highest Na^+ concentration in leaves. Potassium concentration in leaves decreased significantly as EC_e increased. Rootstock Surkha had the highest K^+ concentration in leaves while the Lahori and Gulkandi showed non-significant differences. Mean Cl^- concentration in leaves increased significantly from 877 meg^{-1} at EC_e 5 dSm^{-1} to 2055 meg^{-1} at EC_e 15 dSm^{-1}. Rootstock Lahori accumulated maximum Cl^- in leaves. Similar trends in accumulation of Na^+, K^+ and Cl^- in leaves of roses have been reported by Singh (1982).

Based on this study, Surkha was found the most salt tolerant for sprouting percentage, growth of branches, fresh and dry weight of leaves and number of flowers. Sodium and chloride concentration in leaves increased but that of potassium decreased with increasing levels of salinity in all the rootstocks.

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