RESPONSE OF THREE HERBACEOUS ORNAMENTALS TO SALINITY

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Rapid development in urban and suburban areas is increasing the demand for landscaping in several countries of the Arabian Peninsula. However, the harsh environmental conditions, poor soils and scarce fresh water resources severely restrict the number of species available for landscaping. Among the seasonal herbaceous ornamentals, petunia, zinnias, marigold, periwinkle and moss rose are the most common species seen in landscaping projects, especially in public parks, streetscapes and home gardens. These species are indeed attractive but repeated planting of the same year after year, results in loss of appeal of the landscapes to enthusiastic members of the public and frequent visitors. Hence, to sustain the interest of viewers, greater diversification in the species used for landscaping is needed. This can be accomplished by the introduction of new species.

The successful introduction of new ornamental plants to the Arabian Peninsula requires selection for heat and drought tolerance. Furthermore, due to the rising demand of fresh water for domestic use, the availability of good quality water for gardens and landscapes is becoming increasingly restricted. Consequently, landscape architects are forced to look for plants that perform well with saline and marginal quality water irrigation.

The International Center for Biosaline Agriculture (ICBA) in Dubai (UAE) has been experimenting with several exotic herbaceous ornamentals, studying their adaptation to the local environment with the objective of introducing them into the saline landscapes. Recently a study was undertaken to evaluate growth and performance of a wild flower mixture, containing ten exotic herbaceous

ornamental species by irrigating with saline water at 2.8, 5, 10 and 15 dS m-1. A representative sample of the seed mixture was sown directly in the field in plots of 3m x 3m and irrigated with a drip-irrigation system using water at a chosen level of salinity.

Differences were observed in germination and establishment of the various species in response to the quality of water used for irrigation. Species that germinated in all treatments included Lobularia maritima, Dimorphotheca aurantiaca and Gaillardia aristata. While G. aristata was abundant in the control, L. maritima was dominant at the higher salinity (15 dS m-1). Layia platyglossa, Clarkia ungiculata, Achillea millefolium and Lasthenia glabrata were recorded in low frequency in the control and low salinity treatments, but Eschscholzia californica, Thymus serpyllum and Oenothera lamarckiana did not germinate in any of the four treatments (Table 1).

L. maritima, commonly known as Sweet alyssum, is a hardy annual native to

southern Europe. It produces dense clusters of tiny snow-white flowers continuously throughout the growing season in winter. D. aurantiaca, also known as African daisy, is a native of South Africa, an annual that grows up to 30 cm tall with grayish-green spoon-shaped leaves that combine well with other colors in the garden. The flowers are about 6 cm across with a variety of shades such as yellow, orange and cream and borne singularly at the tip of each branch. G. aristata, known as Blanket flower, is native to much of northern and western North America, where it often grows wild, but also widely cultivated as a garden flower. G. aristata is a perennial herb reaching up to 70 cm tall with lance-shaped leaves near the base and several erect stems holding the flowers with brownish or reddish purple disc florets in the center and a fringe of yellow to reddish ray florets, which are about one to three centimeters long.

An analysis of the data on growth and floral characteristics showed that L. maritima has relatively high salt tolerance among the species studied. In effect, the species performed best at moderate levels of salinity (5 and 10 dS m-1) compared to lower or higher salinities. Thus, plant height, width, number of branches and biomass (fresh and dry weights) increased with increases in salinity from 2.8 dS m-

1 (control) to 10 dS m-1 and declined thereafter. The number of spikes and spike length also showed a similar trend – both these parameters being maximum at 10 dS m-1 (Table 2). In both D. aurantiaca and G. aristata, on the other hand, there was a gradual decrease in plant height, and fresh weight and dry weights with an increase in salinity from 2.8 dS m-1 to 15 dS m-1. In D. aurantiaca, the number of flowers produced per plant decreased by about 12% at 5 dS m-1, 30% at 10 dS m-1 and 90% at 15 dSm-1, compared with the control. In G. aristata, the number of flowers per plant decreased by up to 35% of the control at 5 dS m-1 and by nearly 44% at 10 dS m-1. At the higher salinity (15 dSm-1), the plants remained stunted without producing flowers. Interestingly, flower diameter was not affected by salinity in both these species (Table 2). The results show that L. maritima could be successfully cultivated with low quality water of up to 10 dS m-1 salinity. It is an excellent species for edging a flowerbed, beautifying a rock garden or cascading from a hanging basket. D. aurantiaca appears to perform well at moderate salinity in the range of 5-10 dS m-1. It adds great texture to any landscape and once established needs only occasional watering. G. aristata is less tolerant to salinity compared to D. aurantiaca and should not be irrigated with water of salinity exceeding 5 dS m-1. Gaillardia makes a great addition to flower gardens and adds flair to cut flower bouquets. It is heat and drought tolerant and reportedly grows well even in nutrient poor soils.

Table 1. Species abundance in a 1m x 1m quadrat of wildflower mixture irrigated with saline water.

Species	Common name	Abundance (%)/Salinity (ECw)			
		Control (2.8 dS m-1)	5 dS m-1	10 dS m-1	15 dS m-1
Gaillardia aristata	Blanketflower	38.1	14.3	6.7	0
Dimorphotheca aurantiaca	African Daisy	23.8	42.8	46.7	10
Clarkia ungiculata	Clarkia	4.8	0	0	0
Lobularia maritima	Sweet Alyssum	28.6	35.7	26.7	90
Layia platyglossa	Tidy-Tips	4.8	7.1	20	0
Eschscholzia californica	California Poppy	0	0	0	0
Lasthenia glabrata	Goldfields	0	0	0	0
Achillea millefolium	White Yarrow	0	0	0	0
Thymus serpyllum	Wild Thyme	0	0	0	0
Oenothera lamarckiana	Evening Primrose	0	0	0	0

Table 2. Growth and floral characteristics of three herbaceous ornamentals irrigated with saline water. Data presented are the mean of five plants, randomly sampled from each treatment.

Species	Salinity (ECw)	Plant height (cm)	Plant width (cm)	Number of branches	Number of spikes* or flowers	Spike length* or flower diameter (cm)	Fresh weight (g)	Dry
L. maritima	Control	32.8	37.6	6.4	26.4	23.8	57	17.8
	5 dS m-1	41.7	49	9.6	63.4	26.5	156	37.2
	10 dS m-1	43.6	46.2	10.4	65.2	30	210	45.4
	15 dS m-1	28.1	33	8.6	25.6	15.6	59	12.8
	LSD (5%)	8.6	9.5	n.s.	34.4	6.4	n.s.	n.s.
D. aurantiaca	Control	54	41.6	7	78.4	5.2	669	136.2
	5 dS m-1	46.7	38.4	8.8	68.6	5.1	304	66.8
	10 dS m-1	40.5	34	9.2	54.2	5.4	196	35.4
	15 dS m-1	17.5	20.8	8.8	7.8	4.6	60	9
	LSD (5%)	11.1	9.8	n.s.	39.5	n.s.	204.8	41.4
G. aristata	Control	66.7	62.2	8.2	40.4	6.9	508	132
	5 dS m-1	51.6	29.2	6.4	26.4	6.7	196	42.4
	10 dS m-1	46.1	24.4	5.6	22.8	6.4	152	30.2
	LSD (5%)	11	14.1	n.s.	n.s.	n.s.	140	52.2

L. maritima