Tolerance of Lettuce to Salts in Irrigation Water

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INTRODUCTION

As Arizona lettuce production expands, more marginal lands and water sources with higher salinity may be used. In many plants, salt reduces plant growth and causes marginal necrosis or burning of leaves. The reduced growth could decrease lettuce yields or delay maturity. Marginal necrosis would decrease lettuce quality considerably. Lettuce is reported as moderately sensitive to salt. However, lettuce cultivars differ in their tolerance to salt at germination (Coons and Simons, 1987). The purpose of our study was to compare the tolerance of several cultivars representing four types of lettuce using irrigation water with two salt levels.

PROCEDURES

Lettuce (Lactuca sativa) seed was planted by hand 15 cm apart in two rows on beds with 1 m centers on October 6, 1988, at Maricopa Agricultural Research Center in Arizona. Twenty cultivars and one breeding line of lettuce were planted representing four types, i.e. crisphead (Bounty, Climax, Empire, Golden State, Great Lakes 659-700, Mesa 659, Red Coach 74, Salinas, Vanguard 75, Winterset), butterhead (Dark Green Boston, Summer Bibb, Valprize, White Boston), leaf (Black Seeded Simpson, Grand Rapids, Ruby Red, Valmaine), and romaine (Parris Island, PS-507-86, Salad Bowl). A randomized complete block design was used for cultivars within each salt level. Each cultivar was replicated four times in each salt level with each replication being one 6.1 m bed. Beds were preirrigated and sprinkled with water containing 650 ppm salt beginning October 10 and continuing until a stand was established (approximately one month). Beginning November 3, lettuce was furrow irrigated with water containing 650 ppm (fresh) or 1600 ppm (saline) which came from two different wells approximately every 10 days unless rain fell. Rainfall was 8.0 cm during the season.

Stands were counted on January 26, 1989, for six crisphead cultivars which had shown different salt tolerances at germination (Coons and Simons, 1987). Harvests for butterhead, leaf and romaine types were on January 23 and February 16, 1989, and for crisphead types were on March 7, 1989, by taking five plants from each replication. Fresh weights were determined. Means and standard deviations were calculated.

RESULTS AND DISCUSSION

Stand counts were similar in fresh and saline plots, with no consistent patterns in response to salts in irrigation (Table 1). Cultivars which at germination were tolerant (Empire and Vanguard), intermediate (Climax and Red Coach), and sensitive (Great Lakes and Mesa) to salt showed no differences in stand counts.

Fresh weights of crisphead (Table 2) or of butterhead, leaf and romaine (Table 3) lettuce types were not changed consistently with saline as compared to fresh irrigation water. Some cultivars had lower fresh weights with saline irrigation while others had higher fresh weights.

These studies are only from one season and should not be used to predict differences in cultivar sensitivity to salt until studies can be repeated several seasons. Lettuce plants were not uniform in size within a replication or salt treatment. This variability makes it difficult to detect changes which occurred due to salt. In addition, plots were not irrigated immediately after rains, which could cause salt problems to be less (if rains heavy enough

to leach salts below root profile) or greater (if rains light and moved salts from soil surface into root profile) than if no rain occurred. Thus, these studies are presented as a preliminary report, but should be repeated before specific recommendations can be made to growers.

Table 1. Stand counts (# plants/plot[z]) of six lettuce cultivars irrigated with two salt levels at Maricopa, 1988-89.

	Irrigation Water	
Cultivars	Fresh	Saline
Empire	34 ± 21	32 ± 19
Vanguard	21 ± 17	30 ± 10
Climax	25 ± 11	27 ± 10
Red Coach	27 ± 12	39 ± 2
Great Lakes	31 ± 5	23 ± 16
Mesa	21 ± 17	37 ± 7

[z]Each plot had 2 rows each 6.1 m long

Table 2. Fresh weights (g/plant) of crisphead lettuce cultivars irrigated with two salt levels at Maricopa 1988-89. (Harvest March 7, 1989)

Cultivar	Fresh	Saline	% Change
Bounty	430 ± 94	441 ± 46	+2.5
Climax	635 ± 186	600 ± 165	-5.5
Empire	442 ± 1020	400 ± 116	-9.5
Golden State	617 ± 113	655 ± 165	+6.2
Great Lakes	505 ± 55	520 ± 278	+3.0
Mesa	448 ± 87	436 ± 130	-2.7
Red Coach	419 ± 37	421 ± 124	+0.5
Salinas	469 ± 52	369 ± 149	-21.3
Vanguard	491 ± 154	564 ± 175	+14.9
Winterset	423 ± 112	451 ± 129	+6.6

Table 3. **Fresh weights (g/plant) of butterhead, leaf and romaine lettuce cultivars irrigated with two salt levels at Maricopa 1988-89.**

	Harvest Date					
	January 23			February 16		
	Fresh	Saline	% Change	Fresh	Saline	% Change
Butterhead						
Dark Green Boston	147 ± 18	78 ± 37	-46.9	257 ± 57	251 ± 80	2.3
Summer Bibb	134 ± 33	130 ± 25	-3.0	267 ± 86	287 ± 34	+7.5
Valprize	151 ± 60	137 ± 44	-9.3	392 ± 35	323 ± 77	-17.6
White Boston	94 ± 51	102 ± 15	+8.5	227 ± 30	253 ± 24	+11.4
Leaf						
Black Seeded Simpson	79 ± 42	72 ± 12	-8.9	252 ± 32	200 ± 55	-20.6
Grand Rapids	-	-	-	240 ± 28	191 ± 75	-20.4
Ruby Red	149 ± 39	111 ± 13	-25.5	253 ± 67	299 ± 102	+18.2
Valmaine	-	-	-	305 ± 124	358 ± 114	+17.4
Romaine						
Parris Island	-	-	-	418 ± 57	403 ± 28	-3.6
PS-507-86	-	-	-	492 ± 137	423 ± 60	-14.0
Salad Bowl	144 ± 46	114 ± 14	-20.8	256 ± 38	266 ± 58	+3.9

Coons, J. K. and N. Simons. 1987. Germination of several lettuce cultivars with high temperature and salt. 1987 Vegetable Report. Series P-70, College of Agriculture, University of Arizona, Tucson, AZ. p. 1-5.