HortScience 20(1): 111–112. 1985.

# Physiological and Growth Responses of Seashore Paspalum to Salinity

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*Additional index words.* *Paspalum vaginatum*, 'Adalayd' ('Excaliber'), turfgrass

***Abstract.*** **Two cultivars of Seashore Paspalum (*Paspalum vaginatum* Swartz.), 'Adalayd' ('Excaliber') and 'FSP-1', were grown in solution culture at 6 levels of salinity derived from synthetic sea water. Cultivars differed in changes of leaf water potential, leaf water potential components, and in growth responses to increased salinity. 'Adalayd' exhibited a linear decrease whereas 'FSP-1' exhibited a quadratic decrease in leaf water potential with increasing salinity. Leaf osmotic potentials decreased linearly for both cultivars, but there was a significant interaction. Leaf turgor potential decreased linearly for 'Adalayd' but quadratically for 'FSP-1'. 'FSP-1' had greater tolerance to salinity in solution culture than Adalayd.**

Salt water encroachment into wells used for irrigating turfgrasses presents a serious problem in Florida (10). This phenomenon, 1st reported during the 1920s, has become especially serious since 1960 because increasing demands for fresh water have caused salt water intrusion. The suitability of irrigation water containing salt depends on the salinity, sodium, and boron levels (13). Total soluble salts up to 14,000 ppm have been reported from wells in Volusia County (unpublished survey), due to salt water intrusion, and the composition of water from saline wells approximates sea water (Peacock, unpublished data). Most of this water would be safe for use only on sandy soils because of the sodium adsorption ratio (13).

Physiological responses to salinity include growth suppression, lowered osmotic potential, and/or a loss of turgor potential (6). Turfgrass species and cultivars differ in their response to salinity (3, 4, 5, 7, 14). Of the warm season turfgrass species, bermudagrass (*Cynodon* sp.) has been considered the most salt tolerant (1). Differential salinity tolerance based on growth responses does exist among the bermudagrass cultivars (2). Plants known to exhibit salt tolerance often mediate salt stress by osmotic adjustment, therefore minimizing changes in turgor potential and reducing the overall effect on plant growth responses linked to carbon dioxide assimilation and cell elongation (3, 15). Seashore Paspalum is a salt tolerant grass species which has been used as a turfgrass in Florida, with a cultivar introduced into the United States from Australia (8, 9).

Two selections of *Paspalum vaginatum* Swartz, 'Adalayd' ('Excaliber'), a cultivar introduced into California from Australia, and a Florida selection, 'FSP-1', were evaluated for physiological and growth responses to salinity.

Table 1. Chemical composition of sea salt formula. Formulated after Svedrup et al. (12).

| Salt | Grams/liter | Composition % of total |
|---|---|---|
| Sodium Chloride | 26.9 | 78.3 |
| Magnesium Sulfate | 3.2 | 9.4 |
| Magnesium Chloride | 2.5 | 7.3 |
| Calcium Chloride | 1.1 | 3.2 |
| Sodium Bicarbonate | 0.2 | 0.7 |
| Potassium Chloride | 0.24 | 0.6 |

Plants were established in solution culture from sprigs planted in 12.7 cm diameter 9.8 cm deep plastic pots containing washed gravel. These were suspended 2.5 cm deep into 5.3 liters of the respective salt solution. Synthetic sea water formulated with a salt mixture (Table 1) was added at 0, 3.5, 10.5, 17.5, 24.5, and 31.5 g/liter in half-strength Hoagland's number 2 solution to give electrical conductivity (EC) levels of 0.9, 6.2, 15.6, 24.7, 32.9, and 39.7 dS $m^{-1}$, respectively. A synthetic sea salt mixture was added to the required solution every other day to

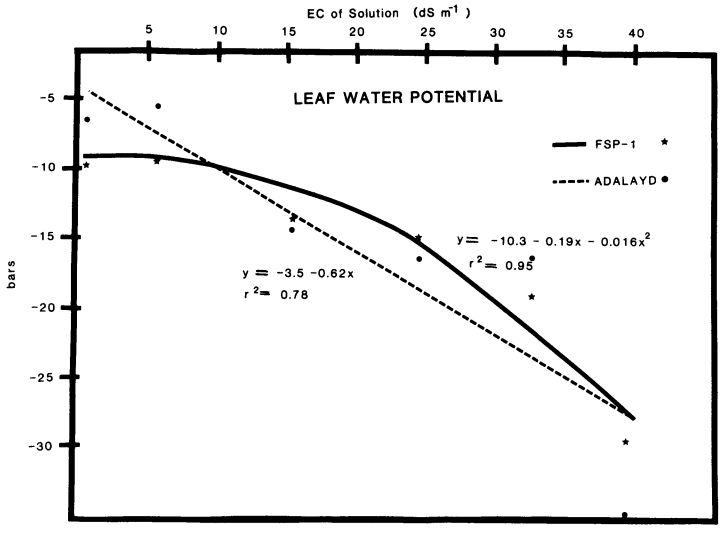


Fig. 1. Leaf water potential responses of Seashore Paspalum cultivars to increasing salinity.

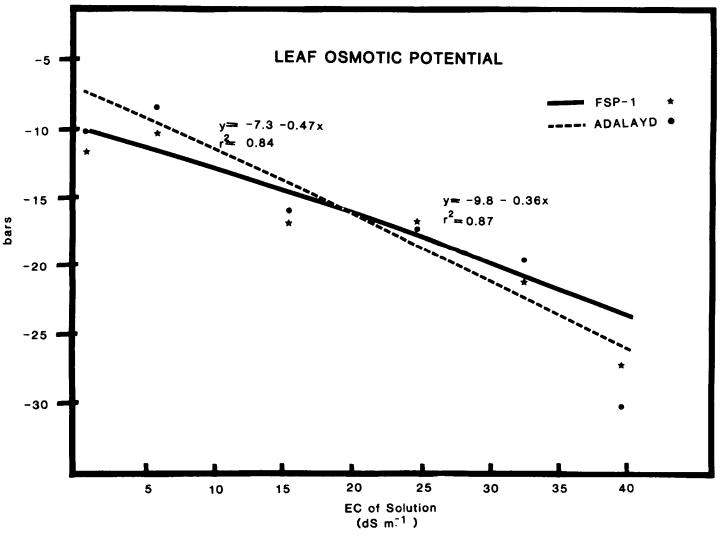


Fig. 2. Leaf osmotic potential responses of Seashore Paspalum cultivars to increasing salinity.

Received for publication 6 June 1984. Florida Agricultural Experiment Station Journal Series No. 5627. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

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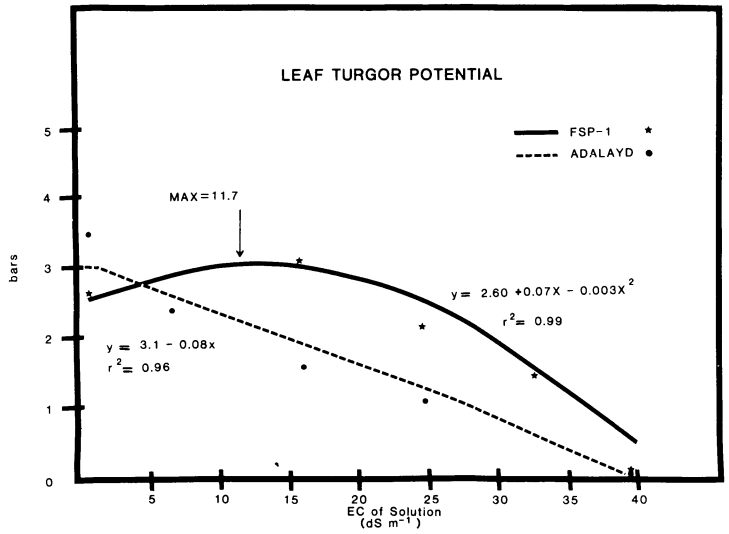


Fig. 3. Leaf turgor potential responses of Seashore Paspalum cultivars to increasing salinity.

bring each treatment gradually to the desired concentrations. Solutions were replaced weekly during the experiment.

Leaf water potential components were measured with thermocouple psychrometers. Each cultivar was sampled at the 39.7 dS $m^{-1}$ conductivity level during the salinity adjustment period, allowing a measurement of plant osmotic adjustment under exposure to increasing salt levels. Eight leaf samples were taken per cultivar at each salinity concentration. The last fully expanded leaf blade subtending a leaf bud was excised, rolled, placed quickly in the psychrometer chamber and sealed. They were placed in a 30°C water bath and allowed to equilibrate for 4 hr. Psychrometric determinations of water vapor content were measured with a LI-COR Model HR-33T microvoltmeter. For osmotic potentials, psychrometers were placed in a freezer overnight, thawed at room temperature, and again equilibrated in the water bath at 30° before determinations were made as previously described. Turgor pressure potential was calculated as the difference in leaf water potential of the fresh leaf minus the osmotic potential determined after freezing (11). All samples were collected at midmorning, 48 hr after salt solutions were added and prior to the increase to the next salt level.

Six biweekly clippings at a 2.5 cm height above the cup were harvested to determine the rate of top growth. Roots growing through the drainage holes outside the pot were harvested at 4-week intervals. Roots inside the pot were separated from stem tissue at termination of the experiment and combined with outside roots to determine rate of root growth. Crown tissue harvested at the end of the experiment is defined as top growth below the 2.5 cm clipping height and stem tissue from which roots were removed.

The experimental design was a split plot with 5 replications. Pots were placed in one wooden lid and suspended over each salt solution which was considered the main plot effect. All data were subjected to analyses of variance or to regression analyses.

Cultivars differed in their response to salinity in leaf water potential. 'Adalayd' exhibited a linear decrease with increased salinity whereas 'FSP-1' decreased quadratically (Fig. 1). Leaf osmotic potential decreased linearly in both cultivars as salt levels increased (Fig. 2), but there was a significant salinity by cultivar interaction (PR > F = 0.02) indicating the slopes of the regression lines were different. Leaf turgor potential decreased linearly for 'Adalayd', but 'FSP-1' responded quadratically by increasing initially to a maximum at 11.7 ds $m^{-1}$ then decreasing as salt levels increased (Fig. 3). Top growth in both cultivars decreased quadratically with increased salinity (Figs. 4 and 5). Root growth response of 'Adalayd' decreased linearly, but rooting in 'FSP-1' increased to a maximum at 15.7 dS $m^{-1}$ before decreasing. Crown tissue in 'FSP-1' was unaffected, whereas crown tissue in 'Adalayd' decreased linearly in response to increased salt levels (Figs. 4 and 5).

Physiological and growth responses to increased salinity differed between cultivars. 'FSP-1' responded to salt stress by an initial increase in turgor pressure potential followed by a gradual loss. Both cultivars adjusted osmotically by lowering leaf osmotic potential, but 'Adalayd' apparently did so at the expense of turgor pressure and subsequently growth. The salinity level at which 50% growth reduction occurred was higher for 'FSP-1' (EC = 28.6 dS $m^{-1}$) than 'Adalayd' (EC = 18.4 dS $m^{-1}$). 'FSP-1' also increased rooting as salinity increased to a maximum at EC = 15.7 dS $m^{-1}$. In solution culture, 'FSP-1' exhibited increased salinity tolerance based on physiological and growth responses.

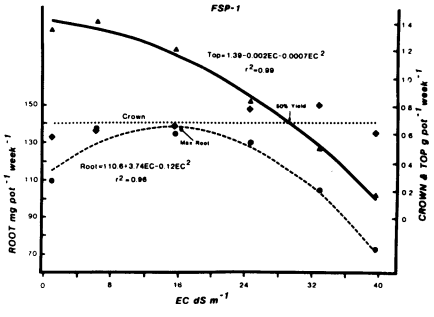


Fig. 4. Topgrowth and rooting response of FSP-1 variety of Seashore Paspalum to salinity.

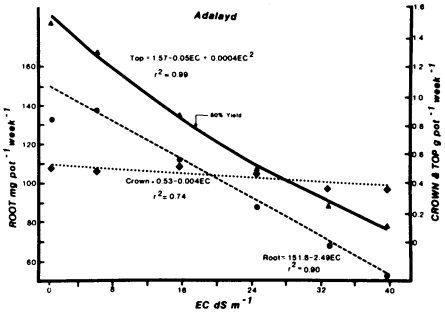


Fig. 5. Topgrowth and rooting response of Adalayd Seashore Paspalum to salinity.

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