Determining the Heritability of Salt Gland Density: A Salinity Tolerance Mechanism of Chloridoid Warm-Season Turfgrasses

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Objectives:

1. Determine the broad and narrow sense heritabilities of salt gland density in zoysiagrass. As salt gland density has been found to be an important salt tolerance mechanism in other turfgrasses in the Chloridoideae subfamily (i.e., bermudagrass, buffalograss), results should be applicable to breeding programs of these species as well.

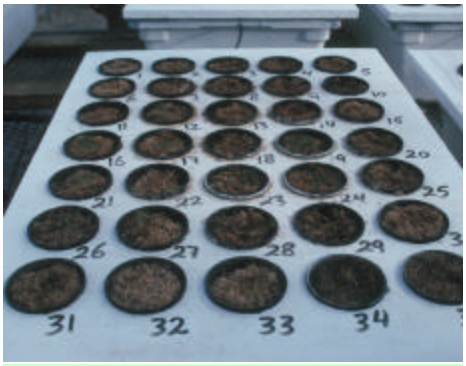
Start Date: 1998
Project Duration: 3 years
Total Funding: $55,815

The need for salt-tolerant turfgrasses is increasing. Continued rapid urban population growth in western states and in coastal areas has put enormous pressues on limited fresh water supplies.

Very little is known about the underlying salt tolerance mechanisms of turfgrasses. However, salt tolerance was highly associated with leaf salt gland density among 57 zoysiagrass genotypes from the United States and Asia.

Leaf salt gland density has not been shown to be affected by the environment, suggesting that this trait is geneticallly stable and highly heritable. The obvious question is just how heritable salt gland density is, and, if so, how much potential would it offer breeders as an ideal selection tool in developing salt-tolerant turfgrasses.

Though there is increasing need for improved salt-tolerant turfgrass cultivars, breeding progress has been limited. Salt tolerance in the Chloridoid warm-season grasses, including bermudagrass, buffalograss, zoysiagrass, and saltgrass



Preliminary results indicate salt gland density is highly correlated with salt tolerance in zoysiagrass.

Dr. Ken Marcum shows how saline water approaching the strength of sea water can dramatically reduce turfgrass root systems.

(*Distichlis spp.*) is strongly associated with shoot salt exclusion, which seems to be associated with leaf salt gland density.

We are examining the relationship between salt gland density and salt tolerance in *Zoysia japonica.* Fifteen entries are being examined for salinity tolerance and salt gland density. These fifteen are being crossed to produce offspring to examine salt gland heritability and genetic control (i.e., if it is passed on from parent to offspring).

Results show a broad range of salinity tolerance. The most tolerant entries were ‘Palisades’, ‘El Toro’, ‘J3-2’, ‘P58’, ‘Belair’, ‘Meyer’, and ‘Crowne’. In addition, salt gland density was highly correlated with salt tolerance, indicating that salt gland density is an important salt tolerance mechanism in zoysiagrass.

Broad sense heritability estimates of salt gland density were high, indicating that genetics, not environment, controls salt gland density. This would support the use of salt gland density as a selection tool in turfgrass breeding programs for development of salt tolerant cultivars.

The use of salt gland density as a selection tool would greatly expedite the breeding process as there would no longer be a need to screen large numbers of accessions under controlled environmental stress (e.g. salinity) conditions.

F1 progeny are currently being produced and sampled for salt gland density which will allow an estimation of narrow sense heritability of salt gland density.

Summary Points

- Salt tolerance in bermudagrass, buffalograss, zoysiagrass, and saltgrass is strongly associated with salt exclusion from salt glands of the leaves.
- Salt gland density on leaves plays a premier role in salt tolerance in *Chloridoid* turfgrasses.
- Heritability estimates (broad-sense) of salt gland density in zoysiagrass indicates the trait could be used to select for better salinity resistance.
- Narrow-sense heritability estimates for salt gland density in zoysiagrass will be available next year.