Development of Seeded Zoysiagrass Cultivars with Improved Turf Quality and High Seed Yields

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Objectives:

1. Development of finer-textured germplasm/cultivar(s) of zoysiagrass with high seed yields that offer an economical alternative to fine textured vegetative types with the potential for rapid turf establishment.
2. Breed to improve characteristics such as turf quality, competitive ability and persistence under biotic and abiotic stresses.

Start Date: 2014 (continued from 2010)
Project Duration: 3 years
Total Funding: $ 89,317

Summary Text –

Zoysiagrass (*Zoysia* spp.) is a warm season, perennial grass used on sports fields and home lawns that is increasing in popularity due the need for low inputs such as fertilizer, water and less frequent mowing. Most cultivars are vegetatively propagated by sprigging or solid sodding. Except for expensive solid sodding, other methods such as sprigging require a minimum of two years to establish and provide 90% cover (Patton et al, 2006). An alternative, relatively inexpensive, way is to propagate zoysiagrass is by seed. The cost for establishing one acre of fairway with a vegetative type zoysiagrass using sprigs is $3,000, strip sodding is $5,000 and solid sodding is $16,000 while the cost of establishment using seed is around $900 (Patton et al, 2006). Unfortunately the number of seeded varieties is limited with 'Zenith' being the most popular. This research projected is focused on the development of new and improved cultivars.

Optimizing seed yield and ease of harvest are important value added traits needed in the development of new seeded type zoysias. Diesburg (2000) reports that seed yields with zoysiagrass have been limited ranging from 100 to 600 pounds per acre as compared to yields for cool season grasses ranging from 700 to 1,600 pounds per acre. Stacking genes that maximize seed yield in the species while maintaining good turf quality is our target and is of utmost importance to the commercial success of newly released varieties**.** Our goal is to develop a multi-clone synthetic variety which exhibits a texture that is finer than Zenith and seed yields that meet the production goals needed to make it profitable to produce. One of our breeding objectives is to minimize inbreeding depression by selecting parental clones with a broad genetic base (different pedigrees) but with approximately the same flowering time in order to enable cross pollination and to create commercially viable synthetic populations.

Since the initiation of the project in 2010, our breeding strategy has been the utilization of the classical plant breeding method known as phenotypic recurrent selection. Recurrent selection is a strategy that has proven to be useful with corn breeding at Iowa State in the development of the Stiff Stalk Synthetic (Lamkey, 1992). The method focuses on population improvement by increasing the frequency of quantitative genes that influence seed yield in the breeding populations. The approach involves alternating between Spaced Plant Nurseries (SPN) and isolation crossing blocks. Selections are made from spaced plant nurseries for individuals with improved seed yield combined with fine leaf texture. Selected lines are entered into isolation crossing blocks for further recombination. This strategy should allow for the gradual increase over multiple generations of desirable alleles in the population.

In 2015 we began our third cycle of recurrent selection. Four isolation blocks were planted in 2013 and grouped based on seed head color and flowering date with (1) nine of the 32 classified as red seedhead /early flowering , (2) seven as red seedhead / late flowering, (3) nine green seed heads / early flowering and (4) seven lines with green seed heads / late flowering. Seed from these blocks were collected in mid-summer of 2014, cleaned during the winter and processed in early spring of 2015. Seed was scarified with 30% NaOH for 35 min. (Yeam, et. al. 1985). Scarified seed was germinated in potting mix in small rectangular pots first under mist then at ambient air. Once germinated, individual seedlings were moved to 50 cell trays where families of 60 were allowed to grow in. The 50 strongest seedlings from each family were planted in the field 7/23/15 to establish a Spaced Plant Nursery of 1,750 progeny with Zenith and Compadre as checks (Figure 1).

In addition, seed that had been harvested from three synthetics in the summer of 2014 (1) early flowering / red seed head, (2) late flowering / red head and (3) late flowering / green seed head were cleaned and scarified as before. The early flowering/red seedhead synthetic was not very productive and produced only 17.5g /54 sq. ft. The yield from the late flowering / red seed head synthetic (DALZ 1512) was much better and yielded 171g /54 sq. ft. (estimated 303.4 lbs./acre). The late flowering / green seed head synthetic (DALZ 1513) yielded 163 g /54 sq. ft. (estimated 289.3 lbs./acre). Seed from these three synthetics were used to plant a replicated field trial (RFT) 7/14/15 at the Research Center – Dallas at a rate of 2 lbs./1000 sq. ft. (Figure 2). In addition a second RFT was planted by Johnston Seeds 6/10/15 in Enid, OK. Seed from DALZ 1512 and DALZ 1513 were also transferred to Patten Seeds for evaluation.

Summary Points

1. The third cycle of recurrent selection was begun with the germination of seed harvested in 2014 from 4 isolation blocks planted in 2013. A spaced plant nursery consisting of 1,750 progeny were planted on 7/23/15. Advanced lines with finer leaf texture combined with high seed head density and good height of seed head exertion will be identified in the spring of 2017.
2. Along side the recurrent selection breeding strategy, three sets of 3 parent synthetics were identified for evaluation of a potential commercial product. Seed harvested in 2014 was treated and planted in replicated field trials on 7/14/15.

References:

Diesburg, K. L. 2000. Expanded germplasm collections set the stage for increased zoysiagrass breeding for turf use. Diversity 16(1):49-50.

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Yeam, D.Y., Murray, J.J., Portz, H.L. and Joo, Y.K. 1985. Optimum seed coat scarification and light treatment for the germination of zoysiagrass (*Zoysia japonica* Steud.) seed. J. Kor. Soc. Hort. Sci. 26(2): 179-185.

Figure 1. Third cycle of recurrent selection spaced plant nursery planted 7/23/15 with 1,750 progeny.

Figure 2. Plot coverage 112 days after sowing/planting. A. DALZ 1512, B. DALZ 1513, C. Zenith seeded check and D. Zorro vegetative check.

Figure 1. Third cycle of recurrent selection. A spaced plant nursery planted on 7/23/15 with 1,750 progeny.

Figure 2. Plot coverage 112 days after sowing/planting. A. DALZ 1512, B. DALZ 1513, C. Zenith seeded check and D. Zorro vegetative check.