Polyploid Breeding Method for Improvement of Bentgrass

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Of the 200 *Agrostis* spp., three bentgrass species (allotetraploid creeping, allotetraploid colonial, and diploid velvet) have been used on golf courses. Of them, creeping bentgrass is the most commonly used due to low mowing tolerance and proliferous stolon production. Due to its susceptibility to dollar spot (caused by *Sclerotinia homoeocarpa*) and snow molds (caused by *Typhula* blight and *Microdochium nivale*), fungicides are extensively used on golf courses. Breeding for improvement of disease resistance is an essential part of integrated pest management. Open-pollinated bentgrasses have conventionally been developed through wind-assisted polycrosses among multiple parental clonal plants with traits of interest such as color, quality, disease resistance, etc. Crosses occur within respective species due to their sexual compatibility. Phenotypic and genotypic recurrent selection methods have been widely implemented for bentgrass breeding. In brief, superior plants are identified from the polycrossed population and will be genetically mixed by intercrossing them for another cycle of selection for superior plants. Since bentgrass species are generally known to have different levels of resistance specific to fungal diseases (dollar spot, brown patch, and snow molds), breeders have attempted to combine bentgrass species-specific elite traits through interspecific hybridization. Due to low seed yield and sterility issues of hybrids, development of new hybrid bentgrass varieties via interspecific hybridization has been unsuccessful.

One clonal hexaploid plant (called “M56” from here on) was discovered from a collection of hundreds of bentgrass plants collected from old golf courses in 1998 by Dr. Mike Casler at University of Wisconsin-Madison. The M56 clone was believed to be a natural hybrid according to bentgrass species-specific DNA markers. The clone was further confirmed to be hexaploid (6x=42) based on cytological chromosome counting and flow cytometry techniques and readily crosses with either creeping or colonial bentgrass plants without a sexual barrier to produce hybrid seeds. Hybrid plants derived from crosses between bentgrass (either colonial or creeping) and M56 are pentaploid (5x=35). As results, M56 can be utilized for breeding as either a bridging plant for crosses between bentgrasses or a parental plant, meaning that traits of interest from creeping bentgrass and colonial bentgrass can be naturally and sexually combined with aid of M56, which has been difficult due to hybrid sterility. In addition, since hybrid plants from crosses between bentgrass and M56 are pentaploid, “new pentaploid bentgrass varieties” can be developed by crossing between tetraploid bentgrass plants and the M54.

In conclusion, M56 can be used as a bridging plant between plants of different bentgrass species and used as a parental plant for crosses with elite plants of commercial company to develop new pentaploid bentgrass variety. Development of pentaploid bentgrass varieties are in progress at UMass.

Bentgrass crossing blocks (Fig. 1) were established in the fall of 2009 using the following three bentgrass clones (M56, creeping bentgrass 372, and colonial bentgrass 372.2) either in two- or three-way hybridizations. Seeds from individual or combined crosses within each block will be separately harvested in summer and evaluation for their field performance.

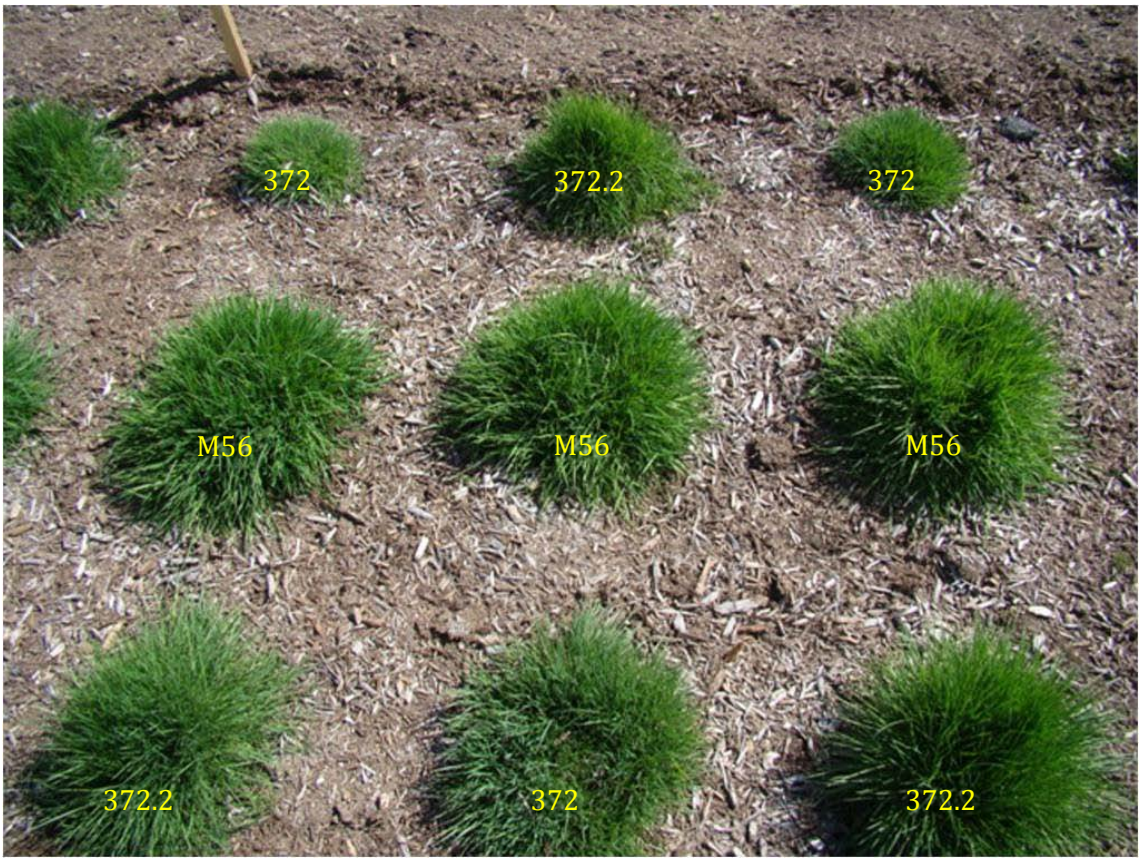

Figure 1. Crossing block with three following clones, hexaploid hybrid bentgrass M56, tetraploid creeping bentgrass 372, and tetraploid colonial bentgrass 372.2