

A Turfgrass Genome Project: Integration of *Cynodon* Chromosomes with Detailed Molecular Maps of the Cereals

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Project Description: We will combine new DNA probes for *Cynodon*, with tools that have been previously mapped in other Poaceae, to develop a primary molecular map of the *Cynodon* chromosomes. The map will be useful for investigating many aspects of turfgrass population biology and genetics, and a molecular conduit for turf improvement to benefit from the large body of genetic information now accumulated about cereals and other grasses. *Cynodon* is chosen as a focal point for turf genome analysis due to its importance across the southern USA, and abundance of phenotypic variation. Dr Wayne Hanna will assist in population development and maintenance.

How Ours is Different: To our knowledge, this project is the first effort to enable turf improvement to benefit from extensive genetic information available for well-studied grains such as maize and rice. The "comparative approach" will reduce costs, and leverage much existing information and tools. Our experience in molecular analysis of complex populations such as sugarcane and buffelgrass, as well as grain crops such as rice, maize, and sorghum, together with our extensive repertoire of molecular tools, puts us in a strong position to efficiently develop a *Cynodon* molecular map useful for turf improvement.

Progress to Date: While the genetic crosses are being developed for making the maps, we have made significant progress in characterizing DNA clones from bermuda and other grasses (especially Pennisetum and Sorghum), for their effectiveness in detecting DNA markers in bermuda. There exists a high level of DNA polymorphism in bermuda, and the establishment of DNA fingerprints unique to individuals will be routine. We have prepared more than 1,000 cDNA clones mapped in other taxa, to be applied to bermuda. DNA extraction protocols for bermuda have been optimized. We have initiated screening of these DNA clones on genomic Southern blots of DNA from the bermudagrass parents being used in this study. The specific parents used in crossing have been clonally propagated, so that we can greatly increase our supply of DNA and blots, and accelerate accumulation of data.

The data accumulated to date suggests that we will be able to not only meet, but significantly exceed the proposed goal of 300 mapped loci. The comparative mapping of bermuda will draw heavily upon a prior map of sorghum that now includes more than 2,000 DNA loci, and a new map of buffelgrass (Jessup et al., in preparation) that now includes about 400 loci.

Genetic crosses are being developed by Dr Wayne Hanna (Tifton, GA). Although Dr Hanna is not presently funded by USGA directly, he has agreed to continue this project, and it is likely that a student funded by this USGA grant will undertake studies jointly with Drs Paterson and Hanna (see other significant events, below).

Plans for Continuation: The focus of year 2 will be the scaleup of identifying DNA polymorphisms, and the beginning of genetic linkage mapping. New lab

facilities and personnel (see below) will facilitate this. We are anticipating that individual seedlings from most, if not all, of the required genetic populations will be large enough to begin sampling of tissue for DNA, during year 2. Full-scale genetic mapping will be done in year 3 -- by the end of year 3, we expect to meet the formal goals proposed for the full 5 years (data analysis may continue into year 4). We will then proceed to applying the map to identification of QTLs, and DNA markers diagnostic of agriculturally-important traits, and also to development of a small BAC library for bermuda.

Once the accumulation of genetic differences and DNA markers is proceeding smoothly, as time permits we will begin to explore the development of large-DNA clones of bermuda in BACs (bacterial artificial chromosomes). Our prior successes with sorghum (Lin et al, submitted), papaya (Ming et al, in preparation), cotton (Abbey et al, in prep.; Rana et al., in prep.), and peanut (Burow et al., unpubl. results) have led to optimization of BAC technology that should be easily transferrable to bermuda.

Leveraging Opportunities Realized: Plant genomics in the USA was recently stimulated by the infusion of nearly \$85 million in federal grants through the National Science Foundation. The US Golf Association designated Dr Paterson's turfgrass genome project to be "matching support of a comparative grass genomics initiative" that Dr Paterson proposed, together with 7 colleagues at three universities. Dr Paterson's proposal was funded at a level of \$3.2 million. This award will provide molecular conduits that will enable improvement of bermuda and other turfgrasses to benefit from the rapid progress that is anticipated for grass genomics as a result of your work, as you have agreed in your proposal to us.

Other Significant Events, and their Consequences: Dr Paterson has recently accepted a "Senior Professorship in Plant Biotechnology and Genomics," at the University of Georgia's main campus in Athens GA (see attached description, that was published in the 23 October issue of SCIENCE). He has the "right of first refusal" to be named the Director of the AGTEC Plant Division, to be created in 1999. This will result in a major scale-up of genomics activities in Georgia, and will also be a significant expansion of the capabilities that Dr Paterson's lab can bring to bear on bermudagrass. In the first year (before AGTEC is created), Dr Paterson will occupy about 4,800 square feet of newly-renovated space, fully and newly-equipped for genomics research. Completion of the AGTEC Center in early 2000 will add about 2,600 square feet of additional lab space for his own activities, as well as shared core facilities of ca. 5,000 square feet for genomics. About \$2.1 million is available for equipping the genomics core facility.

While this move has caused some delays, specifically preventing Dr Paterson from hiring a person dedicated solely to the bermuda project during year 1, by leveraging the activities of other people in the lab we have stayed on schedule. The expanded space and equipment available will greatly accelerate our rate of progress, and we emphasize that we expect to exceed the proposed objectives. Texas A&M has agreed to release Dr Paterson's extramural grants and funds remaining on these accounts to the University of Georgia. The University of Georgia has agreed to honor the terms of existing contracts.

It is also a significant advantage that Dr Paterson will be moving to the same university that includes Dr Wayne Hanna among its faculty -- Drs Paterson and Hanna have already jointly offered assistantship to Mr. Russell Jessup, an excellent graduate student to focus on the bermuda project. Mr. Jessup is presently completing M.S. studies with Dr Paterson and Dr Mark Hussey at TAMU, working on Pennisetum. The offer remains pending, and contingent on the student's formal acceptance into the Univ. GA. graduate school.

Consequently, the short-term delays resulting from this move are expected to yield great rewards in long-term progress and capabilities.