

## DEVELOPMENT OF AN EFFICIENT PROCESS FOR THE INTROGRESSION OF TRANSGENIC TRAITS INTO COTTON

David Dickerson and Albert Balducchi  
Stoneville Pedigreed Seed Co.  
Memphis, TN

### Abstract

An efficient process for the introgression of transgenic traits in cotton involves a combination of three essential elements: facilities, technologies and teamwork. This paper describes the results of years of effort to develop and build such a scheme at Stoneville Pedigreed Seed Company. We also present a vision of future enhancements still under development that will improve introgression efficiencies even further. Results of the application of this process will also be presented.

### Discussion

Stoneville's transgenic research facilities are strategically located in the mid-south region of the cotton belt, within the city limits of Memphis, Tennessee. This location offers several advantages. Among other features, it serves as a major transportation hub for Northwest Airlines, as well as home to FedEx, a major overnight shipping concern. Our efforts to develop a transgene introgression capability started with designing and building a sophisticated greenhouse complex capable of producing up to four generations of cotton each year under BL-1 containment practices. These facilities included computer-controlled systems to manage all aspects of greenhouse function, such as temperature regulation, lighting, watering and fertigation. In order to provide optimum water quality, a sophisticated water conditioning system was installed. Another key feature of the greenhouse system was the incorporation of redundant systems for back-up capabilities, which included the computer control system itself, as well as heating and cooling systems. These facilities exist primarily to incorporate both regulated and non-regulated transgenes into Stoneville germplasm. However, they also serve to provide a means of conducting purity and efficacy testing, as well as off-season seed increases.

Critical to the nature of transgene integration is technology support, service and development. Thus, our transgenic laboratory, located next to our greenhouse facilities within the Stoneville research campus, services the testing needs of both greenhouse and field operations. Key components of this laboratory included a robotic liquid handling system, PCR, ELISA and electrophoretic capabilities. These systems aid in event analysis, studies of gene expression, as well as providing zygosity testing and purity analysis. In short, our laboratory ensures that the correct genes are placed in the correct genotypes.

Laboratory activities must not only be focused on accurately applying current methods to the process of transgenic introgression, they must also be actively applying and developing new technologies and practices. An important part of the laboratory function at Stoneville is to progress emerging technologies to facilitate advancements in selective capabilities. Among these advanced technologies are molecular markers, which can be statistically linked to a wide array of measured traits. And of course, DNA fingerprinting, with its ability to tailor selections to more quickly recover elite genetic backgrounds. Each of these technologies offers significant advances in furthering efforts to shorten the introgression process.

Field testing is an essential part of completing transgene integration. With field plot locations located adjacent to the research campus, as well as near other Stoneville centers of breeding research, our Transgenic Efficacy team ensures that appropriate levels of transgenic technology exist in test

materials. They also work to evaluate how well the technology works in Stoneville varieties.

Up to this point, we have reviewed the importance of facilities and their functions, as well as technologies, as they apply to an efficient system of transgenic introgression. We have not forgotten that research staff makes all of this happen. They are the driving force. And our record of success, has, in large measure, been achieved through teamwork. Assembling the team begins with focusing on the nature of the function of each position. The goal in selecting team members is to base selection on a breadth of targeted capabilities and experiences. This approach provides the depth and flexibility within the team to ensure completion of the required tasks. Once hiring has made certain that all facets of the program are covered, communication among the staff is fostered through database interconnectivity, interactive telecommunication, as well as the nature of the proximity of working conditions at the research campus itself.

As an example of our approach to bringing genetic technologies to the market, we shall examine the case of two products, ST 4892BR and ST 4691B. Both varieties were generated from a cross that was initiated in April 1995 between a technology source population, "BT531/1445RR", and an elite Stoneville variety, ST 474. Using greenhouse facilities, transgene detection technologies, and both domestic and counter-season nurseries and increase locations, commercial quantities of seed were made available for sale in April 2000. Both varieties have demonstrated outstanding competitive performance, with the advantage of proven transgenic technologies.

### Summary

Stoneville Pedigreed Seed Company has for years been dedicated to the development of efficient breeding methods. Today, new genetic technologies offer producers the means to reduce both production costs and risks in order to maximize their profit potential. Stoneville is committed to processes that move these technologies into the most advanced genetics available by the most efficient methods possible.

This paper reports on our company's dedication toward bringing those technologies forward commercially. Our comprehensive approach includes a state-of-the-art greenhouse facility, complete with computer aided control and tracking systems. It involves providing a broad range of laboratory functions and capabilities to ensure accurate transgene detection and placement, as well as the continued financial support to take full advantage of the latest scientific advances in the use of molecular markers and DNA fingerprinting technologies. Along with greenhouse and laboratory practices to ensure genetics fixed at appropriate levels, field evaluations are performed to critically test the effectiveness of the introgression efforts to assure commercial performance. Facilities and equipment don't function without people interacting as a team. A team composed not only of the right numbers of individuals, but individuals with a breadth of experiences, united to a common purpose.

In conclusion, an efficient and effective transgene introgression program requires commitment. This commitment comes from within the team, as well as from a business strategy intent on maintaining a leadership role in the breeding of superior cottonseed products.