

**GLYPHOSATE-RESISTANT EPSPS EXPRESSION IN MICROSPORES AND TAPETUM  
CELLS PROVIDES REPRODUCTIVE TOLERANCE IN ROUNDUP READY® FLEX COTTON**  
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**Abstract**

Plants expressing sufficient amounts of *Agrobacterium sp.* strain CP4 5-enolpyruvylshikimate-3-phosphate synthase (CP4 EPSPS) are known to possess tolerance to glyphosate, a potent herbicide that inhibits the activity of endogenous EPSPS. Transgenic cotton plants (Roundup Ready® Cotton) harboring the glyphosate-resistant CP4 EPSPS gene show excellent tolerance to glyphosate. However, with applications at late developmental stages that are inconsistent with the Roundup® label, RR cotton exhibits male sterility at some first position flowers while maintaining vegetative tolerance to glyphosate. Conversely, Roundup Ready® Flex Cotton exhibits great reproductive success after sequential glyphosate applications at late developmental stages. Our research shows that glyphosate is efficiently delivered to the male reproductive tissues. Histochemical analyses were conducted on these two lines to dissect the male reproductive development in response to glyphosate applications at the cellular level, as well as the correlation between glyphosate injury and the expression of CP4 EPSPS in male reproductive tissues. In RR Cotton, CP4 EPSPS protein was almost non-detectable in microspores and tapetum. The development of pollen was also disrupted at the same stage. In RR Flex Cotton, the expression of CP4 EPSPS is strong throughout the development of pollen, including microspores and tapetum. This indicates that CP4 EPSPS expression in microspores and tapetum, the two crucial male reproductive cell types, is critical to the reproductive tolerance in Roundup Ready® Flex Cotton.