

Improvements of Fiber Yield and Fiber Fineness by Expressing the *iaaM* Gene in Cotton Seed Coat

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Cotton, the most important natural fiber crop in the world, is a mainstay in China's economy. However, for over two decades, cotton yields both in China and U. S. have been at a plateau. One reason for this plateau is the limitation of current cotton germplasm. Cotton fibers are single cells resulting from elongated cells of the ovule epidermis. IAA regulates both plant growth and differentiation, and it has important roles in cotton fiber development. To evaluate plant hormone biosynthetic genes for genetic engineering to modify cotton fiber, *iaaM*, a auxin biosynthetic gene, was linked to two ovule-specific (*Agl5* and *Lefsm1*), one seed coat-specific (*FBP7*), and two fiber-specific (*E6* and *SCFP*) promoters respectively, and a series of transgenic cottons were successfully generated. The transformants containing *E6:iaaM* and *FBP7:iaaM* cassettes showed normal morphology and growth, while most of others exhibited abnormal phenotypes, especially male sterility. In *FBP7:iaaM* transgenic plants, *iaaM* expression was restricted in the -2 to 10 DPA seed coat and fiber. The expression peak was observed at 0 DPA. After 5 DPA, the expression became very low. In the 0 to 5 DPA ovules of transformant 9#, IAA content, measured by HPLC-MS, was much higher than that in nontransgenic plants (Null). *FBP7:iaaM* transformants showed a considerable increase in fiber initials per ovule, 28.6%, and in mature fiber number per seed, 45.5%, compared to those in the null plants. The 2007 field test showed that the lint percentage of *FBP7:iaaM* transgenic line, 9# was as high as 48.6%, an increase of 15.2% relative to that of the null plants (42.2%). Consequently, the lint yield of the line was increased by 15.9%. Interestingly, fiber fineness also was considerably improved in *FBP7:iaaM* transgenic lines. The Micronaire of *FBP7:iaaM* fibers was around 4.5, while that of the null line was 5.2. No obvious changes in fiber length and fiber strength were found between *FBP7:iaaM* transgenic lines and null plants. *FBP7* promoter is active in -2 to 5 DPA seed coat and fiber, during that time fiber cell initiates and the number of mature fibers is largely determined. Fiber initials, mature fiber numbers, the lint percentage and yield were evidently increased in *FBP7:iaaM* transgenic cotton, indicating that IAA plays important role in fiber cell initiation. Our data demonstrate that enhancing IAA content in seed coat by over expression of the *iaaM* gene at the stage of fiber cell initiation can evidently improve fiber yield and fiber fineness of cotton.

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