We previously demonstrated that transgenic tobacco plants expressing cyanobacterial fructose-1,6-/sedoheptulose-1,7-bisphosphatase in the cytosol increased the number of lateral shoots and leaves at elevated CO_2 levels. These findings suggest that alterations in carbon partitioning affect the development of shoot branching. In order to elucidate the underlying mechanisms at the molecular level, we generated transgenic *Arabidopsis* plants overexpressing cyanobacterial fructose-1,6-bisphosphatase-II in the cytosol (AcF). At elevated CO_2 levels, the number of lateral shoots was significantly increased in AcF plants. Sucrose and hexose levels were also higher in AcF plants than in wild-type plants. The expression levels of *MAX1*, *MAX4*, *YUCCA8*, *YUCCA9*, and *BRC1*, which are involved in auxin or strigolactone biosynthesis and responses, were lower in AcF plants than in wild-type plants. These results suggest that alterations in sugar partitioning affect hormone metabolism and responses, resulting in enhanced shoot branching.