To maintain a competitive edge while expanding markets and decreasing production costs, U.S. growers must continue to improve fruit quality and satisfy consumer demands for novelty and convenience. The development of seedless varieties of fruit such as grape, citrus, and watermelon has significantly increased their consumption. The economic potential of doing the same for stone fruits is staggering, considering the marketing possibilities for pitless cherry, peach, plum, and apricot varieties coupled with decreased production costs for canned and dried fruit. However, achieving this requires not only elimination of the seed, but the stone as well; a hard woody carapace surrounding the embryo. In pursuit of this goal, we have begun dissecting the stone development and hardening process to identify key regulatory genes and pathways. Gene expression profiling experiments were conducted on an early peach fruit development series spanning the stone hardening process. Two long-oligo microarray platforms were used for this study: A 5K custom peach fruit array and a 15K apple array from HortResearch, NZ. Results revealed that the phenylpropanoid pathway that is responsible for lignin biosynthesis is highly induced immediately prior to stone hardening and then rapidly declines. Induction of this pathway was found to be specific as significant induction was not observed in fruit flesh or skin. In contrast, the flavonoid biosynthesis pathway was also found to be up-regulated during early fruit development, although the spatial/temporal pattern was not tightly linked to stone hardening. Compositional analyses revealed that peach stones have unusually high lignin content (44%) far above that observed in hard woods (25%), although the ratio of lignin monomers was consistent but not identical to that of peach wood. Collectively, our data provides a first look into the stone formation process and reveals numerous targets for engineering stoneless traits in Prunus species.

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