In this work, fiber distribution through the cross-sections of compact yarns and their packing density values was investigated to provide a better understanding of the internal structures of compact yarns produced by different compact spinning systems, since there is no information available so far regarding their internal structure. The results of packing density analysis indicated that compact yarns had nearly 15–30% higher packing density values compared to that of the conventional ring spun yarns. Also, the packing density values of compact yarns produced by three different compact yarn spinning systems, namely Rieter K44, Suessen Elite and Zinser Air-Com-Tox700, revealed that there were no significant differences among these systems in terms of yarn packing density values.