Hairiness significantly influences the appearance of yarns and fabrics. New methods and spinning systems have been offered to reduce it. Nevertheless, there is still the quest for easy, lowcost processes to produce good quality yarns with reduced hairiness. Therefore, due to its considerable importance for spun yarns, we worked on a new spinning method to decrease yarn hairiness. Many researchers have been studying the use of air nozzles in the spinning and also the winding processes and they indicated that hairiness decreases by up to 40–50%. From this point, we investigated the use of an air nozzle on a compact spinning system and discussed the effect on yarn hairiness. The nozzle was positioned at the exit of the drafting system on a RoCoS compact spinning system and pressurized air was fed into the nozzle by the compressor during spinning. We called the combination of an air nozzle and a compact spinning system as a Compact-Jet spinning system. In the literature, there are no such trials. At the end of the study, it was determined that a Compact-Jet spinning system truly improves hairiness by up to 40% in comparison to the compact spinning system and by up to 70% compared with the conventional ring spinning system. Regarding the nozzle structural parameters, the changes in hairiness indicate that the main hole diameter and nozzle outlet design make the most important contributions in reducing yarn hairiness; whereas the injector angle and nozzle head type show weaker effects. As a result, the Compact-Jet can be considered as an innovative spinning system providing the opportunity to produce less hairy yarn. Additionally, we believe that this study makes an important contribution to the research activities in the spinning field and its associated literature.