Co-Optimization of Fuels and Engines initiative (Co-Optima) of the U.S, Department of Energy started research on several biofuels and biodiesel for internal combustion engines. Biofuels and biodiesel were selected using screening criteria, which consisted of biodegrading, toxicity, flash point, research octane number, motor octave numbers, and economic effect, etc. Measurements of laminar burning velocity (LBV) is one of the key parameters to understand fuel performance and applicability in engines. Furthermore, knowledge of LBV is required to understand turbulent combustion and verify chemical mechanism. In this study, LBV was measured with seven biofuels and three biodiesels. LBVs were measured at 428 K and 1 atm with biofuels and synthetic air. Ethanol is one of the selected biofuels. The pressure and temperature effect of LBV were studied with ethanol because ethanol is a very well-known biofuel. In high-pressure experiments with ethanol, flame instability was observed during the combustion event. To delay the occurrence a cellular structure during combustion, a mixture of helium and nitrogen in synthetic air was employed as a diluent. LBVs of biodiesels were measured at 453 K and 1 atm with synthetic air. To check the condensation of biodiesel in the system, a laser absorption technique was used. Regardless of the fuels tested, the maximum laminar burning velocity occurred at around 1.1 of equivalence ratio. For future works, the measurement LBV of blended biofuel is needed.