

An Efficient Approach for Shear Behavior Definition of Plant Stalk

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Abstract : The information of the impact cutting behavior of plants stalk plays an important role in the design and fabrication of plants cutting equipment. It is difficult to investigate a theoretical method for defining cutting properties of plants stalks because the cutting process is complex. Thus, it is necessary to set up an experimental approach to determine cutting parameters for a single stalk. To measure the shear force, shear energy and shear strength of plant stalk, a special impact cutting tester was fabricated. It was similar to an Izod impact cutting tester for metals but a cutting blade and data acquisition system were attached to the end of pendulum's arm. The apparatus was included four strain gages and a digital indicator to show the real-time cutting force of plant stalk. To measure the shear force and also testing the apparatus, two plants' stalks, like buxus and privet, were selected. The samples (buxus and privet stalks) were cut under impact cutting process at four loading rates 1, 2, 3 and 4 m.s⁻¹ and three internodes fifth, tenth and fifteenth by the apparatus. At buxus cutting analysis: the minimum value of cutting energy was obtained at fifth internode and loading rate 4 m.s⁻¹ and the maximum value of shear energy was obtained at fifteenth internode and loading rate 1 m.s⁻¹. At privet cutting analysis: the minimum value of shear consumption energy was obtained at fifth internode and loading rate: 4 m.s⁻¹ and the maximum value of shear energy was obtained at fifteenth internode and loading rate: 1 m.s⁻¹. The statistical analysis at both plants showed that the increase of impact cutting speed would decrease the shear consumption energy and shear strength. In two scenarios, the results showed that with increase the cutting speed, shear force would decrease.

Keywords : Buxus, Privet, impact cutting, shear energy

Conference Title : ICABBBE 2019 : International Conference on Agricultural, Biotechnology, Biological and Biosystems Engineering

Conference Location : Vancouver, Canada

Conference Dates : September 24-25, 2019