

Cutting tests of kenaf stems

ABSTRACT

We developed a new harvesting machine with a rotary impact cutting system for cutting kenaf stems. The design of the machine was based on effective cutting knife angles and cutting speed. In this research, specific cutting force (SCF) and specific cutting energy (SCE) were measured by considering the following factors: knife edge angle (ANE), knife shear angle (SA), knife approach angle (ANA), knife rake angle (ANR), and the cross-sectional area of plant stems. In addition, an experimental impact cutting machine was manufactured and tested in the field. The rotational speed obtained with this machine had the lowest cutting torque. Kenaf stems of the V36 variety were used as the experimental material. An analysis of variance of the SCF and SCE values of the kenaf stems showed that the effects of all the above-mentioned angles (considering a broad range) on SCF and SCE were significant. Moreover, the preferred values of ANE, SA, ANA, and ANR were 25°, 40°, 40°, and 40°, respectively, according to Duncan's multiple range test. Based on the impact cutting test, the rotational cutting speed had a significant effect on the specific cutting torque. Increasing the rotational speed from 308 to 788 rpm decreased the cutting torque by 26.3%. This experimental impact cutting machine had an estimated capacity of 0.07 ha h⁻¹. The average moisture content of cut samples from the lower area of the stems was 70.78% (dry basis).

Keyword: Cutting energy; Cutting force; Impact cutting; Kenaf; Knife angle