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INVESTIGATION OF KNIFE AND LEAF FACTORS ON CUTTING STRENGTH AND ENERGY OF DATE PALM LEAF

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ABSTRACT

Dates are major horticulture crop in Middle East region. Iran is currently one of the largest producers of dates in the world. Successful production of dates needs plenty of different and specific operations on this plant. Amongst them pruning as an important operation is practiced by removal of old or infected green leaves. Pruning is considered by all farmers and is conducted regularly to the date palm *(Phoenix dactylifera* L.). Current pruning methods involve the use of a chisel or sickle, where the use of such tools requires manual labor and is a tedious job. Hence, mechanical pruning of date palm remains an issue that needs to be solved. Available ability of the cutting properties of midribs being cut is significantly essential, particularly to support the success of any engineering design that deals with mechanized pruning. The aim of the present work was to provide cutting properties of date palm leaf midrib (DPLM) to be utilized in pruning mechanization. Therefore, a shear jig was developed, and a quasi static cutting test was conducted to investigate the effect of knife angle, cutting angle and midrib maturity on specific cutting force and energy requirement per unit cut area for cutting DPLM on Barhee variety (a commercial variety of Iran). Three knife angles (20, 25 and 30C°) and three cutting angles (45, 60 and 90°) were studied, while two levels of DPLM maturity were used as the test samples. The result showed significant effect of knife angle, cutting angle and DPLM maturity; but no interaction between them on specific cutting force (SCF) and specific cutting energy (SCE) requirement for cutting DPLM. Minimum SCF (199.99 Ncm^{-2}) and SCE (377.73 Ncm^{-2}) achieved with 20° knife angle, which was due to the fewer resistance of knife movement through cutting material at less knife angle. It was also found that increasing the knife angle resulted in high SCF and SCE requirement, where increasing the cutting angle from 45 to 90C increased the SCF and SCE to about 29% and 23%, respectively. It may be due to increasing the cutting area from cutting angle 45 to 90^{o}. Similar trend was found for the DPLM maturity. The mature the DPLM, the higher the SFC and SCE required to accomplish the cutting. Although this work generated useful information that would help the designers; but to develop an efficient mechanized date palm pruning system, further researches are recommended.