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DEVLOPMENT OF A CHOPPING MACHINE FOR AGRICULTURAL RESIDUES

BY

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B.Sc. in Agric. Science (Agric.Mechanization). Faculty of Agric., Kafrelsheikh University, 2001

THESIS

Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science

IN
(AGRICULTURAL ENGINEERING)

DEPARTMENT OF AGRICULTURAL ENGINEERING

FACULTY OF AGRICULTURE

KAFRELSHEIKH UNIVERSITY

(2021)

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List of Abbreviation

$A_{f:s}$: Frontal surface area.

$A_{s:c}$: The cross-sectional of area.

CAPMAS: Central Agency for Public Mobilization and Statistics.

CF: Criterion Function Cost, LE/Mg.

Cos ɵ: Electrical power factor, decimal (being equal to 0.71)

LE: Egyptian Pound.

FAO: Food and Agriculture Organization.

I: Current intensity, Amperes.

L: Economic life of machine, year.

L_b: The batch load, kg.

$M_{f.s.l}$: The first squamous leaf mass,

g.M_i : The initial sample mass, g.

ɳ: Mechanical efficiency of motor assumed to be 80%

from data sheet.

P: Manufacturing price of the machine,L.E.

R_{peels} : The removed peels by the machine, %.

SFCM: Star Forage Chopper Machine.

T: The peeling residence time, min.

T_l: The loading time, min.

T_u: The unloading time, min.

Tv: Trade-in value of the machine

uc: unit cost, LE/Mg.

V: Potential difference, Volts.

ABSTRACT

The increased of amount of different kinds of agricultural crops residues is considered as one of the problems which face both the farms and the environment. The cutting process of agricultural plants is more complicated than the cutting of engineering material (steel, copper, alloys etc.), due to the fact that plants are non-homogeneous and non-isotropic materials. The scientists on all the world have thought to solve the problems, there problems have bad effect of the environment. Star Forage Chopper Machine (SFCM) was modified and tested to reduce the power required and to improve forage cutting efficiency, also, it will reduce the environmental and health impacts by replacing diesel-based farm machines with electrically operated ones. Power transmission assembly, rotating cutter head knives and straw outlet position were modified, and newly constructed feed rollers were added and positioned to control plant material to be chopped. The performance of SFCM was evaluated based on its ability to chop rice straw and cotton stalks under three different feed rates 0.8, 1.2 and 1.5 t/h four different knife speed, 78.6 (750), 91.1 (1000), 115.2 (1250) and 136.2 (1500) m/s (rpm).

Minimum cut lengths were 1.35 and 1.27cm for rice straw and were achieved by using the highest feeding rate of 1.5t/h with the maximum of knife speed 136.2 \m/s with using toothed blades and normal (flail) blades respectively. At higher feed rates, either power required to cut rice straw or cotton stalks increased with increasing knife speed under the two types of new knifes. Minimum power required to cut rice straw were 1.81 and 1.76kW and were achieved by using feeding rate of 0.8t/h with knife speed of 78.6m/s for toothed blades and normal (flail) blades respectively. Rice straw and cotton stalks cutting efficiency decreased with increasing feeding rates and increased with increasing knife speeds. Specific energy for cutting rice straw and cotton stalks decreased with increasing feeding rates and decreased also with increasing knife speeds.