DYNAMIC MOTION OF STRAW AND PLANT PARTS THROUGH MECHANICAL MOWING SYSTEM

By

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ABSTRACT

The objective of this work was to study the motion of the straws and plant parts by a small rotary harvester during cutting and gathering operations of crop, until completely collected, and keeping the crop from destruction or loss in straw and grains of crops. The rotary harvester parts were locally made. Experiments were run on lawn; clover mowing, and wheat reaping.

Results indicated that straw remainder on the ground in wheat reaping increased from 35.1 to 42.5% when forward speed increased from 0.6 to 2 km/h, and stayed at 35.6% by increasing the cutting speed from 47 to 65.5 m/s. Using the gathering device with conveyor chain decreased straw remainder on the ground from 32.2 to 11% compared with conveyor belt. Grain losses increased from 6 to 9.2% when forward speed increased from 0.45 to 1.13 km/h. Meanwhile, losses increased from 4.7 to 7.3% with an increase in cutting speed from 35.3 to 65.5 m/s. Losses also increased from 3.5 to 9.2% when using the gathering device with flat conveyor belt as compared with conveyor chain. The front deflection of wheat stem increased by increasing the star

wheel diameter. Meanwhile, the side deflection increased by increasing the width of side deflector. Horizontal drop angle of wheat stems decreased by increasing the conveyor lugs speed, deflector length, and number of deflectors. But, drop distance of wheat panicles increased by increasing the conveyor lug speed, deflector length, and number of deflectors.

Key words

Rotary harvester; Straw remainder; Grain losses; Reaping; Mowing; Conveyor chain; Conveyor belt; Front deflection; Side deflection; Deflector; Lugs; Horizontal drop angle; Drop distance.

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INTRODUCTION

Mowers can generally be used in harvesting forage, cereal and stalk crops such as cotton and corn. Importance of harvesting mechanization cannot be undermined in Egyptian conditions, where the predominant tools for harvesting wheat, barley, and rice are the sickles and scythes. Sickles are by for more in use than scythes. Hoes are used to remove the cotton stalks from the field after cotton picking. These tools have simply remained largely the some. At least they place heavy demand on human energy by increased work hours. They are responsible for low levels of production and increasing reluctance of laborers to work in agricultural sectors. In most cases, labor is not sufficient at the proper time so the operation goes very slowly resulting in high losses through grain shattering, (which accounts for up to 30% at present). In addition, the shortage in hand labor in Egyptian agriculture has become a pressing problem in the recent decade, especially during harvesting periods. This shortage, in turn, has increased the costs of mowing and handling. However, the expenses and scarcity of capital and the small size of the typical land units make it difficult to introduce expensive, heavy and complicated technology of type that serve in the U.S.A. or other countries where land units are large and capital is plentifull.

The importance of harvesting mechanization is due to the extent of area grown with forage, cereal crops and stalks in Egypt,and their seasons per year, as shown in the following table for importance crops (CAPM ,1993).

Season	Crop	Area ,1992 (Million fed.)
Winter	Wheat	2.092
,, ,,	Clover	2.542
Summer	Cotton	0.840
,, ,,	Rice	1.216
,, ,,	Corn	2.222

The wide-scale mechanization of crop reaping has not prevailed so far (Nat. 5-yr. Plan for Mec.,1982).

For these reasons, Egyptian planners have turned toward concepts of increasing mechanization in farming operations to crop with seasonal shortage of labor. Partial mechanization of harvesting operation for small farms could speed up harvesting operation by replacing the slow hand cutting methods, so that the crop could be removed from the land and temporarily stored for subsequent threshing or processing .

What is needed instead is the selection or development of an intermediate technology suited to Egyptian conditions, available at a price that a small farmer can afford or rent; geared to the small land unit, and of a complexity within the farmer's ability to handle.

In previous work, a simple locally made mower was tested for appropriate speeds, geometry of cutters, and other factors pertinent to appropriate design and operation with alfalfa, lawn mowing, cotton-stalks cutting, and inter row weed control.

The objective of this study is to develop a method of predicting the forces acting on plant stems and parts mowed by a small rotary harvester during cutting and gathering operations of crop until completely collected. The rotary mower was designed and constructed in the Workshop of the Agricultural Mechanization Division, Faculty of Agriculture, Ain-Shams