DESIGN, TESTING AND ENGINEERING ANALYSIS OF A STRIPPING HEADER SYSTEM TO A TWO WHEEL TRACTOR TO CARRY OUT SIMULTANEOUSLY THE COMBINED OPERATION OF REAPING AND THRESHING OF PADDY AND THE IMPACT ASSESSMENT OF ITS USE IN NATIONAL MECHANIZATION PROGRAMME

by

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ABSTRACT

Rice harvesting and threshing are done mostly by hand throughout the tropics. In some areas these post production operations are carried out traditionally by women and children. Labour shortages at harvest time results in harvest costs, untimely harvest and subsequent crop losses, and grain quality degradation which rapidly increases with time. Small farmers are hardest hit by increasing costs and delays.

Thus for a rice production system, harvesting and threshing is labour intensive leading to grain losses and is therefore a restriction on development. Even for mechanical threshing energy consumption is high because of the handling of material other than grain (MOG).

Therefore, there is a need for labour saving and cost effective harvesting technology. A harvesting technique in which only the most valuable parts of the crops are harvested is potentially fast and efficient. A stripping header was designed for in-situ stripping of grains and its performance evaluated.

Engineering analysis of the header was undertaken to derive relationships among several variables contributing to the efficient functioning of the stripper. This included rotor diameter, axle height, plant height, hood radius, rotor RPM and forward speed. Analysis of the resultant speed of the grain, its direction and grain path identified the optimum location for the collection tray so that the stripped grain is collected effectively without falling onto the ground.

Prototype stripper was field tested to evaluate the best combination of rotor speed, element height, element angle and rotor height consistent with minimum grain losses. Rigid rotor elements as well as flexible comb elements mounted on a rotor spinning on a horizontal axis with its upper half enclosed by a movable hood were tested. The header

was mounted on a two wheel tractor chassis and was driven by a belt drive powered by a 5 hp kerosene engine.

Only the top part of the crop (ears/heads) is threshed. This stripping method builds on the fact that the ears/heads are naturally attached to the ground through the plant itself. This attachment is of course broken while using the classic stalk cutting reapers/combine harvesters.

The optimum rotor speed for the selected parameters is in the range of 700 - 800 RPM. Detailed analysis of the yield data was undertaken to predict the optimum hood height, rotor RPM and moisture content. Lower edge of the hood 100 - 150 mm below the crop height gave minimum grain loss. Optimum moisture content for minimum total seed loss for a given set of rotor speed and hood height is 22 %.

Assessment was made on the amount of MOG passing through the machine. The field grain losses were also evaluated. The combs (teeth) of the final prototype are so flexible that it withstood contact with ground or any foreign objects during the tests. The system has proved to be effective in terms of stripping capacity and power requirements of dry paddy stripping. Lodged and weed infested fields present no major problems. By threshing the standing crop transportation and handling of the straw is avoided.

Cleaning and collection could be carried out at the farmstead itself minimizing the cost of handling and transport.

The trials show that the stripper header type harvester has a good potential for development as a relatively cheap, simple rice harvester, particularly in developing countries where small plot cultivation is practiced.