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THE DESIGN AND MANUFACTURE OF MAIZE HULLERS**

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1.0 Introduction

The design, development and manufacture of machinery in Malawi have advanced parallel to the agricultural activities and the level of consumption of the food production in the local market.

In the early years of political independence, most of the machines were imported as the accelerated agricultural output required immediate industrial support. When the situation had stabilized, the design of local equipment began to take place, particularly, for the processing of maize and rice products.

This paper focuses on one of the locally manufactured equipment substantially used in the rural areas for production of dehulled maize, a stage prior to making meal flour. The equipment is commonly known as a maize huller.

2.0 The maize huller

The maize huller has been developed to mechanize the removal of the husk and the germ from maize in readiness for further disintegration into flour. In traditional technology this process is accomplished by pounding the raw maize in a mortor and a pestle. This operation is tiresome and less efficient as the rate of production is in the range of 7-10kg/h.

The huller is manufactured through diecasting, the material of which is extracted from cast iron and brass scraps. These scraps are locally found and smelt in a coal-fired furnace.

Scrap material is used as it is the only source of the crude metal.

2.1 The design of the huller is non-traditional as in the indigenous practice removal of the maize huller is achieved by the hammer effect. In fact, the technology is adapted from an earlier foreign design, which vanished from the market due to purchase and maintenance costs.

2.2 The change of local design over the past years has seen hardly any progress. While there have been many failures, there has been no effort to improve or modify the design because of the following handicaps:

- lack of adequate and appropriate skills on the part of the designers
- unfavourable cost of new design and manufacturing methods
- minimal competition available in product development
- unavailability of accepted design standard
- lack of adequate research facilities to support new innovations.

3.0 The design facilities and technology for the huller have neglected the conventional practices. As previously mentioned, the technology has been fully adopted from foreign products and no further development in design has yet occured.

The design has remained closed from criticism and improvement as it has always been left to one person--the designer.

4.0 The drawings attached demonstrate the basic engineering geometries employed in the design. Sometimes, though the designs have been acceptable, further development has been hampered by a poor manufacturing base. For instance, a worm spindle may not come out clearly during manufacturing.

The following discussion raises a few aspects in the design of the huller that would definitely need to be developed further to optimize the huller productivity.

4.1 Hulling worm and chamber geometry

The hulling effect is achieved by rubbing the surface of the maize between the spindle and the chamber. The stripping of this skin is supported by the moisture amount in the maize. In reality, the dehusked maize should be immediately extracted from the system through a screw movement of the spindle. However, owing to manufacture problems, this movement is not distinctly affected. A similar movement could easily be achieved through tapering or offsetting the spindle; but the problem lies either in the under- or in the over-husking of the maize.

4.2 The discharge mechanism also need to be further developed. The present design extracts the husks through a crudely made sieve. The sieve is manufactured from a perforated iron sheet and is made into a semi-cylinder inserted below the chamber. The system's pressure forces out the husks. The discharged maize still contains a fraction of the waste owing to some inefficiency in the above stage. A blower is provided at the product outlet to suck out the excess husks. Despite efforts, the end product still contains husk rudiments, which are manually removed.

4.3 The dehusking mechanism must incorporate some particle-size control. During dehusking some of the maize grains are crushed in the local huller. The crushed material may amount to 50 per cent of the finished product. In the worst situations, an invariable power drive makes the control extremely difficult.

5.0 The above-captioned discussions convey some of the solutions or further developments required in the present huller in this paper.

5.1 The rate of progress or further development of the huller design in this respect may partly be attributed to the source of technology and to some extent to the cost-sensitivity of any design and manufacturing changes. As this is an adopted technology, the level of innovation by the local design is low. As long as there is some performance achieved, the designer will tend to be complacent.

Probably, the recommended approach to designing food processing equipment is to employ the indigenous technologies which are normally simpler and dependent on local raw materials. In this case, one could still look at the traditional pounding of maize as a hint to some design innovation.

5.2 The huller should incorporate some system to control the rate of discharge and consistency of the grain size. The control could also assist in decreasing the rate of waste discharge.

5.3 The huller cannot be easily maintained at the village level, where such equipment is in great demand. Maintenance is restricted by the manufacturing principle employed: 80 per cent of the componentry is iron casting.

6.0 To summarize the discussion, the present huller has undergone no further development because of the poor approach to design, development and manufacturing. An extra effort could easily elevate the design so that a higher production yields a finished product. The promotion of design and manufacturing must be institutionalized so that there are skill-training and research facilities within the reach of the innovators and designers.

THE MAIZE HULLER