DESIGN OF AN ANIMAL DRAWN DISC RIDGER

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Key Words: smallholder farmers, appropriate implements, factors

I. INTRODUCTION

The lack of suitable equipment for smallholder farmers (communal farmers and small scale commercial farmers) to implement Ridging, which is one of the recommended techniques for minimising land degradation and improving rainwater infiltration in Zimbabwe, is one of the main causes for development of the animal drawn disc ridger. Further, surveys in Zimbabwe have shown that a lot of the animal drawn implements used do not match the draught power source which results in either over working or under utilising the animals involved. It is also widely acknowledged that raising the level of mechanisation among small holder farmers, who are the majority of farmers in Zimbabwe, is one of the keys to increased agricultural productivity. Almost all operations except ploughing, harrowing and some weeding operations are done manually. Because of these and other reasons, research and development of appropriate implements for smallholder farmers has been identified as a priority area in Zimbabwe’s Agricultural Policy Framework for 1995-2020.

II. FACTORS CONSIDERED IN DESIGN AND DEVELOPMENT OF THE IAE PROTOTYPE ANIMAL DRAWN DISC RIDGER

Factors affecting equipment and machinery design may be summarised under the following aspects: need; technical and economic requirements; manufacturing techniques, skills and materials; ergonomic considerations; economic and technical acceptability.

Need
Views of the farmers were captured before and during development. Prototypes were given to farmers to use and at the end of the crop season the farmers input obtained. Some of the design features such as the transport position were incorporated as a result of farmer input.

Technical and Economic Requirements
The IAE prototype disc ridger was designed to accommodate ridge spacing varying from 60cm for crops such as Soya bean up to 120cm for tobacco as practised in Zimbabwe. This includes 90cm ridge spacing as recommended from conservation tillage research for maize in Zimbabwe. The dimensions were also determined so as to allow re-ridging and weeding with crops up to knee height. Adjustments were incorporated to allow varying of the disc angles in order to regulate draught and penetration subject to local conditions.

Manufacturing Techniques, Skills and Materials
Designs requiring machining processes were generally avoided so as to make the technology accessible to rural artisans and manufacturers, who normally do not have expensive machinery such as lathes and milling machines. No alloy steels were used, but mild steel, which is locally available. The number of steel sections and types of bolts used was kept to a minimum so as to make sourcing of materials and replacement of parts as easy as possible.
Ergonomic Considerations

Unnecessary weight, which leads to added strain for the draught animals as well as for the user controlling the implement was avoided. The centre of gravity of the IAE prototype was kept as low as possible whilst maintaining enough clearance to allow ridging, re-ridging and weeding with already established crops up to knee height. In addition, a drawbar instead of a chain is used to enhance stability. Off centre handles were adopted and an adjustment for the height of the handles incorporated so as to allow the operator to assume a position as upright as possible during operation. Adjustments were limited to the practical ones so as to keep the design as simple as possible and easy to use.

Economic and Technical Acceptability

Designs and technologies associated with high tooling costs, in particular machining, were avoided in order to keep the cost of production down and so as to make manufacture of the disc ridger possible by rural artisan/manufacturers. 2 standard ZZ6305 ball bearings are incorporated in each disc hub. All in-field adjustments do not require the use of spanners. In addition, the bolt sizes chosen were generally the same as those used on the animal drawn mouldboard plough so as to avoid the acquisition of extra spanners.

III. FEATURES OF THE IAE PROTOTYPE DISC RIDGER

IV. CONCLUSION

From the experience gathered and discussion with farmers, the following factors were found to be most crucial in the design and development of the IAE prototype animal drawn disc ridger: The approach, i.e. involving farmers in determining the need for the implement and its requirements; Cost and Versatility as far as acceptability is concerned; Performance, i.e. quality of ridge made, time saving and labour reduction. Further, the role of researchers is mainly to provide technologies as options from which farmers and manufacturers choose.

V. REFERENCES