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AN OVERVIEW ON DESIGN ANALYSIS AND DEVELOPMENT OF AGRICULTURAL ROTAVATOR BLADE

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Abstract: - The soil tilling is an ancient technique applied in farm and rotavator is a tilling machine used in farm for the purpose of soil tilling. Since blade is a crucial part in rotavator and it can manufactured or fabricated in different shapes like L, J and C. The life of blade is crucial factor and it depends on forces coming on blade and force and geometry of blade has direct relationship with each other. This study is aimed at review of design and development of rotavator blade with different blade dimensions for different radius of curvature. This paper describes the overview of design modification and development of rotavator blade through the (CAD) interrogation method by modifying the design and also by modifying the material properties. The results obtained with material changed are compared with each other and the better design will be compared by comparing the results.

Keywords: *Force, Geometry, Blade, Life Span, ANSYS.*

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I INTRODUCTION

Rotary tilling is a widely used tillage operation in Indian farming because of its superior ability to mix, flatten and pulverize soil. However, the use of rotary tiller is strongly restricted to "shallow" tillage because of its high energy requirements. Deep rotary tillage using less energy has recently become a subject of wide interest to combat soil fatigue caused by excessive use of chemicals among other reasons, and to convert paddy fields into dry fields such as kale fields. Rotary Tiller or rotavator is a highly effective machine for intensive tillage. It is one of the most efficient tillage systems when looking for solutions to specific soil tillage problems. No matter the soil type, soil conditions or the amount of residue, Rotavating will always produce the best result. The Rotavator can be easily adjusted for various working depths and soil finishes. The rotating blades chop and mix the residues evenly throughout the working depth, outperforming any other implement. Nowadays, utilization of rotary tillers has been increased in agricultural applications because of simple structure and high efficiency for this type of tillage implements. The geometry of tiller blades is considered to be the most important factor in their design since both the shape of the blade tip and the length of the tiller blade facilitate cutting (Jain-Song, 2007). Hence there is a need to improve the design through geometrical modifications so that will reduce the blade cost as well as land preparation cost. This paper describes the overview of design improvement and development of blade through computational methods.

II LITERATURE REVIEW

Many researchers have developed a computer aided experimental system for design testing and valuation of agricultural tools and equipment. The selected physical model of rotavator have been measured with accurate dimensions and a solid (3-D) model have prepared in CAD-software such as ANSYS, CATIA, Pro/E, hyper mesh etc. by assembling an individual parts with detail specifications.

Subrata Kr. Mandal and Basudeb Bhattacharya [1] investigated design and development of rotavator blade through the interrogation of computer aided design (CAD) method. This paper describes the interaction of Blades with soil in different way than normal plots which are subjected to impact high friction which creates non-uniform forces and unbalancing which result in the wearing of blade.

Gopal U. Shinde and Shyam R. Kajale [2] explained the design optimization of rotary tillage tool by the application of computer aided engineering (CEA) - Techniques on the basis of finite element method and simulation method was done by using CAD-Analysis software for the structural analysis. The different tillage tool parts of rotary tillage tools were geometrically constrained by the preparation of solid model, meshing and simulation was done with actual field performance rating parameters along with boundary conditions.

Rahul Davis [3] experimentally studied the cutting parameter optimization (spindle speed, depth of cut, feed rate) in wet turning EN 24 steel (0.4%C) with hardness 40+2 HRC. In the present work, turning operations were carried out on EN 24

steel by carbide P-30 cutting tool in wet condition and the combination of the optimal levels of the parameters was obtained.

N.M.Zarroug, R.Padmanabhan, B.J.MacDonald, P.Young, M.S.J.Hashmi [4] obtained the results for combined tension-torsion loading tests carried out on Mild Steel (EN8) specimen. The loading of the specimen was carried out in different methods: (i) Maintaining tensile force or axial displacement constant and increasing torque or angle of twist ;(ii) maintaining torque or angle of twist constant and increasing load or axial displacement. A finite element solution of the problem was obtained to gain further insight into the effects of the loading modes.

Godwin R.J, M.J.O Dougherty [5] in the study revealed the integration of a series of models to predict the forces acting on a range of tillage tools from simple plane tines to mould board ploughs. The models adequately reflect the changes in soil strength and implement geometry.

S.B.Venkatsiva, G.Srinivasarao, M.Mahesh Kumar [6] in the study used online monitoring technique-Acoustic Emission (AE), Experiments were carried out distinguish the various phases. This work aimed for better understanding of the growth mechanism and solid state phase transformations that can occur in carbon steel (EN8). It was found from the experiments that the basic parameters by which the phase transformation can be found out are amplitude, RMS, counts and energy.

Mahesh M. Sonekar, Dr. Santosh B. Jaju [7] investigated Failures of the designing the components with maximum stress value well below yield or ultimate stress can be observed. Tests were carried out for time varying loads. Results obtained proved that the component fails at values below yield stress when subjected to time varying load. It can be pointed that below a specific stress value components are not failing at all.

Khalid Usman, Ejaz Ahmad Khan,Niamatullah Khan [8] carried study to evaluate the impact of three tillage systems viz., Zero Tillage (ZT), Reduced Tillage (RT) and Conventional Tillage (CT) and Five N rates on yield and yield components , soil organic matter (SOM), total soil N (TSN) and income of wheat grow after rice. And explained Conservation tillage as well as nitrogen improves soil fertility, yield and income on sustainable basis.

Many researchers have carried out research for design and development of rotavator blades using CAD-software such as ANSYS, CATIA, Pro/E, hyper mesh etc. by assembling an individual parts with detail specifications. Still much more research need to be carried out to find the best design for rotavator blades and to find out behavior of blades during agriculture applications.

III CONCLUSION

The present research paper suggests that much more research need to be carried out to find the best design for rotavator blades to identify and solve problems on the blade. The experimental as well as simulation based work need to be carried out for different material compositions and dimensions and the load conditions for the rotavator blades. By design change of rotavator blade we can increase the working hours of the blades and by using different materials we can increase the wear resistance of the blades.

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