IJARSCT
ISSN (Online) 2581-9429
ISSN (Print) ABCD-PQRS
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 9, Issue 1, September 2020

Design and Analysis of L Shape Rotavator Blade

Mr. Ravindra B. Kankal and Prof. K. R. Sontakke
Scholar of ME(CAD/CAM), Department of Mechanical Engineering
Associate Professor, Department of Mechanical Engineering
Pankaj Laddhad Institute of Technology and Management Studies, Buldhana-443001
kankalravindra04@gmail.com

Abstract: *The design and optimization of rotary tillage tool on the basis of simulation and finite element method is done by using ANSYS software. The different rotary tillage tool parts are geometrically constrained with preparation of solid model of blades and simulation has been done with actual field performance rating parameters along with boundary conditions. The proposed work results are identifying sufficient tolerance in changing the material such as EN 8 steel and EN 24 steel. The dimensions of rotavator blade sections and to rise the life cycle of the blades for a reliable strength. The present geometry working model with tillage blade is analysed to new design change constraints of its geometry for the maximum weed removal efficiency by presenting its analysis results from the field performance*

Keywords: Structural Analysis, Deformation Analysis and Modal Analysis.

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. Rotary tillage machine which is used in soil-bed preparation and weed control in arable field and fruit gardening agriculture. It has a huge capacity for cutting, mixing to topsoil preparing the seedbed directly. And also It has more mixing capacity seven times than a plough. It's components works under miscellaneous forces because of power, vibration, pointless, impact effect of soil parts as after reaching to higher side. The design optimization of tillage tool is obtained by reducing its weight, cost and by improving a field performance to high weed removal efficiency .The computer aided design analysis by preparing a three dimensional solid modelling and finite elements method applications are getting so widespread in the industry.

1.1. Rotavator

Rotary tiller is a tillage machine designed for preparing land suitable for sowing seeds (without overturning of the soil), for eradicating weeds, mixing manure or fertilizer into soil, to break up and renovate pastures for crushing clods etc. It offers an advantage of rapid seedbed preparation and reduced draft compared to conventional tillage. It saved 30-35 % of time and 20-25 % in the cost of operation as compared to tillage by cultivator. It gave higher quality of work (25-30 %) than tillage by cultivator. The Rotavator is the most efficient means of transmitting engine power directly to the soil with no wheel slip and a major reduction in transmission power loss.

1.2 Rotavator In Agriculture

The rotavator will produce a perfect seedbed in fewer passes. It is the ideal implement for cash crop farmers who need to bury and incorporate crop residues quickly, between crops. Tillage tools direct energy into the soil to cause some desired effect such as cutting, breaking, inversion, or movement of soil. Soil is transferred from an initial

IJARSCT
ISSN (Online) 2581-9429
ISSN (Print) ABCD-PQRS
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 9, Issue 1, September 2020

condition to a different condition by this process. A rotavator is a mechanical gardening tool with power blades attached to a spinning surface to plough soil and give optimum tillage. Different rotavator are designed to suit different gardening needs.

II. Literature Review

The different tillage tool parts of rotary tillage tools are geometrically constrained by the preparation of solid model, Meshing and Simulation is done with actual field performance rating parameters along with boundary conditionsThe undesired stress distribution components, it cannot compensate to the operating forces in the field of environment and results in breakdown and failure due to higher stresses and deformation. The proposed work has developed a computer aided experimental system for design testing and valuation of agricultural tools and equipments. The selected physical model of rotavator has been measured with accurate dimensions and 3D solid model is prepared in CAD-software such as ANSYS, CATIA, Pro/E, SOLID Works.

Rotavator with Six Components

1. Independent Top Mast
2. Single / Multi Speed Gear Box
3. Chain/ Gear drive
4. Six Blades per flange
5. Adjustable depths kids
6. Central with offset positions

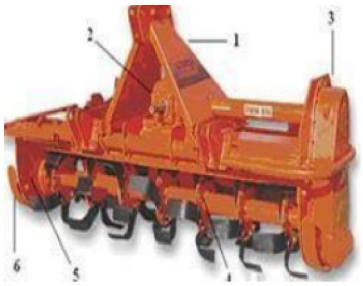

Figure: 3D View of Rotavator

2.1 Blade Configurations

The rotavator is a tillage tool primarily comprising of L-shape blades mounted on flanges that are fixed to a shaft and it is driven by the tractor powertake- off (PTO) shaft. In comparison to passive tools, the rotavator has a superior soil mixing and pulverization capability. During rotavator tillage operations various factors affect its energy requirements. These factors can include soil conditions, operational conditions and rotavator configuration.There are two types of blade configuration used in rotavator. The following blade configuration shows high grade of cultivation,

1. Three blade configuration
2. Two blade configuration

2.1.1 Three Blade Configuration

This is the standard blades configuration and has a three pair of blades per flange except the end flanges which are fitted with one hand only.

2.1.2 Two Blade Configuration

The rotor may be converted into two blade configuration. Two blades per flange used in the rotavator except the end flanges. In this blade configuration, less tendency to the rotor to clog in sticky soil conditions. A cloddy finish can be obtained and rotor can be driven at faster rpm.

IJARSCT
ISSN (Online) 2581-9429
ISSN (Print) ABCD-PQRS
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 9, Issue 1, September 2020

Types of Blade

Rotavator are usually supplied with „power" or L blades for general work. When working in heavy and puggy clay soils, the „speed" or „C" blades should be used.

'L' blade:

The long shank blade as the name implies, has longer shank than the standard power blade. This allows the greater clearance between the blade and rotor. With this, a greater depth of cultivation is obtainable if tractor power and conditions are allowed.

'C' blade

This blade has more efficient self cleaning action, uses less power and produces a coarser finish than the other blades. Other blades like trash, renovating to fit the special rotors for specific applications.

Geometry of the Blades

The dimension details are obtained from real component and design modification will be done by changing geometry are given in the Table.1

Sr. No	Parameters	Notations	Dimensions (mm)	
			Existing blade	New blade
1	Width of blade	W	80	110
2	Effective vertical length	LV	150	220
3	Blade cutting width	BW	10	2x10
4	Blade thickness	T	8	8

Table 1: Dimensions of the blade

In addition to this the following design modification also carried out in the existing blade are shown in Fig. A and Fig. B Adding one more cutting edge on the other side Introduced two more holes to fix with flange in the opposite side as shown in Fig.3

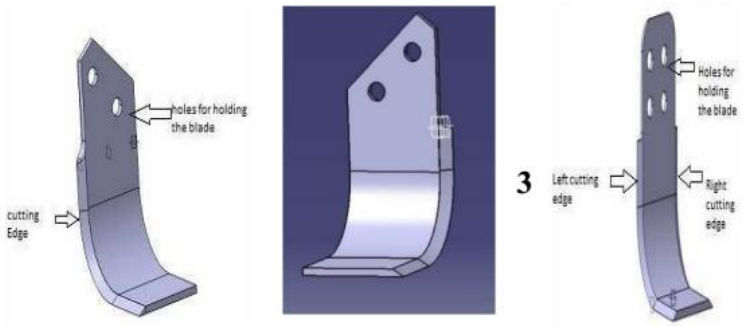

Fig. A Left hand blade Fig. A Right hand blade Fig. B New blade

III. Conclusion

In this Study, Design of rotavator blade is investigated and design modifications are done by introducing one more cutting edge in other side of the blade. After obtaining the geometry of the new blade, structural Analysis for old and new blade is done by using hyper mesh software. From the analysis displacement and stress are compared for new and old blades. The shear, principal and von misses stress are studied from structural analysis. From the above analysis the stress value of new blade is low compared with existing blade. The Finite Element Analysis was done for investigation of stresses experienced by the blade has shown in the above fig1 fig. A comparison was made between the developed blade are made. The results that deformations and stresses are minimum for the developed L-type blade From the above

IJARSCT
ISSN (Online) 2581-9429
ISSN (Print) ABCD-PQRS
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 9, Issue 1, September 2020

analysis of rotavator blades, it is observed that the stress material has been reduced by applying the design change and changing the materials as

- High chromium steel (HCS),
- H13 steel,
- D3 steel.

IV. REFERENCES

[1]. Godwin R.J, O ‟Dogherty M.J (2006),„Integrated soil tillage force prediction models‟ Vol. 44, pp. 3-14.

[2]. Gopal U. Shinde and Shyam R. Kajale (2012) „Design optimization in rotary tillage tool system components by CAEA‟ Vol. 3, No. 3, pp. 279-282.

[3]. Khalid Usman, Ejaz Ahmad Khan, Niamatullah Khan (2013) „Effect of Tillage and Nitrogen on Wheat Production, Economics, and Soil Fertility in Rice-Wheat Cropping System‟ Vol. 4, pp. 17-25.

[4]. Mahesh M. Sonekar 1, Dr. Santosh B. Jaju (2011) „Fracture analysis of exhaust Manifold stud of Mahindra Tractor through finite Element method (FEM) – a past Review‟ Vol. 3, pp. 131-135.

[5]. Rahul Davis (2012) „Optimization of surface roughness in wet turning operation of EN24 steel‟ Vol. 2, Issue 3, pp. 28-35.

[6]. Rahul Davis, Jitendra Singh Madhukar (2012)„ A parameteric analysis and optimization of tool life in dry turning of en24 steel using taguchi method‟ Vol. 3, Issue 1, pp.9-15.

[7]. Subrata Kr. Mandal and Basudeb Bhattacharyya (2013) „Design & Development of rotavator blade: Interrogation of CAD method‟ Vol. 1, No. 10, pp. 439-447.