ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

IJESRT
INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

DESIGN AND STRESS ANALYSIS OF CULTIVATOR TILLAGE DESIGN

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DOI: 10.5281/zenodo.556277

ABSTRACT

In last few decades we all witnessed the development in each field. In the field of agricultural also we had seen remarkable development, big farmers are now a day's using cultivator, harvester, tractor, advance machine tools and advance farm equipments, but in the country like India where more than 70% of farmers are small and marginal and they are still doing farming by traditional method only they are also in need of improved agricultural tools that may be hand driven or bullock driven. In this investigation on failure and analysis of agriculture nine tyne cultivator in different soil condition. Cultivator is important agricultural equipment used for soil preparation in which is stresses are form due to contact of soil, and tyne of cultivator is the actual member to contact the soil and because of this tyne is having a number stresses and find the solution which will minimize determine the stresses. The model of tynes are created by using Creo Parametric software and then by using ANSYS software FEM analysis was done to determine the stresses. The validation of results in good literature Makange et. al. [22], which was also obtained the value of stresses and deformation. In this investigation, the value of stresses and deformation is reducing by using hole and fillet creation in area where maximum stresses are found. Due to hole in tyne the stress and deformation can be reduced. It can be reduced the value of stresses and deformation as compare to Makange et. al. [22].

KEYWORDS: Cultivator Design, Stress Analysis, ANSYS, Creo

INTRODUCTION

The cultivator shovel (sweeps) tools is used for deep soil penetration in place of standard moldboard plows, the loads act on the cultivator components can be very large and, in some cases, may be greater than the manufacturer anticipated in the original facts. This had been resulted in the need for a better understanding of what forces exist under such severe operating conditions so that, if necessary, appropriate changes in design can be made.
Some environmental concerns in the use of herbicides, alternative methods of weed control such as mechanical row crop cultivation is required. Crop cultivation is an excellent method of weed control [2,3,4]. There are basically three types of cultivators: field cultivators, row crop cultivators, and rotary cultivators [1]. Field cultivators are often used as secondary tillage tools for seedbed preparation. They are like chisel plows in appearance but they operate at much shallower depths. Cultivators used in residue-covered fields must allow residue to flow through the implement without clogging. Figure 1 shows the different types of tools that can be attached to a cultivator shank for different applications [1].

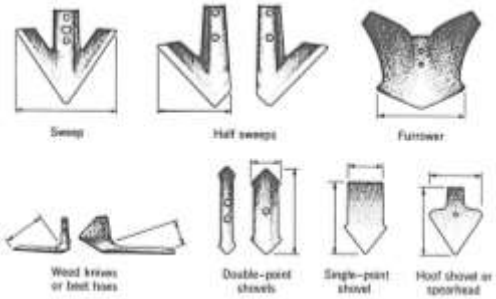

Fig:1 Cultivator Tools

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MATERIALS AND METHODS

Actual Dimensions of traditional Cultivator is taken while preparing solid model
Frame size:180 x 60 cm
Tines spacing :21 cm
Tine size: 45 x 10 x 2 cm
Shovel size :60 mm.

The model is prepared from Creo parametric 2.0 design software and analysis done using FEA tool ANSYS 16.2. The physical dimensions of the choose exist Cultivator model are drafted with its exact geometry and applied all boundary conditions the analysis has been done.

RESULTS AND DISCUSSION

The various results obtained after analysis and optimization has been done using ANSYS. The results are discussed using graphs are bellows.

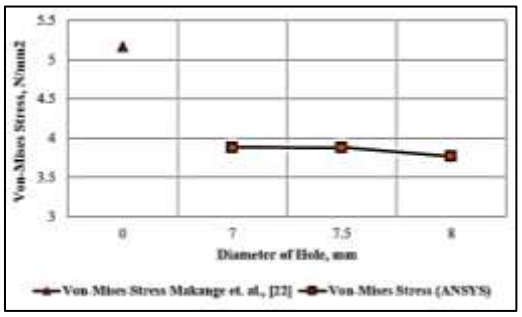

Fig: 2 Graph plotted b/w Von-Mises Stresses developed in cultivator with different hole diameter [Makange et. al., [22] and ANSYS Tool result)

The above figure 2 has been shows that the von-mises stress in cultivator tyne in literature Makange et. al., [22] and present work.

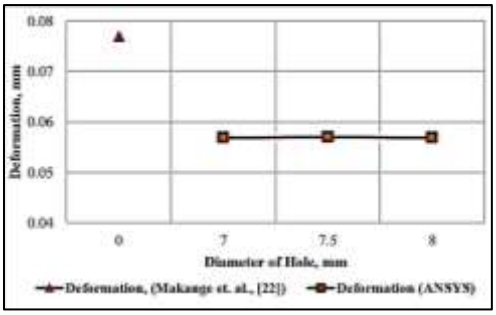

Fig: 3 Graph plotted b/w deformation cultivator with different hole diameter [Makange et. al., [22] and ANSYS Tool result).

The above figure 3 has been shows that the deformation in cultivator tyne in literature Makange et. al., [22] and present work.

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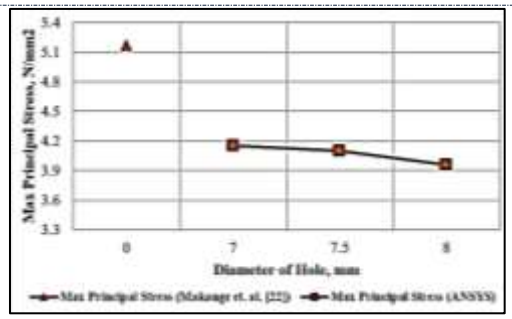

Fig: 4 Graph plotted b/w Maximum principal Stresses developed in cultivator with different hole diameter [Makange et. al., [22] and ANSYS Tool result)

In above graph 4, concluded that the when creating hole in cultivator tyne, the maximum principal stress is also decreased if diameter of hole is 8mm.

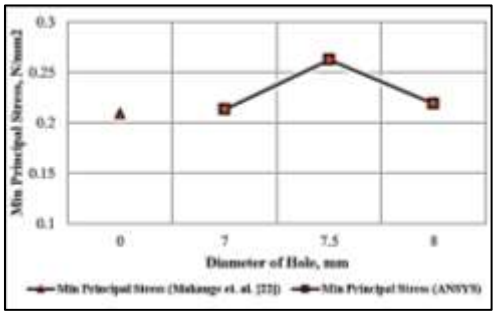

Fig: 5 Graph plotted b/w Minimum Principal Stresses developed in cultivator with different hole diameter [Makange et. al., [22] and ANSYS Tool result).

Also, figure 5, indicates that the when creating of hole in cultivator tyne, the minimum principal stress is also decreased if diameter of hole is 8mm.

CONCLUSION

The following conclusion and future scope can be drawn.

- In present investigation, which concluded that the stress decreased 3.8823, 3.8822 and 3.7656 N/mm2 when diameter of hole is 7mm, 7.5mm and 8mm respectively. The percentage difference between literature Makange et. al., [22] and present work is 27.15%.
- Also in present investigation, which concluded that the deformation decreased 0.056902mm, 0.056982mm and 0.056893mm, when diameter of hole is 7mm, 7.5mm and 8mm respectively. The percentage difference between literature Makange et. al., [22] and present work is 26.1%
- This research work, the maximum principal stress in cultivator are found in this investigation 4.15410 N/mm2, 4.09830 N/mm2 and 3.95930 N/mm2, when diameter of hole is 7mm, 7.5mm and 8mm respectively. The percentage difference between literature and present work is 23.5%. In literature Makange et. al., [22], the principal stress is 5.1726 N/mm2.
- All above discussion it has been finally concluded that the overall the creation of hole in cultivator tyne is gives the best performance to cultivator in different soil conditions.
- After analysis using ANSYS tool the diameter of hole in cultivator tyne, 8mm is best for taking configured cultivator design.

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