International Journal For Technological Research In Engineering
Volume 4, Issue 8, April-2017 *ISSN (Online): 2347 - 4718*

NINE TYNE TILLAGE DESIGN AND ANAYSIS USING FINITE ELEMENT ANALYSIS

Vivek Kumar Bishwa[1], Joji Thomas[2]
[1]M. Tech. Student, [2]Associate Professor,
Department of Mechanical Engineering, CCET, Bhilai, C.G.

Abstract: Now the days the development in the field in agriculture has been increased so the using of cultivator design is most remarkable for the farmer. The cultivator design and analysis was done in this paper. The designed was modeled using Creo parametric and analysis was done in ANSYS. In this paper it is concluded the, if hole was created in cultivator deigned near to the generation of maximum stress concentration was reduced the overall stress, deformation and masses of the model.
Keywords: Cultivator, Finite element analysis, Stresses, Deformation etc.

I. 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 [1]. 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 as shown in figure 1.

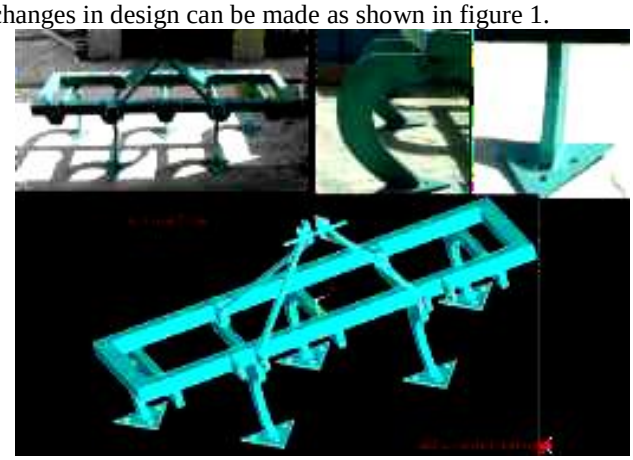

Figure **Error! No text of specified style in document.**. Tine type cultivator tool.

II. MATERIALS

In this paper, the steel materials were used for cultivator design and the dimensions of the traditional cultivator design which was taken while preparing solid model.

- Elastic modulus of material: $2.10x10^5$
- Poisson ratio of material: 0.3
- Frame size:180 x 60 cm
- Tines spacing :21 cm
- Tine size: 45 x 10 x 2 cm
- Shovel size :60 mm.

III. FINITE ELEMENT ANALYSIS

The design and analysis has been carried out with the help of 3D modeling software and FEA technique using standard FEM tool. Creo Parametric 2.0 is used for the modeling assembly of cultivator tyne and ANSYS has been used for the analysis of model. In the boundary condition, cultivator tyne is fixed at top means to the structure of the cultivator. There are a number of steps in the solution procedure using finite element methods. All finite element packages require going through these steps in one form or another.

IV. RESULTS AND DISCUSSION

In this section, the various results have been obtained. The Figure 2 – Figure 5 has been shows the graph plot between various case in this paper was performed.

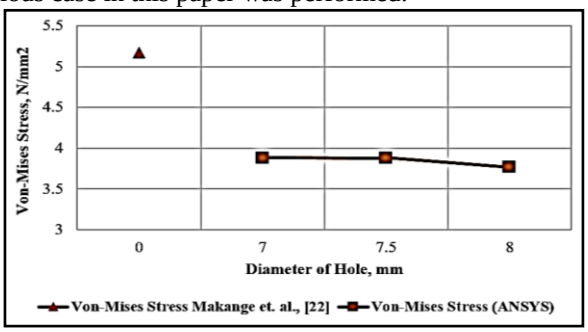

Figure 2. Graph between von-Mises stresses proposed model with different hole diameter [Makange et. al., [22] and ANSYS Tool result)

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

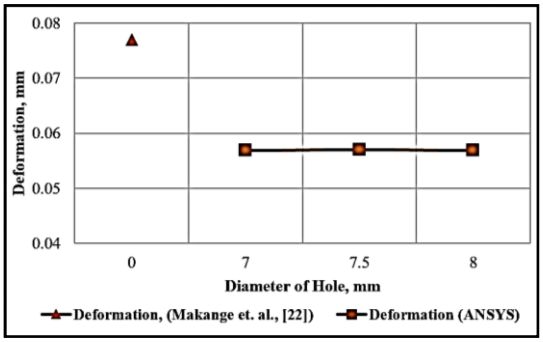

Figure 3. Graph between deformation in proposed model with different hole diameter [Makange et. al., [22] and ANSYS Tool result).

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

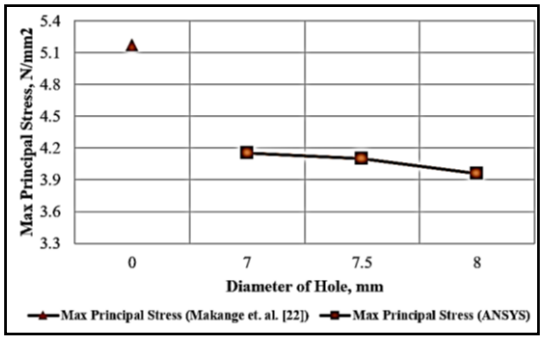

Figure 4. Graph between maximum principal stresses in proposed model with different hole diameter [Makange et. al., [22] and ANSYS Tool result)

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

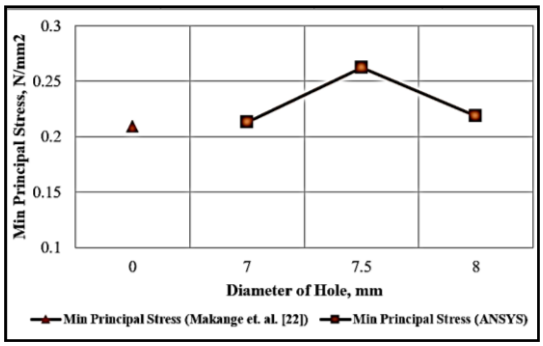

Figure 5. Graph between minimum principal stresses in proposed model with different hole diameter [Makange et. al., [22] and ANSYS Tool result).

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.

V. CONCLUSION

The following conclusion and future scope can be drawn.

- In this paper, it is 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 proposed model is 27.15%.
- Also in present work, 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 proposed model is 26.1%
- This paper concluded 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 was suitable for further design and application.

REFERENCES

[1] A. K. Srivastava, C. E. Goering, R. P. Rohrbach, and D. R. Buckmaster, "Soil tillage. Chapter 8 in Engineering Principles of Agricultural Machines," 2nd ed., St. Joseph, Michigan: ASABE. Copyright American Society of Agricultural and Biological Engineers, 2006, pp. 169-230.

[2] H. M. Hanna, R. G. Hartzler and D. C. Erbach, "High-speed Cultivation and Banding for Weed Management in No-Tillage Corn", Applied Engineering in Agriculture, vol. 16, 2000, pp. 359-365.

[3] K. R. Paarlberg, H. M. Hanna, D. C. Erbach and R. G. Hartzler, "Cultivator Design for Interrow Weed Control in No-till Corn," Applied Engineering in Agriculture, vol. 14, 1998, pp. 353-361.

[4] P. Sullivan, "Principles of Sustainable Weed Management for Croplands," ATTRA Publication #IP039, 2003, available at: http://attra.ncat.org/attraa-pub/PDF/weed.pdf.

[5] Hoggart C. White, Matching Tractor Horsepower and Farm Implement Size. Guidelines for better Family farming, 2001.

[6] W. F. Baillie and G H Vasey, Graphical representation of tractor performance, Journal of the Institution of Engineers, 41(6): 83-92, 1969.

[7] Umesh N. Galat, Ajay N. Ingale, "Failure Investigation & Analysis of Agricultural 9 Tyne Cultivator Used In Various Soil Condition", International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 4 Issue: 1 173 – 179, 2016.

[8] Subrata Kr Mandal, Dr. Atanu Maity, Ashok Prasad, Palash Kr Maji, Sankar Karmakar, "Design & Development of a Suitable Implement Matching with Low HP Tractor", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 02 Issue: 02 2015.

[9] S. A. Al-Suhaibani, A. E. Ghaly, "Comparative Study of the Kinetic Parameters of Three ChiselPlows Operating At DifferentDepthsand Forward Speed In A Sandy Soil," IJES. Vol 2 Issue 7 Pages 42-59 2013.

[10] Mehmet Topakci 1, H. Kursat Celik 2 "Deep tillage tool optimization by means of finite element method: Case study for a subsoiler tine," Journal of Food, Agriculture & Environment Vol.8 (2): 531-536. 2010.

[11] G. C. Kiss1, and D. G. Bellow2, "An Analysis Of Forces On Cultivator Sweeps And Spikes" Can. Agric. Eng. 23 77-83.

[12] U. R. Badegaonkar1, G. Dixit2 and K. K. Pathak3, " An experimental investigation of cultivator shank shape on draft requirement", Archives of Applied Science Research, 2010, 2 (6): 246-255.

[13] R. L. Raper "Force Requirements And Soil Disruption Of Straight And Bentleg Subsoilers For Conservation Tillage System" Applied Engineering in Agriculture 2005 American Society of Agricultural Engineers ISSN 0883−8542 Vol. 21(5): 787−794.

[14] R. Bernik1 and F. Vucˇajnk2 "The effect of cultivator/ridger type on the physical properties of ridge, power requirement and potato yield", Irish Journal of Agricultural and Food Research 47: 53–67, 2008.

[15] S. Gebregziabher1 A.M. Mouazen2 "Design of the Ethiopian and plough using structural analysis validated with finite element analysis" Bio systems Eng I N E E R I N G 97 (2007) 27 – 39.

[16] Gopal U. Shinde1, Shyam R. Kajale2 "Computer aided engineering analysis and design optimization of rotary tillage tool components" 10.3965/j.issn.1934 6344.2011.03.001-006.

[17] L.J. Niemand1 J. Wannenburg2 "Profile optimization of a cultivator shank" R & D fournal, 1995, II(1) page 7-11".

[18] Prof. A. B. Tupkar1, Partha Pratim Roy2, Design And Fabrication Of Soil Rudder And Weeder For Soil Fertility & Fertilization, Tupkar AB, ISSN: 2319-50 7X IJPRET, 2013; Volume 1(8): 55-60

[19] Ms. Pooja M. Raut 1, Dr. G. V. Thakre 2, "Fem Analysis Of Nine Tyne Medium Duty Cultivator IORD Journal of Science & Technology E-ISSN: 2348-0831 Volume 1, Issue V, 2014, PP 58-65.

[20] Yousef Abbaspour, Malek Bavafa et. al., "Design and Construction of a High Speed Inter-Row Cultivator", Applied Mechanics and Materials Vols 110-116, pp 4914-4918, 2012, Trans Tech Publications, Switzerland, doi:10.4028.

[21] R. H. Macmillan, "The Mechanics of Tractor - Implement Performance", A Textbook for Students and Engineers, Senior Academic Associate, Agricultural Engineering International Development Technologies Centre University of Melbourne, October 2002.

[22] N.R. Makange, R.P. Parmar and V.K. Tiwari, "Stress Analysis on Tyne of Cultivator Using Finite Element Method", Trends in Biosciences 8(15), Print: ISSN 0974-8, 3919-3923, 2015.

