FAILURE INVESTIGATION OF AGRICULTURAL 9 TYNE CULTIVATORS USED IN VARIOUS SOIL CONDITION A REVIEW

Umesh N. Galat[1], Ajay N. Ingale[2] , Pooja M. Raut[3]

[1] *Mtech student, Mechanical Engineering Department, Data Meghe institute of engineering and Research Sawangi , Wardha,Maharashtra,India*
[2] *Asst. Prof. Mechanical Engineering Department Data Meghe institute of engineering and Research Sawangi , Wardha,Maharashtra,India*
[3] *Asst. Prof. Mechanical Engineering Department, shri Shankar Prasad Agnihotri college of Engineering, Maharashtra, India*

ABSTRACT

In last few decades we all witnessed the development in each and every field. In the field of agricultural also we had seen remarkable development, big farmers are now a day's using cultivator, harvester, tractor, advan ce 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 Review paper 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. To analyze this tyne mechanism using FEM, firstly a proper CAD model has been developed using Pro/E cad software. Then by using ANSYs software FEM analysis have been done to determine the stresses.

Keyword: - *Nine Tyne Cultivator, FEM, Design Analysis ANSYS.*

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1. INTRODUCTION

Cultivator Tools:

Tillage tools are directly energy in to the soil to cause some desired effect such as cutting, breaking, inversion or movement of soil. Soil is transferred from an initial condition to a different final condition by this process. Soil working tools such as mould board ploughs, disc ploughs and ridges have long been accepted and successfully used by farmer under average field condition. Seedbed preparation greatly contributes towards the overall cost of farm operations, employing that significant savings are possible through optimized design and development of tillage machinery.

Primary and secondary soil manipulation is the basic operation required for cultivation of any kind of crop. Soil manipulating tools should withstand adverse field conditions, such as the pres ence of a hardpan, small rocky formations stumps stable during soil engagement without failure. Soil working tools such as mould board ploughs, disc ploughs and ridger has long been accepted and successfully used by farmers under average field conditions.

The duck foot sweep is another kind of soil engaging tool that is popular amongst farmers for secondary field operations because of its large wing width, which causes better coverage of soil manipulation between two furrows. Cultivators groups such as small, farm, field and row types can be described as

A) Small cultivators: it is used for gardening, powered by small motors, and controlled by an operator walking behind. Garden cultivators can be used to mix soils with manures and fertilizers in preparation for planting

B) Farm cultivators: A tractor-mounted tiller Cultivators are pulled by tractors and can vary greatly in size and shape, from 10 feet (3 m) to 80 feet (24 m) wide. Many are equipped with hydraulic wings that fold up to make road travel easier and safer..

C) Field cultivator: Field cultivators are used to complete tillage operations in many types of arable crops fields. The main function of the field cultivator is to prepare a proper seedbed for the crop to be planted into, to bury crop residue in the soil (helping to warm the soil before planting), to control weeds, and to mix and incorporate the soil to ensure the growing crop has enough water and nutrients to grow well during the growing season.

D) Row crop cultivator: The main function of the row crop cultivator is weed control between the rows of an established crop.

- Types of cultivator on the basis of geometrical features

Disc cultivator: It is cultivator fitted with disc.

Tine cultivator: It is a type fitted with tines having blades.

Rotary cultivator: It is a cultivator with tines or blades mounted on a power driven-horizontal shaft. Depending upon type of power available for the implements, the cultivator can be classified as: **1.Tractor drawn 2.Animal drawn**.

a) Trailed type cultivator: It consists of a main frame which carries a number of cross members to which tines are fitted. A pair of wheel is provided in the cultivator. The lift is operated by both wheels simultaneously so that draft remains even and uniform.

b) Mounted cultivator: Tractors fitted with hydraulic lift operate the mounted type cultivators.

c). Cultivator with spring loaded tines: A tine hinged to the frame and loaded with a spring so that it swings back when an obstacle is encountered, is called spring loaded tine.

d) Cultivator with rigid tines: Rigid tines of the cultivator are those tines which do not deflect during the work in the field.

e) Duck foot cultivator: It is type of rigid cultivator which is used mostly for shallow ploughing, destruction of weed and retention of moisture.

f) Animal drawn cultivator: Depending upon local conditions, soil and climate, different types of cultivators have been designed and are being used extensively throughout country. Three tined cultivators with seeding attachment are popular in some part of the country.

2. LITERATURE REVIEW

Literature review is a body of text that aims to review the critical points of current knowledge and or scientific methodological approaches on the topic related to the study. In this chapter, literature will give information about the Various cultivator and its tTyne The main focus is tyne analysis and Failure investigation

S. A. Al-Suhaibani[1], A. E. Ghaly[2] [1] The effects of plowing depth and forward speeds on draft, unit draft, draft per shank, vertical specific draft, horizontal specific draft and coefficient of pull were evaluated. The results indicated that increasing the plowing depth and/or the forward speed increased the draft, unit draft and vertical specific draft. Also, increasing the plowing depth increased the horizontal specific draft and the coefficient of pull, while increasing the speed decreased the horizontal specific draft and the coefficient of pull. About 16.6% of the draft force was directed towards cutting the soil and 83.4% was consumed in pulverization of soil particles. The values of the vertical specific draft were much higher than those of the horizontal specific draft for all plowing depths and forward speeds. The plowing depth had more pronounced effect on the draft, unit draft, specific draft and coefficient of pull than the forward speed. The optimum forward speed was 1.75 m/sec. The recommended plowing depth should be based on the type of crop (depth of the root system).Shallow seed placement (less than 25 mm) is recommended for most crops that are directly seeded. However, the depth of the crop roots to be raised is a deterministic factor of plowing depth, while the availability of time and implement width will determine the speed required to finish the work on time. The results obtained from this study indicated that the depth has more effect on the draft. Therefore, the depth of plowing should be determined based on the root length.

Mehmet Topakci [1], H. Kursat Celik [2] [2] This study was focused on the structural optimization of agricultural deep tillage machinery and tools by means of CAE applications. For this purpose, a case study was constructed and presented. A subsoiler which has three tines was used in the case study. According to the study, a number of points can be summarized as follows: 1. Maximum draft force of the subsoiler was calculated as 38.32 kN in the field experiments. This means that each tine has 12.773 kN maximum draft forces. 2. In the FEM stress analysis, the maximum equivalent stress was 432.490 MPa, and a total deflection of 18.116 mm was obtained on the initial design of the tine. When compared with the yield point of the tine material, the results signified that there was plastic deformation occurring on the tine. 3. A "what-if" parameter strategy was used in the optimization study and in total, 45 design sets were created and solved. After consideration of all of the results, design set number 34 was agreed as the optimum design of the tine under the defined conditions. 4. The final desig n of the tine has maximum global stress of 346.61 MPa and maximum total deflection of 12.116 mm. 5. Total mass of the tine was reduced by 0.367 kg, the equivalent of 2.01%.

G. C. Kiss[1], and D. G. Bellow[2] [3] Extensive measurements on the forces involved in using sweep cultivators and spikes were undertaken at five different test sites at which depth and speed were varied with the following conclusions. 1. Draft force increased with depth of cultivation and could be approximated with an equation similar to that published by the American Society of Agricultural Engineers. Additional regression analysis is given to show the load distribution be tween leading and trailing sweeps and spikes. 2. The draft force of a trailing sweep was approximately 27% less than mea sured on the leading (and overlapping) sweep and the draft force of a spike was approximately 34% less than the draft force of a leading sweep. 3. Lateral and vertical forces were me asured up to 20% of the draft force. However, lateral forces were generally small or non-existant for leading sweeps and spikes. 4. Tool forces did not appear to be aff ected by speed in the range 6-12 km/h for the cultivator sweep evaluated. 5. Predominant frequencies of vibra tion of the implements tested were obs erved in the range 1 to 9 Hz. Although some peaks were noted at higher frequencies.

U. R. Badegaonkar[1], G. Dixit[2] and K. K. Pathak[3] [4] An increase in horizontal and vertical forces was observed with increasing depth for all experimental shanks having different bend length, bend angle and width. The analysis of variance showed that the effect of design parameters of shank and operational variables and their interactive effect on draft and vertical force was significant. Lateral forces were found to be negligible or non-existent. On the basis of minimum draft requirement, the optimum values of bend length and bend angle for cultivator shank were found to be 200 mm and 300 respectively. The width of shank was optimized as 35 mm, considering the advantage of width in minimizing the lateral bending of shank which may occur due to accidental lateral forces at the time of turning.

R. L. Raper [5] When both aboveground and belowground disruptions were considered, the two shanks that performed the best were the BBP shank and BWT shank. The BBP shank had the west SRI for both soil types and one of the two lowest for the BWT shank. Either of these two shanks should be very useful in conservation tillage systems where draft force and aboveground soil disruption should be minimized and belowground soil disruption should be maximized. Even though soil bin experiments were limited in their scope compared to actual field experiments, important trends794 Applied Engineering in Agriculture were detected that provided engineers with enhanced capabilities to design better field equipment. Differences found in this experiment from actual field condition secluded soil condition and speed of operation .Because the soil use in the soil bin experiment did not contain any organic material and was not stratified with depth, the magnitude of the results obviously differed from actual field results. However, the trends in the data were similar and allowed important differences in forces and disruption to be found. Also, the speed of operation for soil bin experiment saws typically slower than found in actual field experiments. Speed obviously affects aboveground and below ground disruption. However, increased speed should result in increased disruption for all implements and still result insignificant differences being found. The conclusions that were drawn from this experiment were: The bent leg shanks had the lowest draft requirements as compared to the straight shanks for both soil types. Also requiring small amounts of draft was the SK45 stra ight shank. The bent leg shanks were found to generate more side forehand the straight shanks. The BBP and BWT shanks had the lowest above ground soil disruption. The SDW shank had the largest belowground soil disruption. Using the two parameters defined in this article, spoil resistance index and trench specific resistance, enables twos hanks to stand out in their ability to require minimal draft once and aboveground soil disruption while providing maximum belowground soil disruption. The two best shanks for conservation tillage systems based on these selection criteria were the BBP shank and the BWT shank

R. Bernik[1] and F. Vucˇajnk[2] [6] On medium-textured soil in the climatic situation distinctive of South-East Europe, the PTO-driven cultivator/ Ridger was justifiable because it produced ridges with better physical properties than the two This analysis should use similar parameters as our present research. We assume that it would additionally justify the use of the PTO-driven cultivator in potato cultivation on medium-textured soil in South-East Europe.

S. Gebregziabher[1] A.M. Mouazen[2] [7] Mathematical descriptions based on traditional calculations were developed, considering the static analysis of the implement structure of the ard plough at equilibrium condition. The traditional calculations were then verified by means of finite element (FE) analysis and ABAQUS software, with error less than 3% (draught capacity) and 5% (vertical capacity) for working rake angles of p301. Based on the existing structure and the parametric relations developed, the following general design considerations and guidelines are foreseen: For stable operation, the relation vertical forces should be in equilibrium. For high resistive soil, the operator needs to apply a force on the handle to assist the plough to penetrate soil during tillage process. The alignment of the line of pull with the line of pulling of the resultant force acting on the plough body could benefit in minimizing impact of bending moment. Such an arrangement decreases the bending moment on the beam so that the beam is subjected mainly to tension and therefore a lighter beam can be used.

Gopal U. Shinde[1], Shyam R. Kajale[2] [8] A rotary tillage tool such as Rotavator is designed in computer aided design software. The rotary motion and soil surface interaction is considered with respect to the soil Vs. tillage tool dynamics by considering the following factors effecting the tillage operation such as tractor power (hp), maximum peripheral force (N), rotavator tyne velocity (m/s), tractor transmission efficiency (0.9 for concurrent revolution and 0.8-0.9 for reversed rotary), soil resistance to 0.7-0.8, radius of rotary (mm). The design analysis executed following results[10]. The following Figure 2 shows the Resultant stress and displacement for 35 hp and 45 hp tractors along with safety coefficients. Maximum peripheral force on rotary blade 6031.08975 (for 35 hp) N and 7041.17 N (for 45 hp) Torque=270600 N-mm (for 35 hp) and 315920 N-mm

L.J. Niemand[1] J. Wannenburg[2] [9] In terms of desirable stress the optimal design gives a remarkable improvement compared to that of the standard design. From a manufacturing point of view, the solution is feasible, since the manufacturer may use off-the-shelf spring steel flat bars. When the values of the angle 0s increases, the stiffness of section CD decreases and the stiffness of section AB increases accordingly. This ensures that the material in section CD contributes more to the deformation and load absorption. This new design lessens the stressing of the shank significantly and therefore leads to improved durability.

Prof. A. B. Tupkar[1], Partha Pratim Roy[2] [10] Conclusion of the project work is that it helps the students to their imagination, engineering skills and fundamental knowledge. This semi automatic machine is developed to reduce the time and effort required for production up to the great extent .also this machine manufacturing cost is less as compared to other. By selecting above topic we are understand , familiar and know the details of agricultural technology, with the help of this semi automatic machine we are trying to reduce labor cost, time of a middle class and small sector farmers. This is our little effort to make comfort to our farmers also this machine is manufactured in less cost as compared to other. The project also teaches the way of working as a unity proper co ordination is to be established with student in the project group. it enhance the thinking or filling of mutual co operation in the project Also the project tees learn to fabricate any model according to its requirements. All the manufacturing processes are carried out with a great concentration; any wrong calculation may have result in the failure of project model. Development of high capacity energy efficient versatile machines and combination machinery for increased labour productivity, reduced unit cost of operation, improved timeliness of operation and suitable for custom hiring.

Ms. Pooja M. Raut [1], Dr. G. V. Thakre [2] [11] The analysis of Nine Tyne Medium Duty Cultivator is carried out to find out the failure in the shovel due to different loading condition at different speed. By conducting FEM analysis of existing model it has been observed that the shovel gets break due to impact force on the shovel of material En45 at very low speed. Accordingly I change the material of shovel Boron Steel it is suitable material for Shovel. Modern engineering tools like CAD, CAM, FEM, QFD and RP etc are the powerful tools for the manufacturing of improved agricultural tools. By using CAD/CAM technology visualization, Color selection, checking interference between mating parts of an assembly, Modifying and improvement in the models of the components become easy. Also this technology helpful in preparing detailed component drawings and assembly drawings. By using FEM technology it is possible to analyze correctly different type of stress which is going too developed on the product with the different loading condition. Also by applying this technology it is possible to overcome all the problem of intuitive manufacturing and produced the improved tools with good quality, improved life and cheaper in cost.

3. CONCLUSION

From the literature review it is concluded that Cultivator is the one of Important Device which is Form Directly Stress due to Contact of soil and Tyne of cultivator is the actual member to contact the soil. and Tyne is having a number stress but we conclude shear stress is maximum form as compare to other Stress. And we have the better solution to minimize the shear stress to improve life and efficiency of tyne.

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