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A Review on Problem Identification in Tyne for 5-Tyne Duck Foot Cultivator

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Abstract: ***In last few decades we all witnessed the development in each and every field. Also 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 80% 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 paper a review on design modification of tyne for 5 tyne duck foot cultivator is presented. For soil preparation Cultivator is important agricultural equipment. The main objective of this analysis is to study the existing design of tyne and analyse it.***

Keywords: Duck Foot, Cultivator, Tyne, Shovel

I. INTRODUCTION

Tractor operated 5 tyne duck foot cultivator is one of recently popularized implement being used by the farmers for primary tillage operation to plough the field. Cultivators are used to break up, stir and pulverized the soil. They are pulled behind tractors using either a three-point linkage or a tractor drawbar. Cultivators are generally used before plough to till the soil and prepare it for the dispersing of seeds and after the crops are sowed. They can provide other functions, such as removing and destroying weeds, as well as fertilizing the soil and covering seeds with soil.

In market various companies are available that manufacture different type of cultivators according to their suitability to application and wide range of power to drive it.

To execute this study, Raj 5 Tyne Duck Foot cultivator is taken into consideration to check its maximum cutting depth and calculate the stresses on tyne during on field operation.

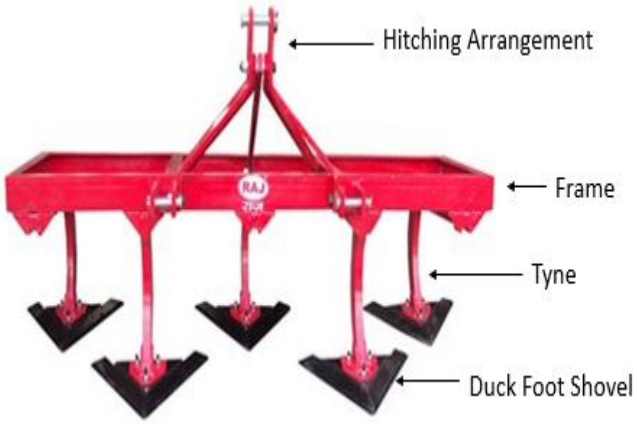


Fig 1.1 : 5-Tyne Duck Foot Cultivator

The duck foot cultivator consists of a box type steel rectangular frame, rigid tynes and sweeps. The sweeps are triangular in shape similar to foot of duck, hence called duck foot cultivator. The sweeps are made from En45 material and joined to tynes with fasteners, which makes them replaceable after being worn out or becoming dull. The tynes are made of mild steel flat and forged to shape. The equipment is mounted to the tractor with three point hitch and operation in the field is controlled through hydraulic system of the tractor. The implement is mostly used for shallow ploughing and in hard soils. The equipment is generally available in two sizes depending on the number of sweeps as five or seven.

II. LITERATURE REVIEW

The study of various researchers has been carried in detail under the literature review. By conducting literature review it has been observed that different researchers had analyzed different implements like subsoiler, rotary tiller (rotavator), mould board plough, sweep cultivator (duck foot cultivator) etc. It is presented as under

1) *Manikandan, G. et al. (2021),* had studied the draft requirement of five tyne duck foot plough in clay soil for different soil moisture content, depth of operation and forward speed of tractor using a specially designed three-point hitch dynamometer. The designed dynamometer was matched with the tractors having category II or III hitch systems. The investigation was carried out at that three levels soil moisture content (10-13%, 14-16% and 17-20%), at three different depth of operation (15, 20 and 25 cm) and three levels of the forward speed of tractor (3, 5 and 7 km h-1). The designed dynamometer performed well in all the levels of the experiment. The results showed that draft force required for five tyne duck foot plough was increased (408 kg) with an increase in soil moisture content (17-20%), depth of operation (25 cm) and forward speed of tractor (7 km/h). The suitable sweep, the forward speed of operation, depth of operation and soil moisture content that influenced the draft force and energy consumption for tillage operation of duck foot type plough were identified and developed duck foot plough was better coverage with better soil operation.
2) *Mr. R.L. Raper (2005),* administered a study on force requirements and soil disruption of straight and bent leg subsoilers for conservation tillage systems. to help in choosing the simplest shank for strip-tillage systems, comparisons among several shanks commonly used to provide in-row subsoiling before planting in conservation systems were made. it's observed that the bent leg shanks had low draft requirements as compared to the straight shanks for both soil types
3) *Mehmet Topakci. et al. (2010),* focused on obtaining optimum geometry parameters of a subsoiler tine by using computer aided engineering (CAE) applications. A field experiment was conducted to determine draft force of the subsoiler. The results from the experimental study were used in the finite element analysis (FEA) to simulate stress distributions on the subsoiler tine.
4) *U. R. Badegaonkar et al. (2010),* had investigate the effect of shank geometry on draft requirement under simulated conditions. Experiments were conducted in a soil bin sizing L:W: H as 16.0 : 2.5 : 1.0 m. The shank geometry was varied with respect to bend angle and bend length. Bend angles of 0^0, 15^0, 30^0 and 40^0 and bend lengths of 150, 200 and 250 mm were used in experimentation in the soil bin under uniform conditions, at 50, 100, 150 and 200 mm depth levels. Using the experimental results, the bend angle and bend length were parametrically optimized for the shank of duck foot cultivator. A significant increase in draft was observed for all the shanks with increase in tillage depth. Shank with 300 bend angle and 200 mm bend length gave minimum force at all depth of operation, as compared to other shanks.
5) *According to R. L. Raper and A. K. Sharma (2004),* a decent seedbed is usually considered to imply finer particles and greater firmness within the vicinity of seeds. In arid and semi arid areas with high average soil temperature and dry spells, there is a need to break the soil, which becomes very hard. A pointed tool like chisel or bar point are used on country plough to break soil without inverting or disturbing crop residue, in order to collect and store rain water and reduce wind erosion and evaporation losses. Under such conditions list plough, rigid tine cultivator, duck foot sweeps and other similar equipment are useful and may be operated for one or two passes. One of the important parameters for performance evaluation of these tools is soil disruption. This depends on type of soil, depth, speed of operation and design of tyne on which they are mounted.
6) *Prof. Srinivasan. K and Prof. Viswanath R. P,* researched rotavator blades. The purpose of their research is to design and make the Rotavator Blade have a better life and be more efficient on the field. Therefore, any improvement in the performance of the same field can also increase productivity in the agricultural sector. Within the study they had various kinematic and static analysis statistics on rotavator blades and various soil areas were also analyzed by the appropriate failure model and finally described the effect of flexible analysis of rotavator blades during planting using soil. FEA Abaqus tool.

III.FORMULATION OF PROBLEM

A. *Research Gap*

After conducting a detailed literature review it is observed that so many authors had carried out FME analysis on tynes and shovels of cultivator. In particular there is very less research done on modification of shovel design especially in case of duck foot cultivator. Shovel design play a vital role in performance of cultivator. It needs to be modified so as to get maximum work done within reasonable time.

B. Formulation Of Problem

It has been observed that there are frequent complaints from customer performance of 5-tyne duck foot cultivator. Customer experienced that the tillage depth is less as compared to other brand cultivators. They get only 6 to 7 inches depth with the cultivator. Also if they lower the draft position to get more depth sometimes the cultivator gets stuck in soil which leads to tyre slippage and to free the cultivator they have to raise the draft up and again restart the work.

IV. PROPOSED METHODOLOGY

Methodology refers to the discussion regarding the specific method chosen and used in a research paper. In other words, the methodology represents the technical steps involved in conducting the research. For the successful completion of any project, work must be in the proper direction. The flow chart is given to show the proper direction.

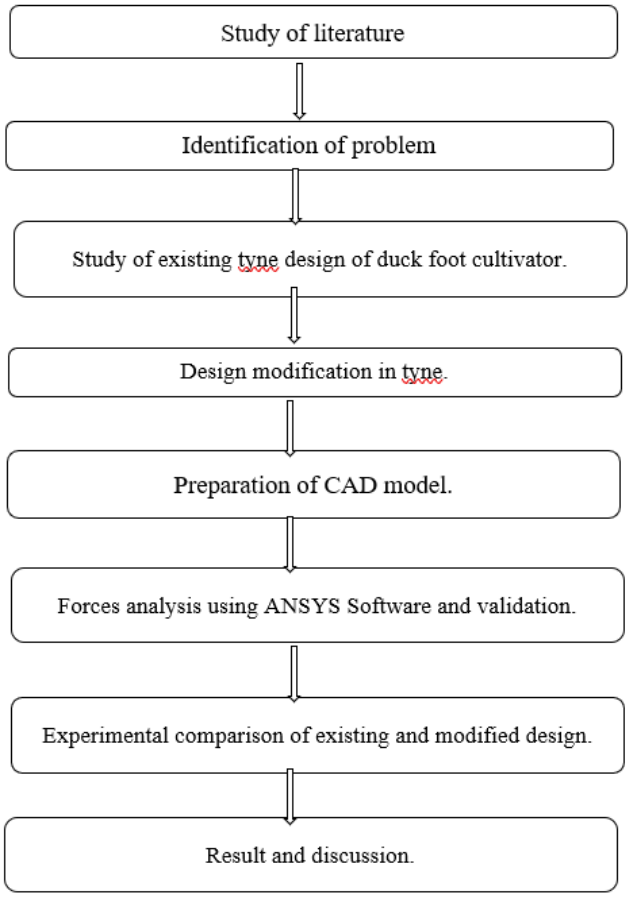


Fig. 2 Methodology chart

A. Study of Literature Review

This help to select the direction of work. The researchers who have already worked on the rotavator and rotor shaft assembly parts will be studied and from their reference, further work will be carried forward.

B. Identification of Problem

No mechanism or no system is ideal. Every system consists of some problem. Therefore to make the system more economic and useful, identification of problems must be done. Once the problem in the system is identified it can be solved by properly studying it and giving the best possible solution.

C. Study of Existing tyne design of Duck Foot Cultivator

Within this, the overall tyne and shovel design will be study including the forces acting it, the material used, and other general specifications of cultivator.

D. Design Modification in tyne

Once the design is studied, suggest the possible modifications in tyne or shovel design which may overcome the identified problems.

E. Preparation of CAD model.

Prepare the CAD model of the existing as well as suggested modified design of cultivator. For modeling purposes, we use CATIA V5R21.

F. Forces analysis using ANSYS Software and Validation

After modeling both the existing and modified designs are analyze for sustainable condition and this analysis will be done by using ANSYS WORKBENCH 19.2 and generated results will be compared.

G. Experimental Comparison of Existing and Modified Design.

After preparation of CAD model a prototype of modifies design will be fabricated and a on field experimental trials are performed for both the designs to check the performance gap between both designs.

H. Result and Discussion

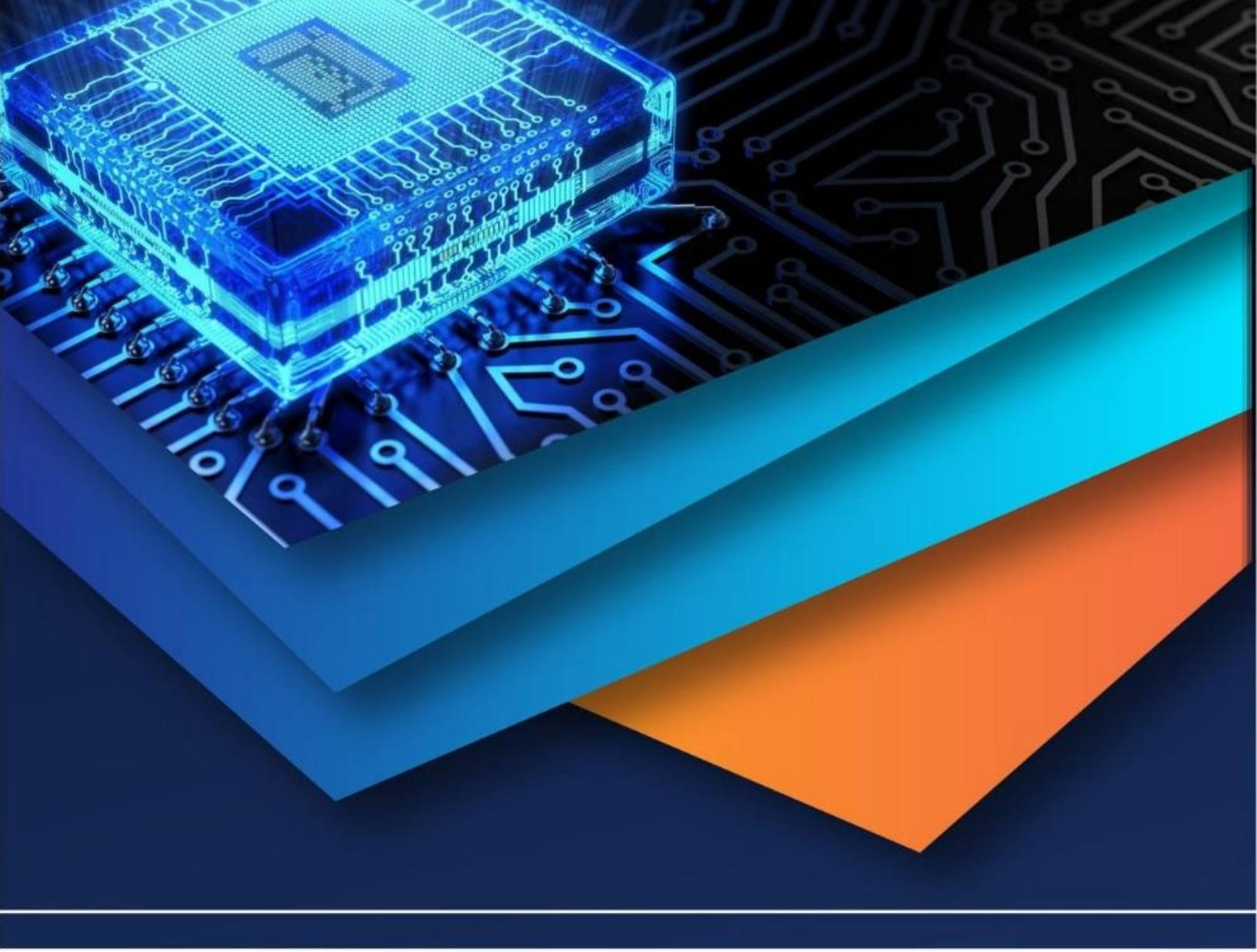
Compare existing and modified design on the basis of demonstration and ANYSYS results and find the conclusion.

V. CONCLUSION

This study will helps understand the working of duck foot cultivator. Knowing the working pattern helps to identify the problems which occurs during the field operations. Through this study it has been observed that the cultivator will perform better if its tyne and shovel are modified. It will have better soil removal rate which results in faster soil preparation for sowing. By using CAD/CAM technology, modifying and improvement in the models of the components become easy. 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.

REFERENCES

[1] Manikandan, G. , Shridar, B. , & Jesudas, D. M. . (2021) “Draft measurement of five tyne duck foot plough in clay soil”, Journal of Applied and Natural Science, 13(SI), 73 - 79.
[2] 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.
[3] Topakci Mehmet & Celik, H. Kursat & Canakci, Murad & Rennie, Allan & Akinci, Ibrahim & Karayel, Davut. (2010) “Deep tillage tool optimization by means of finite element method: Case study for a subsoiler tine”, International Journal of Food, Agriculture & Environment. 8. 531-536.
[4] U. R. Badegaonkar, G. Dixit and K. K. Pathak, " An experimental investigation of cultivator shank shape on draft requirement", Archives of Applied Science Research, 2010, 2 (6): 246-255.
[5] R. L. Raper, A.K Sharma. Soil moisture effects on energy requirements and soil disruption, of subsoiling a coastal plain soil. Transactions of the ASAE. 47 (6) : 1899-1905; 2004.
[6] Prof. Srinivasan. K, Prof. Viswanath R. P, ‘Design and Optimisation of Blades for Rotavators’, IJIRSAT, Volume 4, Special Issue 4, April 2015.



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