Journal Homepage: - www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI: 10.21474/IJAR01
DOI URL: http://dx.doi.org/10.21474/IJAR01

RESEARCH ARTICLE

National Conference on Innovation in Science, Engineering and Management (NCISEM-2022)
Date of Conference 11-12 March 2022

A REVIEW ON DESIGN MODIFICATION AND ANALYSIS OF TYNE FOR 5-TYNE DUCK FOOT CULTIVATOR

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Manuscript Info

Key words:-
Tyne, Duck Foot Shovel, Cultivator

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 analysis 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.

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 the project future, 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.

The duck foot cultivator consists of a mild steel C-Section rectangular frame, rigid tynes and sweeps. Leaf spring steel sweeps in the shape of duck foot are used. The sweeps are fitted fashionably to replace, when worn out.

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Figure 1:- 5-Tyne Duck Foot Cultivator.

Literature Review:-

In order to study the earlier work that has be carried out related to the topic and also to get an idea regarding the topic or related to topic from research papers, books, etc., the literature survey has been carried out. A comprehensive literature review of some selective research papers has been elaborated below.

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%), whereas it was increased (408 kg) with an increase in depth of operation (25 cm) and forward speed of tractor (7 km h-1). 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) carried out a study on force requirements and soil disruption of straight and bentlegsubsoilers for conservation tillage systems. To assist in choosing the best shank for strip-tillage systems, comparisons among several shanks commonly used to provide in-row subsoiling prior to planting in conservation systems were made. A portable tillage profiler measured both above and belowground soil disruption. Two parameters, spoil resistance index and trench specific resistance, were developed from the data to assess draft force, aboveground soil disruption and belowground soil disruption. Based on these selection criteria, the two best shanks for conservation tillage systems were the Bigham Brothers Paratill shank and the WorksaverTerramax shank, both of which were bent leg shanks.
3. Ms.PoojaRaut. *et al.* (2014) carried out FEM analysis of 9 tyne medium duty cultivator. The main objective of this analysis is to study the forces on tynes and increase the life of shovel.
4. Mehmet Topakci. *et al.* (2010) this study 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.
5. Prof. Srinivasan. K and Prof.Viswanath R. P has made a study on rotavator blades. The aim of their study is to design and optimize the Rotavator Blade for better life and performance on field. Hence any improvement in the field performance of the same would in turn, augment the productivity in the agricultural sector. Within the study they had include the various kinematic and static analysis calculation on the rotavator blades and various soils properties were also been studied with the suitable failure model and at last they explain their result of dynamic analysis of rotavator blades during the tilling operation on soil using the FEA tool Abaqus.

Problem Identification:-

After the discussion with factory incharge it was observed that there are frequent complaints from customer side regarding the working depth of cultivator. Customer experienced that the tillage depth is less as compared to other brand cultivators. Also if they lower the draft position more sometimes the cultivator gets stuck in soil and to free it they have to raise the draft again and restart the work. As the cultivator gets stuck frequently this results uneven soil preparation. Also this results in further delay of other soil preparation processes before sowing. This also results in increased fuel consumption and tyre slippage of tractor.

Methodology:-

Methodology to carry out this study will be as follows ;

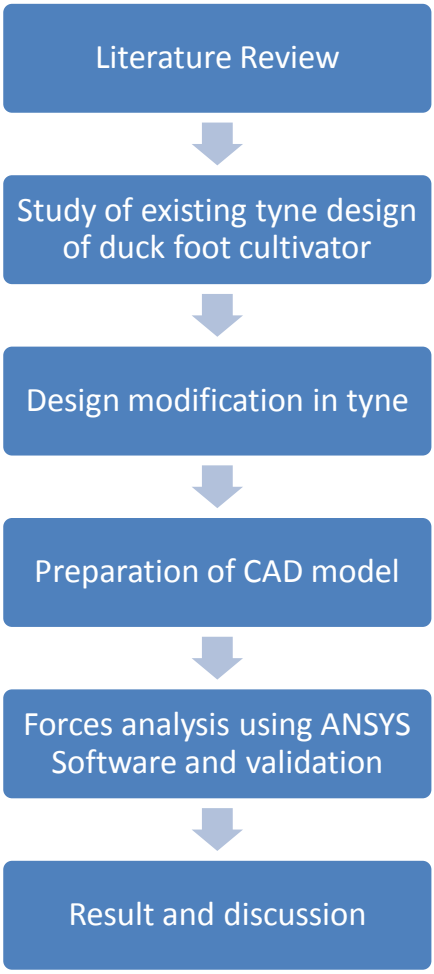

Figure 2:- Methodology.

The work will be carried out in the following manner:

1. First, a on field demonstration of cultivator will be carried out in which parameters like tillage depth, soil removal rate and forces developed of tyne during working are calculated.
2. Then CAD model of existing tyne design is made by using Creo.
3. By using Creo the modified designs of existing tyne will be prepare and its analysis will be carried out in ANSYS.
4. After analysis of modified designs the most optimum design will be finalized and it will be fabricated.
5. Finally the demonstration is again carried out to check how the new design will perform as compared to older one.

Conclusion:-

This study will helps to modify the current design of 5-Tyne duck foot cultivator which will perform much better as compared to the existing design. It will have better soil removal rate which results in faster soil preparation for sowing.

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