DEVELOPMENT OF SOIL LOOSENING EQUIPMENT FOR MEDIUM AND LARGE SIZED FIELDS OF SUGARCANE

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INTRODUCTION:
Agriculture is the backbone of Indian Economy. Today, India ranks second worldwide in farm output. Agriculture contributes to about 10% of the total GDP (Gross Development Product) and to about 50% of the workforce. Agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India. The total Agricultural land cover in India is 60.6% of the total area of India which is equivalent to 197.28 million hectares.

Reasons for Loosening of Soil:
For a plant, compacted soil is like a pile of bricks. Roots must work harder to grow into soil which means that the plant takes up fewer nutrients and water. This translates to poor plant growth. Beyond this, when soil is too compact, it can make it hard for water to percolate through the ground. When water cannot sift through the ground properly, plant roots can literally suffocate. For the following reasons, loosening of soil is crucial and is a necessity. Loosening of soil facilitates the active microbes to become functional when subjected to proper supply of water, air and sunlight which ensures effective utilization of nutrients. Along with this, leguminous bacteria ensure proper nitrogen fixation.

Problem Definition:
In most of the cases, the spacing between the line of crops is very small and this restricts the usage of machines like tillers and cultivators. Cattle assisted ploughing can be done only when the crops are still in the budding stages. So majority of farmers have very little choice but to use the conventional hand held tools for loosening of soil. As a result, the labour increases, the work rate reduces and associated costs increases.

OBJECTIVES:
This project aims at the development of agricultural equipment for loosening of the soil which is used during the cultivation of sugarcane crops. It aims at reducing the manpower used for the loosening of soil for sugarcane and indirectly helps in reducing the costs involved in the process. This equipment is meant to help in saving time by reducing the number of labourers hired for the soil loosening process.

METHODOLOGY:
The development of equipment is done in four stages wiz,Conceptual Diagram, Design Freezing, Fabrication and Development and Testing Based on the survey, to cater the
needs of Medium and Large field shoots of sugarcane, a conceptual design was developed for suitable equipment with two tools (which is fixed on rotating shaft) for loosening of soil between two lines of about 2ft width.

The power is supplied to the rotating tool by engine of power 3bhp to supply the required torque of 100 Nm. The engine was mounted on a CR frame which acts as chassis and the power is transmitted to the tool through the set of spur gear assembly (reduction gear).

The whole chassis is mounted on four polyurethane wheels which helps the operator to move the equipment from one end to the other end of the line performing loosening operation and the equipment is being pulled for the easy and forward movement.

An experiment was conducted to know the torque required for loosening of soil which is 100Nm. The set of three tool shafts welded with fins on its circumference are used.

Gear calculations depending upon material, speed and forces acting on the tool was determined and arrived with the safer design.

Fabrication of the parts was done as per the calculations and conceptual design. The assemblies of all the parts are done for experimentation.

2-Dimensional Drawing:

![2D Drawing of the equipment](image)
3 Dimensional Drawing of the Equipment:

Fig 3: Front View of the Equipment

Fig 4: Side View of the Equipment

Fig 4: Top View of the Equipment

Fig 5: ISO View of the Equipment
CONCLUSION:
Development of Soil Loosening equipment suitable for farmer’s requirement of Medium and Large scale sugarcane field is developed and tested. The equipment helps to reduce the effort required by the laborers and cost and the necessary objectives are achieved.

SCOPE FOR FUTURE WORK:
1. The automobile engine can be replaced with a high power agricultural engine which is more compact and thereby reduces the self-weight.
2. Replacing polymer wheels with tiller wheels which offer lesser resistance to the movement of equipment in damped soil conditions.
3. Using a better and stronger material for the tool fins and providing a dead weight at the tool end so that tools don’t move away from the line action.
4. Designing the equipment for pushing as well as for pulling rather than only for pulling so that the farmer can use it in a way which he is comfortable with.
5. Providing steering mechanism for the equipment so that the equipment can be easily maneuvered.