DESIGN AND FABRICATION OF TEA LEAF MACHINE

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ABSTRACT:

Tea is one of the major and cheapest beverages in India. Tea cultivation in India has a long history and used in traditional system of medicinal application as well as for consumption. India is cultivating and consuming it for hundreds of years. India is the second largest producer of tea in the world after china and also one of the largest consumers. Tea is manufactured by processing the leaves in the factories which are plucked and graded with various grades depending on the quality. The best quality is the bud and the two leaves along with it. The major problems faced by tea industry in India such as shortage of laborers, decrease in wages and attack of pests led to decrease the production rate. Thus mechanization of tea leaf harvesting was introduced. Tea leaves harvesting machine will have an important role in improving the tea production by employing the innovative cutting edge technology. This project gives a brief idea about the existing methodologies and also proposes a new model to overcome the disadvantages in existing mechanism.

KEYWORDS: Exhaust gas recovery,waste heat recovery, I.C Engine fuel economy,TEG Elements (Thermo-electricGenerator), Harnessing waste heat

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INTRODUCTION:

Harvesting tea is a very vigorous process that requires hard work and perseverance in order to coax the most out of the plant. Tea leaves are either plucked manually or using machinery. The emphasis is on reducing cost of harvesting without compromising on the quality of the tea leaves. Hence an efficient, user – friendly, portable machine is necessary. The existing tea leaf harvesting machines have several drawbacks and this project aims at tackling some of those problems and introducing a new method for easier leaf collection.

HISTORY OF MECHANIZATION OF TEA LEAF HARVESTING:

Even though tea is largely harvested by hand, the interest in alternative harvesting methods is almost as old as the industry itself. Kilgore cite the use of the Swinburne copper in Assam in 1887 and shears in japan in the 1990s rising production costs and fears about labour shortages have led tea producers to investigate mechanization of tea harvesting. In japan and Argentina most of the field operations, including plucking, are already mechanized. Meanwhile, the tea industries of southern Africa still rely mainly on manual labour for plucking , through the use of mechanical harvesting is becoming more common place in some countries where manual labours is not only in short supply, but also becoming more expensive. In South Africa and Zimbabwe, large estates and out growers are now mechanically harvesting all, or a large portion of their tea.

CURRENT SCENARIO:

The current information available on mechanical harvesting comes from industries covering a wide range of conditions. The environment influences the growth characteristics of the tea bush and the way it is managed; for example only 3 to 4 plucking rounds are required in a season in japan but between 16 and 25 are required in Malawi. Various types of machines have been developed, from hand held single man machines, through rickshaw machine pulled by two operators to large self-propelled harvesters. The success of the machines has varied as much as the design of the machines themselves. Plucking machines may be used throughout the season or only during the peak cropping season. Growers require information on how to manage

the tea bush under mechanical harvesting, including practices such as plucking rounds, table height rise and pruning cycles. Some estates have reported yield loses if plucking machines are used in more than one season; this needs to be investigated. Leaf quality form mechanical plucking also needs to be assessed. There is some evidence that a greater proportion of maintenance and immature shoots are harvested under mechanical plucking as compared to manual hand plucking. Fibercontent may be increased, and there is evidence of decrease in the percentage of main grades produced.

PRODUCT STUDY:

Figure 1. product Study

Tea leaf harvesting is done manually and by machine. A tea leaf harvesting machine is a device used for easy harvesting of tea leaves with minimum number of labourers. Manual harvesting can again be classified as hand plucking and plucking with the help of scissors. Machines are two types- petrol/gas operated and battery operated. The main parts of a petrol/gas operated tea leaf harvesting machine are cutter, blower and two stroke engine and collection bag. Battery operated harvesting machine consists of cutter, a flap for moving the leaves into the bag, collecting bag, dc motor and a battery.

Figure 2 .Product study

The petrol operated machine has a harvesting capacity 900 kg/day. The weight of the machine is around 17kg. In a battery operated machine, the energy source is a 12v and 7.5 Ah battery. From the power obtained from the battery the dc motor connected to that rotates. Rotating motion from the horizontally kept motor to vertical direction is achieved with the help of bevel gears. The fast rotating blades are responsible for the cutting of the leaves. The metal plate that is connected to the axis of the blade is responsible for the transferring of cut leaves into the bas attached when the bag is filled, it is replaced with the new bag

CUSTOMER'S VOICE:

Increasing price, fumes and smell, body pain due to overweight are the common complaints about petrol operated machine. This machine consumes 600ml of petrol per hour. Damages to the tea leaves is the complaint about battery operated machine. Body pain while using scissor type harvesting are the major observations.

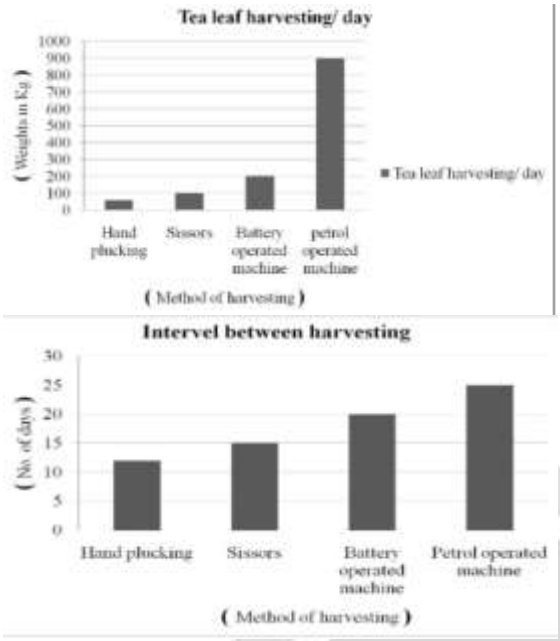


Fig 3 Customer Voice

PROBLEM DEFINITION:

The aim of this project is to create an alternate method for mechanization in tea leaf harvesting. With the main criteria being improved productivity along with reduced labour, time and hence greater profit. This report involves a case study of the existing tea harvesting machine, finding solution to the problems, proposing a new design, doing a feasibility study of the design and fabrication and testing of the machine.

PRINCIPLE:

Our project consist of motor, cam, link mechanism ,handle, cutter and collecting try. here motor is used to rotate the cam and The main function of cam is used to convert rotary motion into linear motion. Cam is connected to link mechanism. Other end of link is connected to cutter , whenever motor is switched on they activates the cam and link mechanism. Finally cutter to be cut the tea leafs and which is collected by the collecting tray, the hole setup is moved by manually using handle .

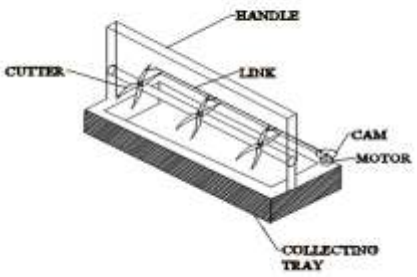


Figure 4.Tea Leaf Machine

LITERATURE REVIEW:

MECHANICAL HARVESTING OF TEA IN SOUTH AND CENTRAL AFRICA; MARTIN

Argentina started mechanizing of tea harvesting in early 1970's shortage of labour lead to mechanizing of tea harvesting among the member countries of tea research foundation of central Africa, south Africa was the

first among them to start using machine. Since in the most of the region the tea harvesting machine is in its infancy simpler types of machines were used.

Most of the estates tried shear plucking as a part of cost reduction. Majority has banned this since the productivity was not as expected and the bushes were damaged. In most of the estates hand held machines were used since they are suited for hilly terrain. These machines were singles or double man operated. 3 or 4 men operated 2 or 4 stroke engine powered machines with wheels were introduces later. These machines have sizes from 1.2m to 2.4m. Generally the machines with four wheels have better control over maintaining the height of the bush than two wheeled machines, since they have a tendency to tilt. The output with the machines is 350 kg green leaf for single man operated.

TEA LEAF HARVESTING AN ANCIENT ART FORM: STEVE GREENS

The right amount of rain and sun of the sub tropical climate as well as the mountainousterrains along with the acidic sand provides the distinct flavor of the tea. Picking of the tea has to be done by hand to preserve the integrity of leaves before harvesting. Hand plucking involves plucking of leaves without damaging the stem.

Using of machine increase the amount brushing and number of stems included in the harvest and will result in poor quality of tea. Tea brushes will reach up to thirty feet. This makes the harvesting difficult. In tea farming the height of the bushes are maintained at a comfortable height for easy plucking of the leaves and buds. Pruning the plants in comfortable heights regularly train the plants to produce leaves tightly around the area easily accessible by hand. The process of tea harvesting requires quick eye and fast hand. Up to one pound of tea is produced from a single plant.

COMMERCIAL CROP TECHNOLOGY: VOL08 HORTICULTURE SCIENCE: ALICE KURIAN

Countries like japan and Russia have started mechanical harvesting in order to reduce the labour cost during plucking. Now India is also trying this. South India has a distinct cropping pattern with alternate high cropping and low cropping period. One of the serious problems in tea harvesting is availability adequate number of labourers. This problem can be solved to an extent with the help of integrating machines for harvesting. Mechanical harvesting helps in reducing the man hour. These machines require additional worker for leaf collection and keeping the bags properly. The output for mechanical harvesting is 1000kg/8hr compared to 25-40kg plucked by operator. Machine harvesting cannot be done in closely spaced section.

The tea leaves of new tea plant are ready for harvesting in five years. The growth of the plant is not uniform throughout the year. The environment where the plant is growing has a great influences in the plant for the production of new buds and leaves and also the number of harvesting.

In some places tea have a dormant winter period and a growing season. Harvesting is mostly done by women and each day they are set with a quota or a set amount of leaves to be picked. 30 kg per day is the harvesting of an experienced picker. Hand picking of tea leaves are recommended since only the bud and top two leaves are removed. A blade is the portion of a tool, weapon, or machine with an edge that is designed to puncture, chop, slice or scrape surfaces or materials. A blade may be made from a flaking stone, such as flint, metal (usually steel), ceramic, or other material.

Blades are one of humanity's oldest tools, and continue to be used for combat, food preparation, and other purposes.

TEA HARVESTING IN DIFFERENT PART OF THE WORLD: FRANCIS XAVIER DELMAS

In south srilanka, individual framers cultivate tea in their own land and will sell the tea after harvesting since they don't have the infrastructure to process them. They will sell these to the local factories. An inclined plane is ideal for tea growth since it is easy for the rain water to run away. In flat regions drainage system should be maintained for growing healthy bushes. Tea plucking is done only by women and other jobs by men in most of the region.

COFFEE, TEA AND COCOA: AN ECONOMIC AND POLITICAL ANALYSIS: VERNON DALE WILDZER

Selection can be made carefully if the plucking is done with hand in japan shears were employed in harvesting and the tea bushes were maintained as ornamental plant. The introduction of shears has increased the output per person but have less control over quality. Rising labour cost has resulted in mechanizing tea harvesting. The fineness and coarseness of the plucking depend upon the number of leaves taken and the time given between plucking rounds.

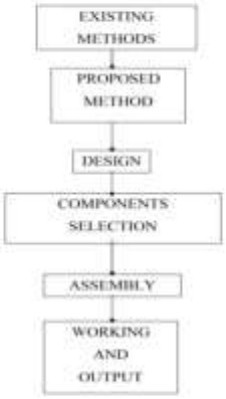
FACTORS IN ERGONOMIC HAND TOOL DESIGN: SARAH

Handle design have great influence efficiency as well as safety in all kind of daily activities. The handle diameter should be thick enough to separate the finger tips from palm. For power grip the length of the handle should be 10 – 15cm and the diameter should be 3-4cm.

WORKING METHODOLOGY:

OBJECTIVES

One man operated machine with series of light weight noiseless blades. This equipment is equipped with flexible shaft for power transmission and sturdy steel blades for cutting the leaves. A large bag is provided with this machine to effectively pluck and collect the tea leaves in bag without any wastage. The advantages are that it is cost effective, labor and time saving device which increases the productivity almost 5 times compared to manual plucking.



COMPONENT USED:

- DC MOTOR
- CAM
- LINKAGES AND MECHANISM
- BLADE
- SHAFT
- COLLECTING BAG

COMPONENT DESCRIPTION:

DC MOTOR

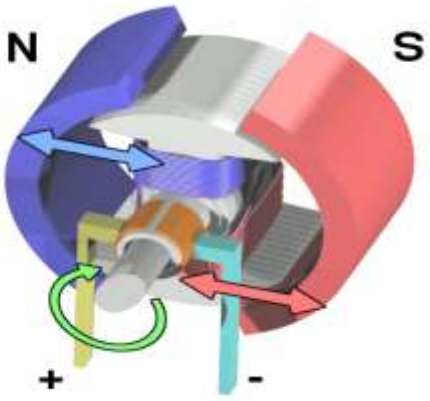


Fig 5 Dc Motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motor possible in many applications.

ELECTROMAGNETIC MOTOR:

A coil of wire with a current running through it generates an electromagnatic field aligned with the center of the coil. The direction and magnitude of the magnetic field produced by the coil can be changed with the direction and magnitude of the current flowing through it.

A simple DC motor has a stationary set of magnets in the stator and an armature with one or more windings of insulated wire wrapped around a soft iron core that concentrates the magnetic field. The windings usually have multiple turns around the core, and in large motors there can be several parallel current paths. The ends of the wire winding are connected to a commutator. The commutator allows each armature coil to be energized in turn and connects the rotating coils with the external power supply through brushes. (Brushless DC motors have electronics that switch the DC current to each coil on and off and have no brushes.)

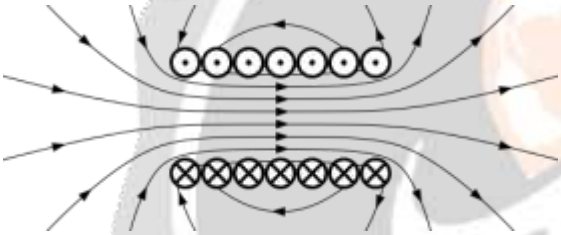


Fig 6 Electromagnetic Motor

BRUSHED DC ELECTRIC MOTOR:

The brushed DC electric motor generates torque directly from DC power supplied to the motor by using internal commutation, stationary magnets (permanentor electromagnets), and rotating electromagnets.

Advantages of a brushed DC motor include low initial cost, high reliability, and simple control of motor speed. Disadvantages are high maintenance and low life-span for high intensity uses. Maintenance involves regularly replacing the carbon brushes and springs which carry the electric current, as well as cleaning or replacing the commutator. These components are necessary for transferring electrical power from outside the motor to the spinning wire windings of the rotor inside the motor.

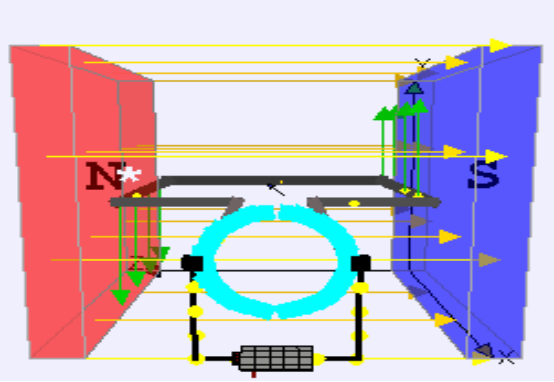


Fig 7 Bushed Dc Motor

BRUSHLESS DC MOTOR

Typical brushless DC motors use one or more permanent magnets in the rotor and electromagnets on the motor housing for the stator. A motor controller converts DC to AC. This design is mechanically simpler than that of brushed motors because it eliminates the complication of transferring power from outside the motor to the spinning rotor. The motor controller can sense the rotor's position via Hall effect sensors or similar devices and can precisely control the timing, phase, etc., of the current in the rotor coils to optimize torque, conserve power, regulate speed, and even apply some braking. Advantages of brushless motors include long life span, little or no maintenance, and high efficiency. Disadvantages include high initial cost, and more complicated motor speed controllers. Some such brushless motors are sometimes referred to as "synchronous motors" although they have no external power supply to be synchronized with, as would be the case with normal AC synchronous motors.

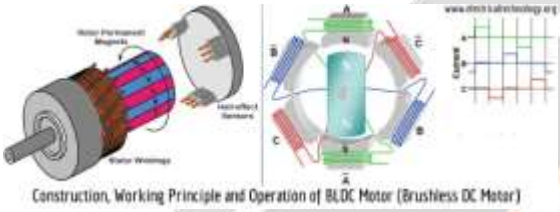


Fig 8 Brushless Dc Motor

ADVANTAGES:

- It was easy to operate, clean and service.
- As the person could carry it to the required bush.
- Less damage is caused to the bushes.
- It is cost effective,
- Labor time saving device.
- Increases the productivity almost 5 times compared to manual plucking.

APPLICATION:

- Large scale tea harvester.
- Pesticide sprayer.
- Can be used for gardening.
- To automate tea leaf cutting in unconditioned farms.
- Employs innovative cutting edge technology with blades made of ferrous metal.
- Plucking of side shoots.
- Operate the machine in hilly-terrain areas.

COST ESTIMATION:

S.NO	COMPONNTS	QUANTITY	COST
1	DC MOTOR	2	2500
2	BLADE	2	500
3	WIRE	AS REQUIRED	200
4	FRAME	1	600
5	BATTERY	1	1200
6	SOLAR PANEL	2	500

7	POWER CONVERTER	1	500
TOTAL	-	-	60000

CONCLUSION:

Tea industry contributes large amount to the national income of India, as it is one of the largest exporters of tea in the world. Therefore it is necessary to overcome the problems existing in the tea industry such as shortage of laborers, increase in wages, and decrease in production due to improper application of pesticides. The proposed model is an effort made to increase the production rate by overcoming these challenges. Both the pesticide sprayer and the harvester are integrated in a single machine, which does not compromise on crop safety and the production rate. Tea leaf harvesting machine is more viable, feasible and profitable than manual harvesting.

FUTURE WORK:

- To automate tea leaf cutting in unconditioned farms.
- 2. Employs innovative cutting edge technology with blades made of ferrous metal.
- Plucking of side shoots.
- Operate the machine in hilly-terrain areas.

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