

# Fabrication and Development of 4 Stroke Cultivation Vehicles for Agricultural Applications

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**ABSTRACT:** The conversion of bike into a line digging tractor, the idea of using bike instead of tractor is to save lot of digging cost, labour cost and time saving. Now converting is done in rear part of bike. The rear axle is removed to fix line digger with the help of two supporting wheels. The line digger is attached to rear portion of bike, the wheeling system i.e. chain is arranged for newly adopted wheels. The lifting up and down of line is done by lever system which helps to lift up and down the line digger. There is scarcity of tractor in villages due to high cost of tractors. So in order to overcome this problem this bike line digger helps to do same work as tractor in less cost and labour cost also decreases. The main advantage is that fuel used for the bike is very less. Labour cost is reduced. It is suitable for small vegetables plants. Maintenance cost is very low. Farmer has to use various agricultural equipment's and labours for caring out those steps, our purpose is to make the conversion of bike into a line digging tractor, the idea of using bike instead of tractor is to save lot of digging cost, labour cost and time saving.

## I. INTRODUCTION

### 1.1 Introduction

Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. —A man without food for three days will quarrel, for a week will fight and for a month or so will die. Agriculture is a branch of applied science. Agriculture is the science and art of farming including cultivating the soil, producing crops and raising livestock. It is the most important enterprise in the world. Over the years, agricultural practices have been carried out by small-holders cultivating between 2 to 3 hectare, using human labour and traditional tools such as wooden plough, yoke, leveller, harrow, mallet, spade, big sickle etc. These tools are used in land preparation, for sowing of seeds, weeding and harvesting.

Modern agricultural techniques and equipment's are not used by small land holders because these equipment's are too expensive and difficult to acquire. By adopting scientific farming methods we can get maximum yield and good quality crops which can save a farmer from going bankrupt but majority of farmers still uses primitive method of farming techniques due to lack of knowledge or lack of investment for utilizing modern equipment.

The use of hand tools for land cultivation is still predominant in India because tractors require resources that many Indian farmers do not have easy access to. The need for agricultural mechanization in India must therefore be assessed with a deeper understanding of the small holder farmer's activities. There is huge gap in technology adoption and Implement used with small and marginal farmers.

Sustainable improvement in the livelihoods of poor farmers in developing countries depends largely on the adoption of improved resource conserving cropping systems. While most of the necessary components already exist, information on the availability and performance of equipment is lacking and effective communication between farmers and agricultural research and development department is unsuccessful.

## 1.2 Main Features of Indian Agriculture

### (i) Source of livelihood:

Agriculture is the main occupation. It provides employment to nearly 61% persons of total population. It contributes 25% to national income.

### (ii) Dependence on monsoon:

Agriculture in India mainly depends on monsoon. If monsoon is good, the production will be more and if monsoon is less than average then the crops fail. As irrigation facilities are quite inadequate, the agriculture depends on monsoon.

### (iii) Labor intensive cultivation:

Due to increase in population the pressure on land holding increased. Land holdings get fragmented and subdivided and become uneconomical. Machinery and equipment cannot be used on such farms.

### (iv) Under employment:

Due to inadequate irrigation facilities and uncertain rainfall, the production of agriculture is less; farmers find work a few months in the year. Their capacity of work cannot be properly utilized. In agriculture there is under employment as well as disguised unemployment.

### (v) Small size of holdings:

Due to large scale sub-division and fragmentation of holdings, land holding size is quite small. Average size of land holding was 2 to 3 hectares in India while in Australia it was 1993 hectares and in USA it was 158 hectares.

### (vi) Traditional methods of production:

In India methods of production of crops along with equipment are traditional. It is due to poverty and illiteracy of people. Traditional technology is the main cause of low production.

### (vii) Low Agricultural production:

Agricultural production is low in India. India produces 27 Qtls Wheat per hectare. France produces 71.2 Qtls per hectare and Britain 80 Qtls per hectare. Average annual productivity of an agricultural labour is 162 dollars in India, 973 dollars in Norway and 2408 dollars in USA.

### (viii) Dominance of food crops:

75% of the cultivated area is under food crops like Wheat, Rice and Bajra, while 25% of cultivated area is under commercial crops. This pattern is cause of backward agriculture.

Introduction about bike cultivator



Mini tractor was made in view of the small & individual farming need. It was made to eliminate the problems created by the usage of bullock carts in the fields. Mini tractors reduce the working hours of the farmers.

The tractors which are having less than 20 HP are considered to be the mini tractors. 82% of the people do not have tractors and land holdings are smaller, for small farmers it is 0.4 hac & for marginal farmers it is 1.4 hac. Thus they need a tractor which is not bigger in size. The mini-tractor is of 12 HP and hence it would be best suitable for small and marginal farmers due to its low cost and lesser fuel consumption with more utility and less maintenance.

## II. CULTIVATOR

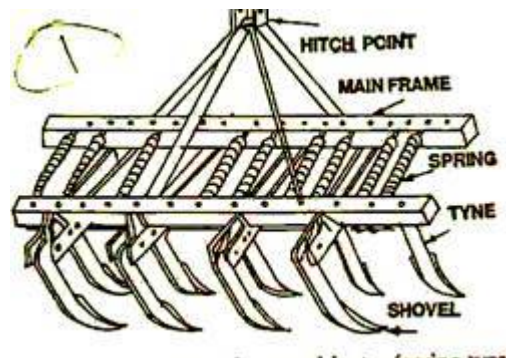


Fig 2: cultivator

A cultivator is any of several types of farm implement used for secondary tillage. One sense of the name refers to frames with the teeth (also called shanks) that pierce the soil as they are dragged through it linearly. Another sense refers to machines that use rotary motion of disks or teeth to accomplish a similar result.

### 2.1a: CULTIVATOR ATTACHED TO BIKE



Fig 2.1a: cultivator attached to bike

Tine cultivator is a perfect solution for stubble cultivation with an objective to provide a thorough and complete mix of soil and straw to the required working depth, incorporation of crop residues and organic fertilizer into the soil. Perfect machine for the stubble cultivation Tine Cultivator - perfect stubble cultivation implement suitable for light and medium soil conditions.

The cultivator attaching the teeth to the front ends or sides of the beams, or other parts of the cultivator or harrow (to which they are secured) that any straw, stones, or other substance which would otherwise choke, or clog up in front of the hoes or teeth will pass up over the upper ends thereof, and fall off from the cultivator or harrow. To effect this object the shanks or teeth are made so as to extend up across the front part of the frame to which they are attached, and

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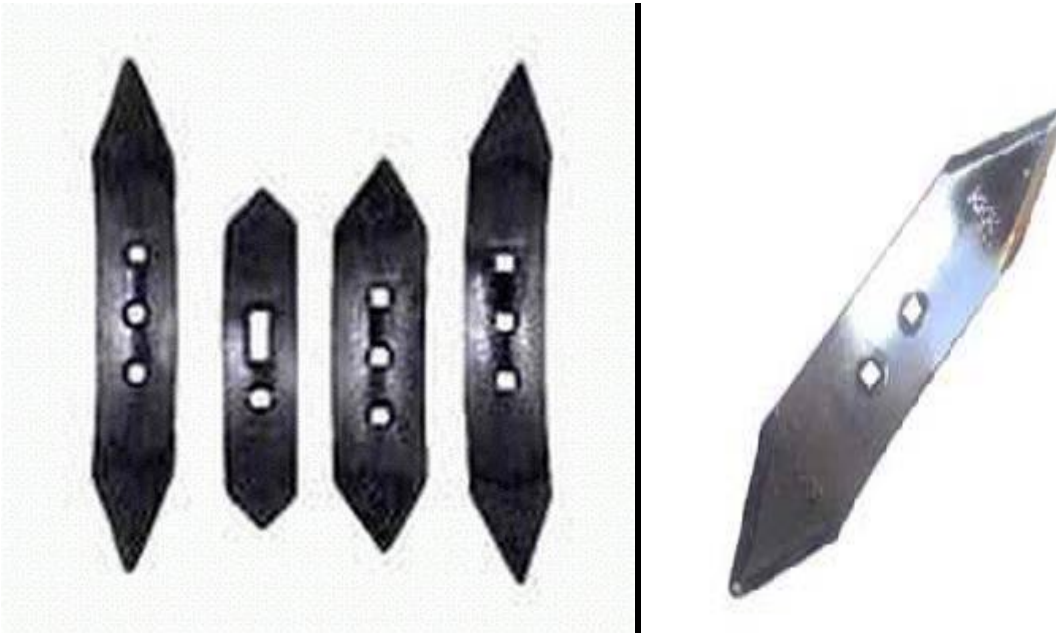
the upper ends of said shanks are bent back over on to the top of the frame, to which they are secured by small bolts passed through the ends of the shanks of the hoes or teeth, and through the frame of the cultivator or harrow.



The frame of the cultivator or hoe-harrow may be made in any convenient shape or form, provided it is so constructed that the hoes or teeth may be attached as above mentioned to the front end or sides of the different parts of the frame, that is, so that the frame or woodwork shall not extend in front, over the hoes, or teeth to render it liable to choke. It may be made as follows let there be a sill or beam extending longitudinally through the centre of the frame from the front end to the back, with a hoe or tooth attached to the front end in the manner above described. Passing through, or attached, and secured to said sill or beam, there will be cross pieces extending out a suitable distance each way therefrom. The cross pieces may be straight, with a hoe or tooth attached to the front side of the ends thereof in the manner aforesaid or the ends of said cross pieces may be bent or curved toward the front of the cultivator or harrow so that the hoes or teeth may be attached to the ends thereof,

The same as the hoe or tooth on the front may render necessary. The teeth may all be of the same size or dimensions; or for tilling corn, and for other similar purposes a part of them may be made large to act as small plows, and the other of the usual size. The stilts or handles, and the lever, and other appendages for regulating the draft may be fixed in the usual or in any other convenient manner.





1.3 BIKE CULTIVATOR



Fig 1.1 bike cultivator

Mini tractor was made in view of the small & individual farming need. It was made to eliminate the problems created by the usage of bullock carts in the fields. Mini tractors reduce the working hours of the farmers.

The tractors which are having less than 20 HP are considered to be the mini tractors. 82% of the people do not have tractors and land holdings are smaller, for small farmers it is 0.4 hac & for marginal farmers it is 1.4 hac.

Thus they need a tractor which is not bigger in size. The mini-tractor is of 12 HP and hence it would be best suitable for small and marginal farmers due to its low cost and lesser fuel consumption with more utility and less maintenance.

Using old motorcycle the developed a machine system called bike cultivator for small farm holdings, complete with attachments for tilling. The motorcycle's engine was converted to a 16.68bhp petrol engine and the rear wheel replaced with an attachment with two wheels.

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- ❑ Bike cultivator was made in view of the small & individual farming need. It was made to eliminate the problems created by the usage of bullock carts in the fields. Mini tractors reduce the working hours of the farmers.
- ❑ The tractors which are having less than 20 HP are considered to be the mini tractors. 82% of the people do not have tractors and land holdings are smaller, for small farmers it is 0.4 hac & for marginal farmers it is 1.4 hac.
- ❑ Thus they need a tractor which is not bigger in size. The mini-tractor is of 16.68bhp and hence it would be best suitable for small and marginal farmers due to its low cost and lesser fuel consumption with more utility and less maintenance.

#### 1.4 Soil

The knowledge of soil, draft, and traction is very important in tillage. Unfortunately few soil science texts cover these subjects in a practical, integrated manner. In this technical note we shall examine these subjects, their practical significance to tillage, and to the power requirement in farming.

For example, lower ground speeds are typical of primary tillage tools such as mouldboard plows and heavy disks. Higher ground speeds are required for harrow and cultivators that pulverize the soil and produce a finer tilth, and for mechanical weed control.

#### 1.5 Draft

The force required to pull a tillage tool through the soil is called its draft. The draft force is located at the point where the tool is attached to the power unit, called the hitch. The power unit is usually a tractor, a name coined from the more ponderous word traction engine that translates the power developed by the internal combustion engine into forward motion. The direction of the draft force is in the direction of travel and the units to measure it are pounds force). When using physical power force, and work, we should understand that these words have different meanings, but are related to one another.

#### 1.6 Traction

When a tillage tool is pulled through the soil, the power unit (tractor) must overcome draft force by soil resistance in order to move forward. This can be done because modern tractors are designed to transmit large amounts of power to the soil.

Power is transmitted to soil by way of the drive axle on which the wheel and tires are mounted. Transmitting that power requires large frictional forces, or traction, at the soil surface which converts the torque, or rotary motion of the tractor crankshaft into forward motion. In other words, traction is the force off or ward motion derived from contact between the tractor.



Fig 1.6 .Traction

### III. REVIEW OF LITERATURE

This chapter deals with the review of the past research works conducted by the scientists in the field of evaluation and control of slip in the tractive devices. Accurate methods to measure the slip is difficult task when the tractor is under operations in the field. Slip indicators are not provided even in the latest development of tractors although the same is a very critical requirement. For optimizing the performance of a tractor, slip is an essential parameter at the operating load. Efforts have been made in this chapter to study, analyse and review the works conducted for the computation of slip by different scientists to maximize tractive efficiency (TE). It is apparent from the relevant studies that slip measurement can be brought under two groups. Research methods are followed when accuracy is very essential. Tractors were suitably modified before the conduction of lab experiments, whereas, field measurement method does not require modifications. Literature indicates that complex mechanism is involved in the research projects for the computation of slip. Most of the methods are involved for the measurement of linear velocity.

The major discussions in the field of slip measurements are presented below.

- Slip measurement techniques
- Depth measuring methods
- Draft measurement methods
- Influence of slip on performance
- Draft control mechanism
- Slip control mechanism
- Effect of soil salinity on slip
- Effect of Soil moisture on slip
- Traction models

### 3.1 Slip Measurement Techniques

Two major processes are followed for the measurement of slip

1. Manual method
2. Automatic method

### Scope of the project

Soil tiller and weeder reduce human effort as compared to operation by bullocks. The bullock implements require the hand and body pressure to achieve depth and alignment of the implement in use, whereas in soil tiller and weeder, the implements are mostly self-guided. This reduces human drudgery to a great extent. The comparative higher output of operation by the soil tiller and weeders as compared to bullocks reduces the operational time and achieves timeliness in operation. The maintenance of the soil tiller and weeder is easy. It is ideally suited for mechanizing small farm holdings which account for 80 % of the farm holdings of the country. Cost wise the soil tiller and weeder should be an obvious choice of smaller farmers, if they are intending to have a mechanical power source for farm- operation. Soil tiller and weeder reduce the drudgery of collecting the waste grass between crops in the field during operations as compared to operations by bullocks. The soil tiller and weeder make the manual of that wastage grass by cutting it in small piece and thoroughly mixed with soil during operation.

## IV. METHADODOLOGY



Fig 5.1: cultivator attached to bike

Tine cultivator is a perfect solution for stubble cultivation with an objective to provide a thorough and complete mix of soil and straw to the required working depth, incorporation of crop residues and organic fertilizer into the soil. Perfect machine for the stubble cultivation Tine Cultivator - perfect stubble cultivation implement suitable for light and medium soil conditions.

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5.1b Cultivator fabrication

The frame of the cultivator or hoe-harrow may be made in any convenient shape or form, provided it is so constructed that the hoes or teeth may be attached as above mentioned to the front end or sides of the different parts of the frame, that is, so that the frame or woodwork shall not extend in front, over the hoes, or teeth to render it liable to choke. It may be made as follows let there be a sill or beam extending longitudinally through the centre of the frame from the front end to the back, with a hoe or tooth attached to the front end in the manner above described. Passing through, or attached, and secured to said sill or beam, there will be cross pieces extending out a suitable distance each way therefrom. The cross pieces may be straight, with a hoe or tooth attached to the front side of the ends thereof in the manner aforesaid or the ends of said cross pieces may be bent or curved toward the front of the cultivator or harrow so that the hoes or teeth may be attached to the ends thereof,

The same as the hoe or tooth on the front may render necessary. The teeth may all be of the same size or dimensions; or for tilling corn, and for other similar purposes a part of them may be made large to act as small plows, and the other of the usual size. The stilt or handles, and the lever, and other appendages for regulating the draft may be fixed in the usual or in any other convenient manner.

**Planning and design**

- Fabrication
- Experimentation
- Rework and compression to improve



Fig 6.2 (plumber block)



Fig 6.3 (chain sprocket)

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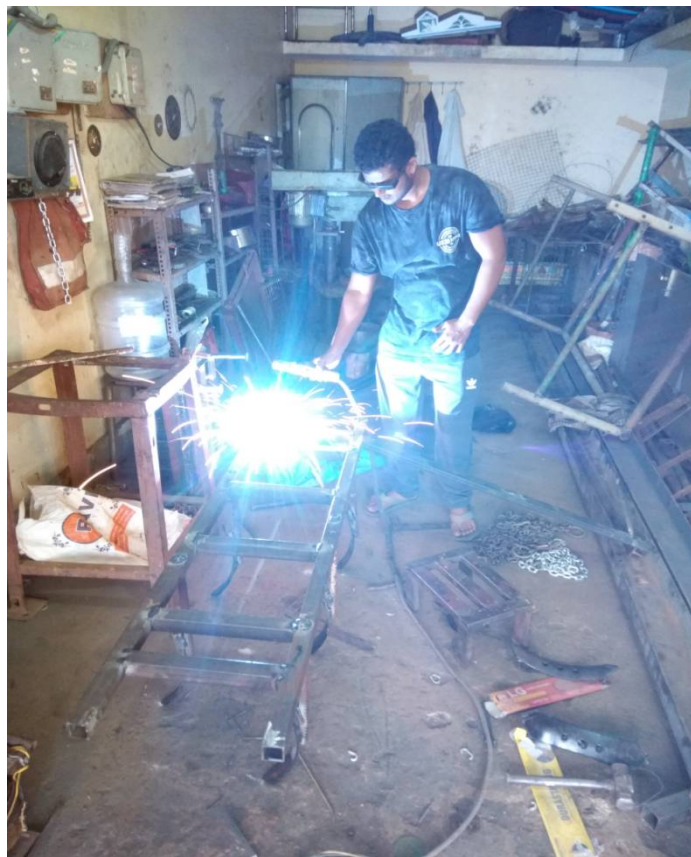


Fig 6.4 (Fabrication of cultivator)

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### ADVANTAGES & DISADVANTAGES OF BIKE CULTIVATOR

#### ADVANTAGES

- ❖ So by replacing tractor by mini tractor work can be done.
- ❖ Affordable price.
- ❖ Lower operating cost.
- ❖ Low maintenance & easy repairs.
- ❖ Smaller wheel base & turning radius.
- ❖ Accessibility to smaller areas.
- ❖ Multitasking.

#### DISADVANTAGES

- ❖ Cannot plough in hard soil.
- ❖ Gives less millage than previous.
- ❖ Speed is reduced.
- ❖ Time taking for ploughing is high when compare to normal tractor.
- ❖ Cannot plough high depth.
- ❖ There are no brakes for rear axle. Brake is applied only at front wheel.

#### How Replacement of Rear Wheel



Fig 11. (Tyre replaced)

- The rear wheel of the motorcycle is removed and replaced with two smaller wheels and various implements. The motorcycle pulls a retro-fitted chassis which can be adapted to perform shallow plowing, weeding, sowing. It can be easily converted back into a motorcycle for transportation.
- ❑ Creating new frame The Rear wheeling system is changed in this process. Single tyre is replaced with two tyres in the rear part of the bike.
- ❑ Attaching cultivator then cultivator is attached at the rear part of the Bike and there are levers to pull up and down the ploughing equipment.
- ❑ Cultivator attached to remodelled bike The cultivator attached to the frames arranged with pulleys on left and right side of the seat so that cultivator can be lifted up and down. There is a locking system for cultivator to keep it in a steady position.

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The bike ploughing machine by using bike ploughing machine there is a simple way of ploughing introduced to the cultivation system. There is no assistance required while using the machine. There is no wastage of time on waiting for a big tractor, no need of spending lot of money for cultivation.

By using the bike ploughing machine farmer can plough a large area of land and increase in the mileage and performance of bike with ploughing system. The work which cannot be done and covered by tractor can simply be done by the mini-tractor.

The cultivator attached to the frames arranged with pulleys on left and right side of the seat so that cultivator can be lifted up and down. There is a locking system for cultivator to keep it in a steady position.

### V. RESULTS

- Fabrication of a bike cultivator is done with minor design modification for the rear wheel of a bike which shows lot of characters in its working and cost.
- Easily affordable to all in comparison with the existing tractor which may cost in terms of lakhs.
- Simple in constructions Economically worth full
- Most useful in Multipurpose forming as the system can be assembled and dismantled very easily.

### OUTCOMES

- ❖ Works at speed of 10-20 kmph.
- ❖ Millage 1liter per 25 kilometers.
- ❖ Turning radius - 5 meters.
- ❖ Can pull load up to 260kg.
- ❖ Plugging can only do at soft and wet soil.
- ❖ Cultivator can plough up to the depth of 34mm.

### VI. CONCLUSION

The project work is designed and developed successfully. For the demonstration purpose a bike is taken and remodelled to rear axle of two tyres and attached a handmade cultivator and fixed at back portion of bike.

Cultivator can lift up and down by lever which is beside of the seat. The mini-tractor will move at low speed of 10-15 kmph.

The ploughing process should also be done in soft or wet soil because at hard soil it cannot be plough.

This concept fail at speed when compared normal tractor and by using this concept a good mini tractor can be made by using a very heavy cc bike and a good cultivator with tillage tool.

### FUTURE SCOPE

By using this principle the mini-tractor can be made by using heavy cc bike of 350cc to 500cc followed by the required length of cultivator. By using heavy cc bike instead of small cc bike thus the power required will be more sufficient for the cultivation purpose.

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