

# Review of Multipurpose Agriculture Machine

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**Abstract:** Farming is the backbone of Indian economy. In this agriculture sector, there is a lot of fieldwork, such as weeding, reaping, sowing etc. these operations previously were done by traditional equipment's. Working with those equipment's was tedious and laborious. Also traditional ways are time consuming. Mechanization in agriculture made farming easier and quick. There are variety of machines are available for almost every task in agriculture. Beginning with preparing land to the harvesting of crop and further process can be done by machines. This machines not only easier way to do this tasks but also very efficient. The agriculture machineries that are used now a days are costlier and cannot be afforded by most of farmer with rural background. Most of the farmers in India own very small pieces of land and owning this costlier machines may not be feasible for them. Apart from this most of farmers consider the traditional ways of farming as primary methods. Considering above mentioned factors there is need to develop such an equipment, which will be of multiple use and especially will be of low cost.

**Keywords:** mechanization sowing, weeding, cultivation, harvesting

## 1. Introduction

### A. History of Agriculture Mechanization in India

The story of the development of agricultural mechanization in India is both fascinating and in many ways, quite remarkable. The country has moved forward over the past six decades from one in which it then faced severe food shortages to where today it has become an exporter of many food commodities and a major exporter of other industrial products, including agricultural tractors. This has been achieved despite a more than three-fold increase in its population and insignificant increase to the arable land area.

India is the second most populous country in the world with an estimated population of 1.25 billion in 2014 and an annual growth rate of 1.3 per cent. About two-third of the population live in rural areas with about 50 per cent still dependent on agriculture for their livelihood. The total land area of the country is 297 million hectares of which 142 million ha is classed as agricultural land. Whilst it has basically an agrarian economy the share of agriculture has now declined to 14 per cent from a level of 56 per cent in 1950. The manufacturing and service sectors presently constitute 27 per cent and 59 per cent of the economy, respectively. The biggest challenge which the agricultural sector is facing is to meet the growing demand for food to feed the ever growing population of the country.

The agriculture sector in India has witnessed a considerable

decline in the use of animal and human power in agriculture related activities. The trend has paved a way for a range of agricultural tools. A large number of these are driven by fossil fuel operated vehicles such as tractors, diesel engines. This has resulted in a shift from the traditional agriculture process to a more mechanized process. Though the level of mechanization in India is lower as compared to other developed countries, it is certainly on growing. The role of tractors in the Indian agriculture sector reflects the growing trend of tractor-station in the country. Custom hiring of farm equipment is a prevalent practice in India, especially among small land owners who find ownership of large farm machines expensive and uneconomical.

An ICAR study (2004-2007) showed that 34.2 percent of accidents in agriculture were due to hand tools, with sickles and spades involved in 46 percent of farm injuries. Implications of injuries due to hand tools are severe as these injuries are very painful and disabling due to delayed treatment. A survey conducted in India showed that 70 percent of agricultural hand tools injuries had a recovery time of more than seven days. Thus, developing farm machinery more suited to the local conditions is essential so that injuries and problems that come with the use of hand tools can be abated while making agricultural practices more productive.

### B. Advantages of Mechanization in Farming

Farm mechanization has been known to provide a number of economic and social benefits to farmers. Primary among the economic benefits is the improved yield that comes as a result of greater level of mechanization. Looming water scarcity crisis along with the need to ensure food security in the country, the benefits of farm mechanization makes it a crucial component of shaping the future of Indian agriculture.

- 1) *Input savings:* Studies have shown a direct relationship between farm mechanization (farm power availability) and farm yield. Farm mechanization is said to provide a number of input savings.
- 2) *Increase in efficiency:* Aside from the above stated inputs, farm machinery also helps in increasing the efficiency of farm labor and reducing drudgery and workloads. It is estimated that farm mechanization can help reduce time by approximately 15-20 percent. Additionally, it helps in improving the harvest and reducing the post-harvest losses and improving the quality of cultivation. These benefits and the savings

in inputs help in the reduction of production costs and allow farmers to earn more income.

- 3) *Social benefits:* There are various social benefits of farm mechanization as well.
- 4) Helps in conversion of uncultivable land to agricultural land through advanced tilling techniques and also in shifting land.
- 5) Used for feed and fodder cultivation by draught animals towards food production.
- 6) Decrease in workload on women as a direct consequence of the improved efficiency of labor. Improvement in the safety of farm practices.
- 7) Helps in encouraging the youth to join farming and attract more people to work and live in rural areas.

### C. Objective

- 1) The main objective of this project is to design and fabricate multipurpose agriculture machine.
- 2) To study various agriculture process and the equipment used.
- 3) To design agriculture machine housing various agriculture equipment.

## 2. Literature review

Since last century, mechanization is continuously adapted in agriculture. Various developments in farm machineries have been observed. The machineries with high costs and with low costs are available. The approach toward various multipurpose, handy equipment is also seen. Affordable and easy to use machines have been developed.

1. Ramesh D: This research paper present "Agriculture Seed Sowing Equipment: A Review". The present review provides brief information about the various types of innovations in seed sowing equipment. The basic objective of sowing operation is to put the seed and the fertilizer in rows at desired depth and seed to seed spacing, cover the seeds with soil and provide proper compaction over the seed.

2. Kannan A: This research paper presents design modification in multipurpose sowing machine which describes the sowing purpose and the import of the machinery, which are bulk in size having more cost. To prevent this they design multipurpose sowing machine which consists of hopper, seed metering mechanism, ground wheel, power transmission system, seed distributor, and tiller. It is designed on PRO-E software.

3. Jeremy, in 2005 designed and fabricated solar charged cutter machine. The machine was dependent on weather since the battery would be charged using solar panel. The common drawback was that the engine runs slowly and the production cost was high for an average individual to purchase.

## 3. Constructional Features

Different components of multipurpose agriculture machine are as follows:

*Body:* The body is a supporting member of machine. The engine is mounted on this body at front side. The handle is attached to the front side of the engine. The reaper is attached behind the front wheels. The cultivator and the seed sowing arrangement is attached at back side. The bar which is used for making the body is made from mild steel. The length is 36 inch and the width is 24 inch. The overall length of the assembly is 6 ft. and overall height of the assembly is 3ft.

*Engine:* Engine is the heart of an automobile. It is a device that converts chemical energy of fuel into mechanical energy which is used to drive vehicle. It is basically a device that produces power. In automobile I.C. engines are used. I.C. engine is the engine in which combustion (burning of fuel) takes place inside a cylinder and it suddenly generates a high pressure force. This pressure force generated is used to drive vehicle or rotate wheel by use of some mechanism.

Engine is a device which is used to run the machine. For the transmission of power differential is attached to the engine. The following are the specification of the engine. The minimum value of fuel consumption was 0.546 l/h and was recorded by using three blades with 1.8 km/h cultivator for forward speed at depth of operation ranged from 0-40 mm and soil moisture content 16.18, while the maximum value of fuel consumption was 0.936 l/h and was recorded by using four blades with 2.4cultivator forward speed at depth of operation ranged from 20-40 mm and soil moisture content 7.73%.

*Engine specifications:*

Type: two stroke, single cylinder, forced air cooled, 174.44cc engine

Max. power: 6.29Hp@ 5200rpm

Fuel efficiency: 27 kmpl

Max speed: 50kmph

Transmission: four forward gears and one reverse gear

*Air Filter:* The function of air filter is to remove the moisture and particulate matter present in the air. It passes only fresh air into the carburetor. The carburetor is attached to the filter. An air filter is a device composed of fibrous material which removes solid particulate such as dust, pollen, mold, and bacteria from air. Filter containing an absorbent or catalyst such as charcoal (carbon) may also remove odors and gaseous pollutants such as volatile organic compounds or ozone. Air filters are used in applications where air quality is important, notably in building ventilation system and in engines.

*Carburetor:* A carburetor is a device that mixes fuel and air together and delivers the mixture to the intake manifold of an internal combustion engine. Early carburetors achieved this by simply allowing air to pass over the surface of the fuel (i.e. gasoline), but most later dispensed a metered amount of fuel into the air stream.

Carburetion was the dominant method of mixing fuel and air for internal combustion engines until the 1980s, when emissions regulations and concerns about fuel efficiency resulted in fuel injection taking over. Although carbs were used in the United States, Europe, and other developed nations

through the middle of the 1990s, they made use of increasingly complex control systems to meet emissions requirements.

Different types of carburetors work via different mechanisms. For instance, wick-type carbs work by forcing air to pass over the surface of gas-soaked wicks, which causes gasoline to evaporate into the air. However, wick-type carburetors (and other types of surface carbs) were more or less obsolete more than a century ago. Most carburetors that are used by vehicles that are still in service today use a spray mechanism, and they all operate in more or less the same way.

When a carburetor fails, the engine will run poorly in certain conditions. Some carburetor problems result in an engine that is unable to run at idle without assistance, and others result in various rough running conditions. The most common issues are tied into cold engine conditions, and a carburetor that works poorly when an engine is cold may work just fine when it is warm due to problems with the choke or other components.

**Differential:** The differential is a device that splits the engine torque two ways, allowing each output to spin at a different speed. The differential is found on all modern cars and trucks, and also in many all-wheel-drive (full-time four-wheel-drive) vehicles. These all-wheel-drive vehicles need a differential between each set of drive wheels, and they need one between the front and the back wheels as well, because the front wheels travel a different distance through a turn than the rear wheels.

Car wheels' spin at different speeds, especially when turning. You can see from the animation that each wheel travels a different distance through the turn, and that the inside wheels travel a shorter distance than the outside wheels. Since speed is equal to the distance traveled divided by the time it takes to go that distance, the wheels that travel a shorter distance travel at a lower speed. Also note that the front wheels travel a different distance than the rear wheels. For the non-driven wheels on your car-the front wheels on a rear-wheel drive car, the back wheels on a front-wheel drive car -- this is not an issue. There is no connection between them, so they spin independently. But the driven wheels are linked together so that a single engine and transmission can turn both wheels. If your car did not have a differential, the wheels would have to be locked together, forced to spin at the same speed. This would make turning difficult and hard on your car: For the car to be able to turn, one tire would have to slip. With modern tires and concrete roads, a great deal of force is required to make a tire slip. That force would have to be transmitted through the axle from one wheel to another, putting a heavy strain on the axle components.

Functions of differential:

- 1) To aim the engine power at the wheels.
- 2) To act as the final gear reduction in the vehicle, slowing the rotational speed of the transmission one final time before it hits the wheels.
- 3) To transmit the power to the wheels while allowing them to rotate at different speeds (This is the one that earned the differential its name.)

**Silencer:** When an engine runs, high pressure exhaust gas is

released. This causes a pressure wave in the air causing and explosion very fast to form a steady noise. These are two group low frequency from 50 HZ to 500 HZ. To reduce the noise, the engine exhaust is connecting to exhaust pipe to the silencer it is also called as muffler in automobile vehicles. In the muffler the gases or the polluted air are allowed to expand gradually and to cool. There is various type of mufflers they are explained as below.

- 1) **Baffle Type Muffler:** In this type of muffler there will be number of plates that are arranged alternatively to reduce the speed and temperature of the gases which pass through it.
- 2) **Wave Cancellation Muffler:** In this type there will be two and more path for the exhaust gases to pass through the muffler. As the length of the path increases the temperature and speed decreases and reduces the noise.
- 3) **Resonance Type Muffler:** In this type of muffler it consists many number of Helmholtz resonators in series, through which a pipe containing access ports passes. These resonators reduce the noises when the gases pass through.
- 4) **Absorber Type Muffler:** This type of muffler contains sound absorbing particles like fiber glass and other fine particles which are placed in the case around the perforated tube through which the exhaust gases pass. These particles absorb the sounds and temperature by the increase in size of the air passing through pipe. Mufflers are installed within the exhaust system of most internal combustion engines. The muffler is engineered as an acoustic device to reduce the loudness of the sound pressure created by the engine by acoustic quieting. The noise of the burning-hot exhaust gas exiting the engine at high velocity is abated by a series of passages and chambers lined with roving fiberglass insulation and/or resonating chambers harmonically tuned to cause destructive interference, wherein opposite sound waves cancel each other out. An unavoidable side effect of this noise reduction is restriction of the exhaust gas flow, which creates back pressure, which decreases engine efficiency. This is because the engine exhaust must share the same complex exit pathway built inside the muffler as the sound pressure that the muffler is designed to mitigate.

**Drive shaft:** A drive shaft, driveshaft, driving shaft, propeller shaft (prop shaft), or Cardan shaft is a mechanical component for transmitting torque and rotation, usually used to connect other components of a drive train that cannot be connected directly because of distance or the need to allow for relative movement between them. As torque carriers, drive shafts are subject to torsion and shear stress, equivalent to the difference between the input torque and the load. They must therefore be strong enough to bear the stress, while avoiding too much

additional weight as that would in turn increase their inertia. To allow for variations in the alignment and distance between the driving and driven components, drive shafts frequently incorporate one or more universal joints, jaw couplings, or rag joints, and sometimes a splined joint or prismatic joint.

**Chain drive:** One of the most power transmitting component in transportation machines like motor-cycles, bicycles, automobiles, conveyors, agriculture machinery and machine tools. Chain drives are flexible and made of number of links and it's an intermediate between belts and gears drives. Chains can only be used to transmit power between parallel shafts. Unlike belt drives, chain drives use special toothed wheels called sprockets.

**Wheels:** Automotive tires go on steering axles and drive axles. As such, they're made to bear the load and provide the traction that motorized rotation and steering require. Trailers, by their very nature, don't have powered wheels, and most don't have steering or brakes. Trailer wheels, which mount on trailer axles, simply have to bear the load of the trailer and its intended cargo. Properly inflated vehicle tires operate at relatively low pressures, generally around 32 pounds per square inch, so as to cushion the passengers while also supporting the weight of the vehicle. Granted, you can follow Hunter S. Thompson's example from "Fear and Loathing in Las Vegas" and inflate them to around 90 psi, but you'll feel every pebble in the road and risk tire failure. Trailer tires, however, frequently call for even higher air pressure than automotive tires do. Fill them to a mere 32 psi, and the tires walls will flex too much and overheat. While automotive tires have flexible sidewalls, trailer tires have stiffer sidewalls to accommodate higher air pressure. Trailer suspension systems also are generally stiffer than vehicle suspensions and inflict more abuse on tires. Tires fall into three categories: passenger (P) tires, light truck (LT) tires and special trailer (ST) tires. You'll want to go with ST tires. Your trailer should have each axle's gross vehicle weight (GVW) listed on the body or in the owner's manual. This figure is the total amount of weight the axles can withstand, so you'll need tire capacity that meets or exceeds the GVW. If you know how much weight you plan to tow, you can be a little more exact. First, determine the weight of the unloaded trailer. Then add the weight of your payload. The combined capacity for all of the trailer's tires should exceed the total. Once you've found tires that fit your weight requirements, save yourself a lot of trouble and make sure they're attached to wheels that are going to fit on your wheel hub. To avoid any frustrating revelations, know the bolt pattern for your trailer's wheel hubs. It may have four, five or even eight bolts, and you'll want your trailer tire to match up. The distances between the bolt holes, called the bolt circle, also has to be exact. The bolt circle is the center-to-center diameter of the imaginary circle that the bolts or bolt holes' outline. With even bolt numbers, simply measure the distance between two opposing holes or bolts. With odd numbers, measure the distance between a bolt or hole and the halfway point between the two opposing it. If your wheel hub has five bolt holes and

the bolt circle is 4.5 inches (114.3 mm), then your wheel's bolt pattern would be 5 on 4.5.

**Cultivator:** A cultivator is any of several types of farm implement used for secondary tillage. One sense of the name refers to frames with 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. The rotary tiller is a principal example. Cultivators stir and pulverize the soil, either before planting (to aerate the soil and prepare a smooth, loose seedbed) or after the crop has begun growing (to kill weeds—controlled disturbance of the topsoil close to the crop plants kills the surrounding weeds by uprooting them, burying their leaves to disrupt their photosynthesis, or a combination of both). Unlike a harrow, which disturbs the entire surface of the soil, cultivators are designed to disturb the soil in careful patterns, sparing the crop plants but disrupting the weeds. Cultivators of the toothed type are often similar in form to chisel plows, but their goals are different. Cultivator teeth work near the surface, usually for weed control, whereas chisel plow shanks work deep beneath the surface, breaking up hardpan. Consequently, cultivating also takes much less power per shank than does chisel plowing. Small toothed cultivators pushed or pulled by a single person are used as garden tools for small-scale gardening, such as for the household's own use or for small market gardens. Similarly sized rotary tillers combine the functions of harrow and cultivator into one multipurpose machine. Cultivators are usually either self-propelled or drawn as an attachment behind either a two-wheel tractor or four-wheel tractor. For two-wheel tractors they are usually rigidly fixed and powered via couplings to the tractors' transmission. For four-wheel tractors they are usually attached by means of a three-point hitch and driven by a power take-off (PTO). Drawbar hookup is also still commonly used worldwide. Draft-animal power is sometimes still used today, being somewhat common in developing nations although rare in more industrialized economies.

**Seed drill:** A seed drill is a device that sows the seeds for crops by metering out the individual seeds, positioning them in the soil, and covering them to a certain average depth. This makes sure the seed will be placed evenly. The seed drill sows the seeds at equal distances and proper depth, ensuring that the seeds get covered with soil and are saved from being eaten by birds and being blown by the wind. This allows plants to get sufficient sunlight, nutrients, and water from the soil. Before the introduction of the seed drill, a common practice was to plant seeds by hand. Besides being wasteful, planting was usually imprecise and led to a poor distribution of seeds, leading to low productivity. The use of a seed drill can improve the ratio of crop yield (seeds harvested per seed planted) by as much as nine times. Some machines for metering out seeds for planting are called planters. The concepts evolved from ancient.

**Sweeper blades:** Blades are the component which directly interact with soil and as such have major impact on the

operation of weeds. The blades are the main component of the machine which remove unwanted trash from the field. It directly contacted with seed and inserted into soil.

*Sprayer:* Sprayers are commonly used on farms to spray pesticides, herbicides, fungicides, and defoliant as a means of crop quality control. There are many kinds of machine-operated sprayers, the most common of which are low-pressure, high-pressure, air-carrier, and fogger types. Insects and weeds are largely responsible for the crop destruction. In modern horticulture and agriculture, insecticides/pesticides, a man made or natural preparation are used to kill insects or otherwise control their reproduction. These herbicides, pesticides, and fertilizers are applied to agricultural crops with the help of a special device known as a "Sprayer." Based on the concept of high or low pressure, sprayer provides optimum performance with minimum efforts. There are several types of sprayers available in the market such as manual or self-propelled sprayers, tractor mounted sprayers and aerial sprayers. Science and technology always help the mankind to improve its life. This thing applies to the agriculture sector too. Innovative human brains use their creative power and blend it with the principles of mathematics and physics to develop an ultimate range of plant protection equipment's, showcasing the highest degree of human excellence. The invention of a sprayer, pesticides, fertilizers, etc. bring revolution in the agriculture/horticulture sector. Especially the invention of sprayers, enable farmers to obtain maximum agricultural output. They are used for garden spraying, weed/pest control, liquid fertilizing and plant leaf polishing. It is available in man-portable units, self-propelled units.



Fig. 1. Sprayer arrangement

*Steering:* Steering is the collection of components, linkages, etc. which allows any vehicle (car, motorcycle, bicycle) to follow the desired course. An exception is the case of rail transport by which rail tracks combined together with railroad switches (and also known as 'points' in British English) provide the steering function. The primary purpose of the steering system is to allow the driver to guide the vehicle. The most conventional steering arrangement is to turn the front wheels using a hand-operated steering wheel which is positioned in front of the driver, via the steering column, which may contain universal joints (which may also be part of the collapsible

steering column design), to allow it to deviate somewhat from a straight line. Other arrangements are sometimes found on different types of vehicles, for example, a tiller or rear-wheel steering. Tracked vehicles such as bulldozers and tanks usually employ differential steering—that is, the tracks are made to move at different speeds or even in opposite directions, using clutches and brakes, to bring about a change of course or direction.



Fig. 2. Sweeper blades



Fig. 3. Cultivator



Fig. 4. Multipurpose agriculture machine

#### 4. Advantages

1. It alternates the soil levels more quickly than traditional methods.
2. It can cover large field area in short time during spraying.
3. The seed sowing is more effective and quick.
4. It can remove unwanted trash from field.
5. Animal requirement can be completely eliminated.
6. Less labor is required.
7. It is best suitable option in absence of animal weeding.
8. Labor wages can be completely neglected.
9. It is advance and faster method of farming.

10. The machine cost is considerably low.
11. Simultaneous operations can be performed.
12. Due to manual handling of machine crop damage is less likely.

### 5. Conclusion

The product was designed and developed on existing engine operated sweeper weeder machine, implementing the 4 wheeler arrangement. The spraying unit, the cultivator cum seed sower arrangements are also provided. The device is made such that can be easily operated in field. The vehicle power is provided by two stroke petrol engine, and controls are given at handles and foot rest.

The steering mechanism is easier to operate and simple. Equipment controls are handy and easily accessible. The control switch is provided for spraying operations. This device is designed for ergonomically considerations only to push in the forward direction such a way that machine drag cultivator or sweeper blade or machine can transport the nozzle to cover the farm area. Thus, this fabrication is value for money.

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