

Optimization of Agricultural Crop Yield Using Modern Mechanical Techniques an Overview of Modern Agricultural Equipments

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ABSTRACT: Agriculture is an important sector of India's economy and adjacently it is one among the top two farm producers in the world. This sector provides about 52% of total number of jobs available in India and contributes around 18.1% to the GDP(Gross Domestic Product). A lot of farmers still need to explore methods of automation, operation research and resource planning in order to increase the quality and quantity of the agricultural yield. Due to high exorbitant prices the hybrid seeds aren't affordable by the majority of the farmers. Indian soils have been used for growing crops over thousands of years without caring much for replenishing. This has led to depletion and exhaustion of soils resulting in their low productivity. In spite of the large scale mechanization of agriculture in some parts of the country, most of the agricultural operations are carried on by human resources using simple, conventional tools and implements like wooden plough, sickle, etc. It results in huge wastage of human resource and in low yields per capita income. The mechanical engineering has a long and honourable history of achievements in agricultural sector. Now-a-days, most of the agricultural equipment is automated which gives non-conventional approach to improve the yield of the farmer's produce. Thereby, it reduces human efforts and improves the efficiency of the agricultural processes resulting in high crop yield obtaining returns on investment.

This paper gives the data about latest technology of designing and building machines which allows the agriculturists to sit back and watch their work being done without much effort such as Tractor driven onion transplanter, paddy thresher, and tree climber and so on. It shows how engineering methods can be applied to this large and growing sector of the economy.

KEYWORDS: GDP, Operation research, Conventional and Non-conventional approach, per capita income, economy.

I. INTRODUCTION

Agriculture, with its allied sectors, is unquestionably the largest livelihood provider in India, more so in the vast rural areas. It also contributes a significant figure to the gross domestic product (GDP). Sustainable agriculture, in terms of food security, rural employment, and environmentally sustainable technologies such as soil conservation, natural resource management and biodiversity protection, are essential for holistic rural development. Currently, around 51% of India's total workforce is engaged in agriculture and its allied sectors, like forestry, fisheries, and so on. For most of the 21st century India is expected to remain an agricultural society. One can't underplay the role of agricultural growth in improving rural incomes and securing India's food and nutritional needs. Our population is expected to be 1.4 billion by 2020. The increasing population, coupled with growing income will generate increased demand for food grains and non-food grain crops. Therefore Indian agriculture has to achieve and maintain a consistent and higher growth rate of 4% per annum. Brazil, Russia, India, China and South Africa, The BRICS Nations, along with Japan and Turkey are joining the ranks of heavy weight in agricultural machinery market. According to federUnacoma report, India is world's largest tractor market, with sales 620,000 units in 2014, providing clear proof that India has emerged as new agricultural machinery mega market.

Mechanization of farms means the use of machines for conducting agricultural operations, replacing the traditional methods which involve human and animal labour. Farm mechanization is one of the packages of green revolution

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technology. Farm mechanization implies the use of mechanical technology in the varied farming operations like sowing, harvesting, threshing, levelling, watering, spraying, weeding etc.

The Farm mechanical technology includes:

1. CHEMICAL TECHNOLOGY—Plant protection measures.
2. HYDROLOGICAL TECHNOLOGY—Tube wells.
3. MECHANICAL TECHNOLOGY—Tractors , threshers, bulldozers

II. RELATED WORK

1. TRACTOR DRIVEN ONION TRANSPLANTER

The task of transplanting onion seedlings manually is time consuming, labor intensive and toilsome process. Innovator Pandharinath Sarjerao Shri More, who is a farmer, has developed an affordable, semi-automatic Trans planter for timely sowing of onion seedlings. It is a tractor drawn semi - automatic Onion transplanter. It can perform three functions at a time viz. transplanting the onion, applying the fertilizer and making the irrigation channels.

1.1 WORKING:

When the tractor moves forward, the star wheel type metering mechanism gets the drive to release the fertilizer in the tubes. The seedlings are delivered manually in the delivery chutes for planting. The inter-row and inter-plant spacing can be adjusted in the machine to a finer level. Two depth controlling wheels fitted on either ends of the equipment maintain the uniform depth of onion planting, which is kept at 1 cm. A channel forming ridge plough is mounted offset to the right end of the transplanter to form the irrigation channel simultaneously.



FIG 1.1: TRACTOR DRIVEN ONION TRANSPLANTER

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1.2 TECHNICAL SPECIFICATIONS:

Power required	More than 25hp tractor
Working width	1.5 meters (includes 8 furrow openers)
Plant spacing	1) 18 x 9 cm
Depth of plantation	1 cm
Transplants	555950 seedlings per ha.
Manpower requirement	5 labours
Capacity	1 hectare per day
Weight	300-350kg (with fertilizer drilling arrangement)

TAB 1.1: TECHNICAL SPECIFICATION FOR TRACTOR DRIVEN ONION TRANSPLANTER

1.3 SALIENT FEATURES:

1. Uniform Planting (maintain row to row and plant to plant spacing)
2. It gives 100 % of plant emergence
3. Facilitates the mechanical weeding and harvesting
4. It can also be used for drilling the cereals and pulses

II. MULTI-TREE CLIMBER

As reported by Coconut Development Board, coconut Tree climbers are a rarity these days in Kerala and other coconut growing states of Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra and Goa, with very few taking on the traditional profession. There is a reluctance to enter this field because of the occupational risk and the arduous labour involved in climbing tall coconut trees. Due to scarcity of labour as against the general norm of harvesting cycles of 45-60 days, farmers are currently able to harvest only once in three to four months.

1.2 WORKING

There are three variants – Coconut Tree Climber, Multi Tree Climber and Tree Walker. Upper frame is operated by hand and lower frame is operated by leg. By up and down movement of upper and lower frame, one can climb on the tree. Multi Tree Climber Equipment is suitable for climbing coconut, palm, and teak, and rubber, silver oak & similar trees.

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FIG 2.1: MULTI-TREE CLIMBER

1.3 TECHNICAL SPECIFICATION

Overall Dimensions (LxWxH)	1. Upper Frame - 40 x 20 x 2.5" 2. Lower Frame - 30 x 20 x 1.5"
Tree Circumference preferred	15" - 51"
Time taken for Climbing	5 mins for 60 feet height
Tree Climbing Capacity	10-12 trees/hr.
Materials Used for Main Body	Stainless Steel 202 Grade

TAB 2.1: TECHNICAL SPECIFICATIONS OF MULTI-TREE CLIMBER

1.4 SALIENT FEATURES

- Eco –friendly
- Manual Operation
- Easy Handling
- Safety Harness for Climbers' Safety
- Women can operate easily
- Low Weight
- Easy Transportation
- Climbing Height - no limits
- Addresses labour shortage
- Long Life / Zero Maintenance

III. LOW COST PADDY TRESHER

In paddy farming, threshing operation, which involves separation of paddy from panicles, is one of the time consuming and laborious conventional methods of paddy threshing manually by beating against stone or by draught animal. FazlulHoque has

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developed a thresher that can thresh without chopping the straw of the moist crop. The straw, chaff, grains are separated and thrown separately, thus reducing labour and drudgery. Using this machine threshing can be done even in Rainy days under a shade.

1.5 WORKING

The thresher can be operated by a 5 hp electric motor or tractor PTO. It requires only two people to thresh. The thresher is consisting of feeding chute, threshing cylinder, blower, straw outlet and grain outlet. The body is made of high quality steel and sheets to withstand maximum wear and tear. These threshers can be operated both with electric motor and diesel engine. The paddy crop's straw is separated from grain in the threshing cylinder. The straw is thrown out from the machine with the help of blower, and the paddies are thrown out through other outlet. The special feature of this machine is that it does not chop the straw and hence we get it in full length.



4 Walker Paddy Thresher

FIG 3.1: PADDY TRESHER

1.6 TECHNICAL SPECIFICATIONS

Overall dimensions (in mm)	L – 1660, W -1580, Height -1650
Weight	250 kg
Engine power requirement	5 hp Diesel Engine or Electric Motor
Thresher cylinder Speed (rpm)	510
Cleaning system	Blower
Feeder capacity	900 kg /hr. (789 kg / lit)
Grain output	444 kg /hr. (370 kg / lit)
Thresher efficiency (%)	96.5 - 96.8

TAB 3.1: TECHNICAL SPECIFICATIONS OF PADDY TRESHER

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1.7 SALIENT FEATURES

- It can thresh paddy without chopping the straw of the moist crop
- Low cost and high power threshing machine
- The straw, chaff, grains are separated and thrown separately thus reducing drudgery.
- The device is easy to install and maintain.
- It does not chop the straw and hence we get it in full length.

IV. ADVANTAGES

1. INCREASE IN VOLUME OF PRODUCTION: Farm mechanization has helped in increasing the volume of agricultural production.
2. ENCOURAGES MULTIPLE CROPPING: Farm mechanization encourages multiple cropping which was not possible under traditional farming.
3. REDUCES DEPENDENCE UPON ANIMAL POWER: Farm mechanization reduces dependence upon animal power which is costly and also slow in operation.
4. DIVERSION OF LAND FROM GROWING FODDER: Farm mechanization makes it possible to divert the land used for growing fodder for animal power. The same land can be brought under cultivation for growing food and non-food crops.
5. GREATER AREA UNDER CULTIVATION: Farm mechanization saves labour, makes the job for levelling and preparation of land easy and helps in bringing more land under cultivation.
6. INCREASE IN LABOUR PRODUCTIVITY: Farm mechanization increases efficiency of farmers and raises the output per worker.
7. TIMELY WATER SUPPLY, SPRAY: The timely availability of water supply from tube wells, the use of new package of modern inputs has been made possible only with the help of mechanization. The use of modern inputs increases the yield of crops.
8. REDUCTION OF COST: Due to efficient use of resources through the mechanized farming the cost of production of various crops goes down.
9. INCREASE IN INCOME: Mechanization helps in increase in income of farmers by minimising pre and post-harvest losses.
10. PROVIDES OFF FARM EMPLOYMENT: It provides of farm employment to the population living in rural areas.
11. SELF SUFFICIENCY IN FOOD: mechanization of agriculture helps in achieving self -sufficiency and surpluses in food and other crops.

V. CONCLUSION

Farm mechanization is an important component of modern agricultural production system. Population of tractor-machinery is increasing year by year in the country. Now tractors are owned not only by the farmers of large land holdings but also by those with small land holdings. Many farmers are using their tractors on custom- hiring for extra income. With the availability of tractors on custom-hiring, farmers are reducing bullock population and their hiring-in tractors for the farm operations. In fact, use of tractor enhances the capacity of machines increasing precision and timeliness in farm operations.

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