

REVIEW PAPER ON ONION LEAF CUTTING MACHINE

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Abstract: The state of agriculture in India is a point of concern for its entire population. The farmers in rural India suffer greatly from illiteracy and poverty; hence, there is a lack of good continuous services. For Indian agricultural sector one of the most common problem facing by the Farmer is Unavailability of labour from last two decades. Because of education facilities in Indian and the industrial and technological development of India. Hence it is necessary to move the Indian traditional agricultural field into modern technology base agriculture by using technology we can reduce the work of farmers by using a machine that helps to a farmer in agriculture work.

IndexTerms - Onion Leaf Cutting Machine, Rate of Cutting, Traditional Agricultural, Modern Agriculture.

I. INTRODUCTION

Onion is an extremely important vegetable crop in India not only for internal consumption but also for the highest foreign exchange earner among the fruits and vegetables. Being an essential food item, India ranks second in global onion production after China and with an annual production of 16 to 17 million tons accounts for around 20% of global production. Annual turnover on the Indian onion market in more than 10,000 corers and Maharashtra contributes nearly 30% in it.[1] In India onion is grown in three crop seasons, namely Kharif (harvested in October-November), late Kharif (January February), and rabi (April – May). Rabi season crop is the largest accounting for about 60 percent of annual production with Kharif and late Kharif accounting for about 20 percent each. Major producing states are Maharashtra, Karnataka, Madhya Pradesh, Andhra Pradesh, Bihar, Gujarat, Rajasthan, and Haryana, which together account for 85 percent of total production.[2] The onion is a commonly used vegetable type in price/production modelling. studies It was reported that cobweb theory is valid for onion production. Accordingly, growers determine production strategies based on market prices that emerged in the previous season. Higher prices lead to higher production for the next season and lower prices lead to lower production for the next season. The marketing of onions and the formation of prices occur in free-market conditions in Turkey. For this reason, onion prices and production show a very fluctuating course. Whatever the reason, the fluctuations in the price of a product from year to a year lead to the study of the mechanism called cobweb theorem by economics.[3]

Following have some data on onion production in India[4]and from this we can observe that how onion production is important for Economical point of view.

Table 1: onion export

Onion Export (Quantity in Lakh MT)			
	2016-17	2017-18	2018-19
April	1.95	1.60	1.73
May	2.30	2.09	2.20
June	1.90	1.24	1.05
July	1.54	1.42	1.53
August	1.95	1.58	1.81
September	1.97	1.44	2.02
October	2.04	0.87	1.78
November	1.90	1.14	1.36
December	2.57	1.00	1.75
January	1.90	0.58	
February	1.99	1.01	
March	2.15	1.90	
Total	24.16	15.89	15.22



Figure 1.1 onion

Hereby referring above data, we can see that the importance of onion from an economic point of view. Hence here the development in this field is necessary and the traditional way of agriculture [5] is to need to convert into modern agriculture. For onion farming, the major drawback is the cut of onion leaf, every leaf needed to cut, and hence the labor cost of that process is more in today's technological world. it is impossible to easily availability of labor and the chargers of cutting of onion is very high.

In Maharashtra state, the labor cost is as following
 15 kg of onion cart = Rs.20
 1 Quintal Onion = Rs.133.33 per Quintal
 In an average rate of onion = Rs.700-1000 per Quintal[5]

Hence the Rs 133-150 is a very high amount to cut the onion. in that amount other transport and maintenance charges are also added. hence farmer do not have efficient earning from onion. hence it is necessary to work on this field.

II. FEASIBILITY OF PROJECT STUDY

In this Feasibility of project study, various factor should consider while Design and develop the project. In this factor the cost of the product, the life of the product, the input factor, and technical factor is including. following factor should consider while Designing.

1 Economical

The main parameter of the product for determines its Success rate is the cost of that device. The cost of a machine should be less and its onetime investment the other factor like maintenance cost is also very less and the productivity of the machine is also high. we should design such kind of machine that can use for maximum number onion.

While study economical factor the less maintenance cost, easy availability of part, high life, low maintenance cost should consider while designing.

2 Operational feasibility

Operational feasibility is mainly concerned with issues like whether the system will be used if it is developed and implemented. Whether there will be resistance from users that will effect the possible application benefits. In operational feasibility of product operation and construction of the project are very simple which leads to easy identification, rectification, and replacement of the components also designer should consider that

Here we consider some factors while the design is the model doesn't use the blade or hard friction for cutting, so the outcomes will whole shaped fresh onion. The. The operation is simple, so the chef can easily operate the machine and also here we should take care that onion is an important task while Designing also we should consider the ergonomic consideration[6] while on this the onion entry and exit point are well defined and the also cutting leaf is not mixed with other machine parts.

3 Technical feasibility

In A technical feasibility study assesses the details of how you intend to deliver a product or service to customers. Think materials, labor, transportation, where your business will be located, and the technology that will be necessary to bring all this together. This point is considered in technical feasibility.

III. PREVIOUS WORK ON ONION LEAF CUTTING MACHINE

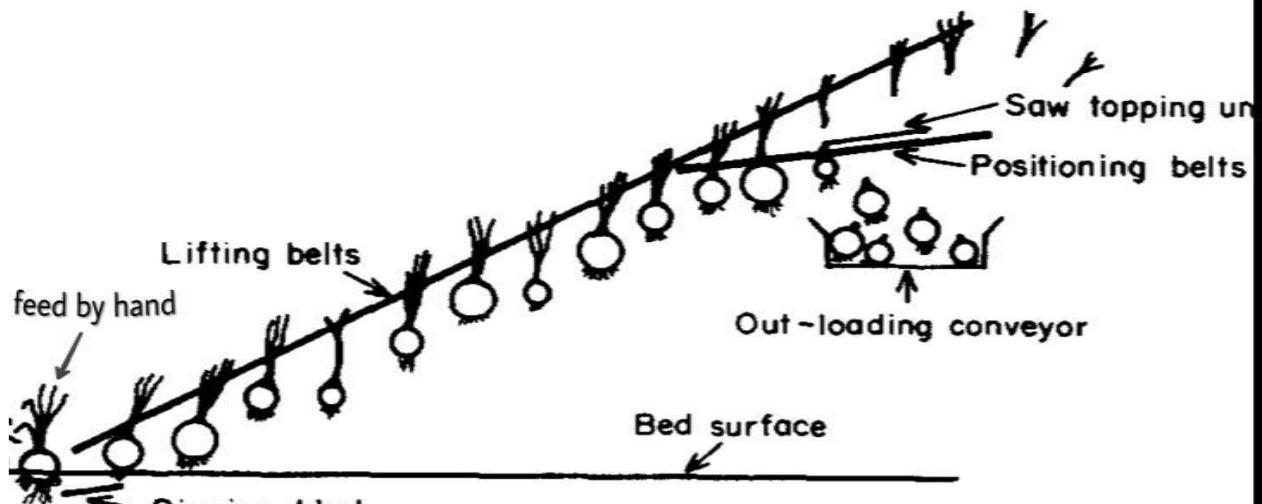


Figure 1.4 Working of onion leaf cutting machine.

As shown in the above Fig. 1.4 The Student of Dept. of Mechanical Engineering, GCOERC, Nashik was Design, And Develop of the onion Leaf-cutting machine. In This project consists of cutter & belt conveyor assembly which is mounted on the end side of the movable platform on M.S. frame. The rotary cutters are mounted at the top side of the belt conveyor system. When we required operating the onion leaf cutter/remover, we can push the onion on conveyer which will move in a forward direction. When there is an approach of onion to cutter due to electric cutter it will cut the leaf of onion. Belt conveyor system can be supported by the support of four pedestal bearing operated by using electric gear motor. After cutting of onion & leaf are separated & collected in-tray. Fig.1.4 shows the semi-automatic onion leaf cutting machine.[7]

This semi-automatic type machine. here machine need to feed the onion in the machine at the specific interval hence time required is more to cut the onion. but because of support system structure it is easy to Fabricate this model. hence the cost project is very less.

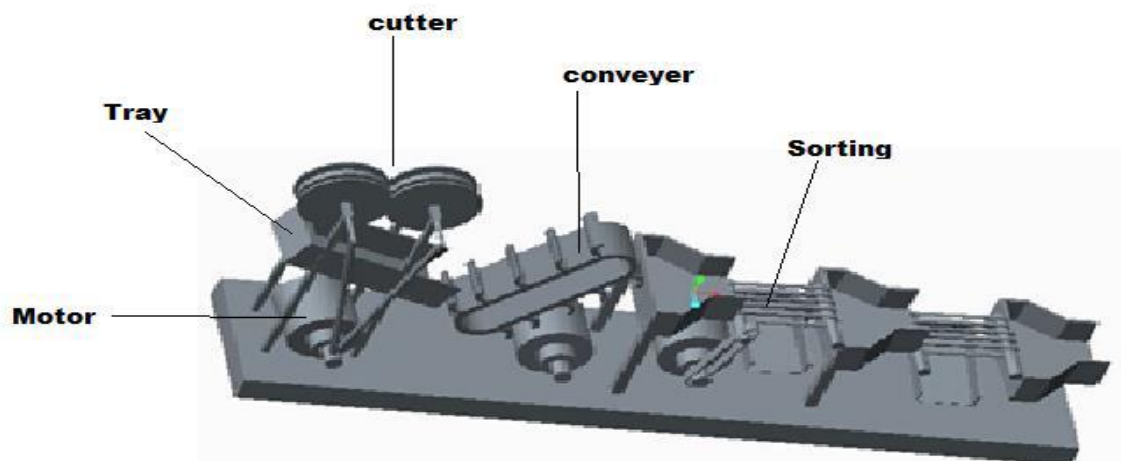


Figure 1.5 Working of Onion Leaf cutting machine

As Mention in Above Fig 1.5 Student, Department of Production Dept. AVCOE, Sangamner, Maharashtra Design and Develop The onion Leaf-cutting machine. In this project consists of following construction in this they used the motor and belt drive, and the power of that motor is used to run the cutter as shown in the figure.

here need put onion manually in the tray, and the cutter has cut that onion leaf as required. after that used the conveyer system to move the cut onion. conveyer put the onion on sorting table. Sorting table are sort the small and large size of an onion as per size. this the working of this project. In this the sorting mechanism is also introduced in this project, we required power for cutter, for a conveyer system, and also for sorting mechanism hence here the power required is more in this machine. This is also semi-automatic type onion leaf-cutting and sorting machine[1].

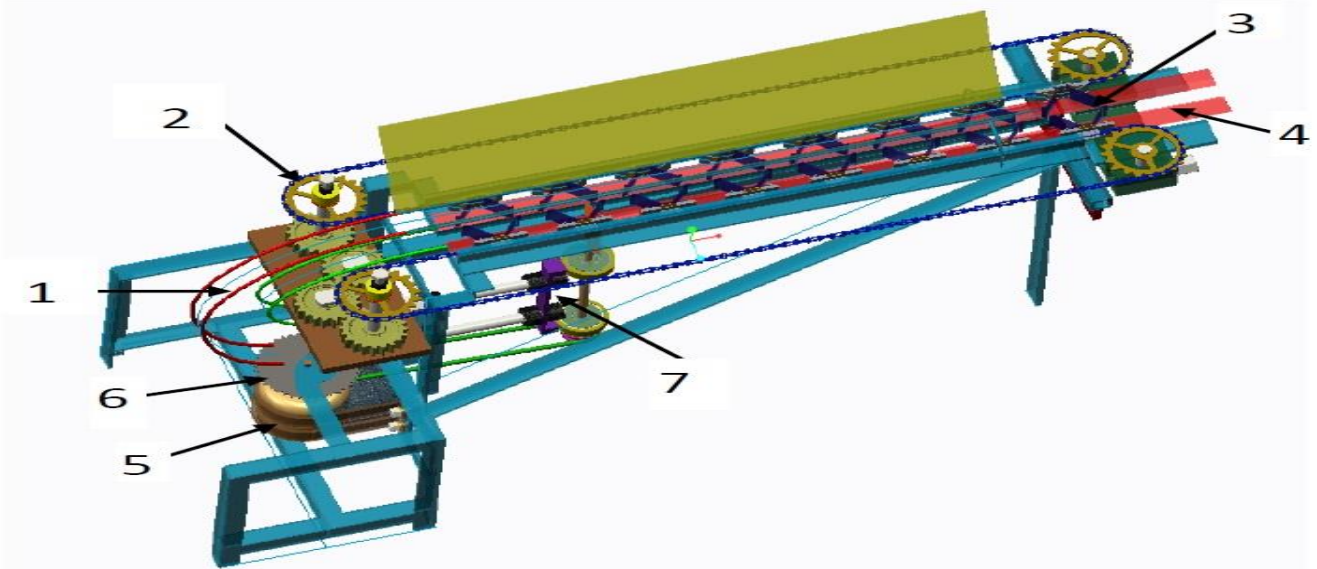


Figure 1.6 Onion Root and Shoot Cutting Machine

- 1-Toppling mechanism 2-Sprocket chain drive 3-Holding devices
- 4-Guideways 5-Motor 6-Disk type shoot cutter
- 7-Chain tightening mechanism

Here We can see in Fig. 1.6 Student, Department of Mechanical Engineering, G H Patel College of Engineering & Technology, V.V Nagar Design of Onion Root and Shoot Cutting Machine in This project Initially when an onion is at last stage of growth, workers will have to pick up from the soil and make small heaps. After that onion will be fed into the machine manually at the feed point located at the starting point of guideways. The conveyor belt will move the onion forward at a specific speed. Guideways and conveyor will support onion from bottom and top so that it will not fall on the sideway. A cutter provided mid-way on the conveyor will cut root from the bottom. The onion continues its motion and is guided into the toppling mechanism which inverts onion by 180 degrees and moves forward up to the next cutter provided to cut shoot parts. The shoot will be collected in a hopper and onion in another hopper. This was the simple mechanism that was thought but there were many problems faced and many changes needed which were resolved by trial and error process.[8]

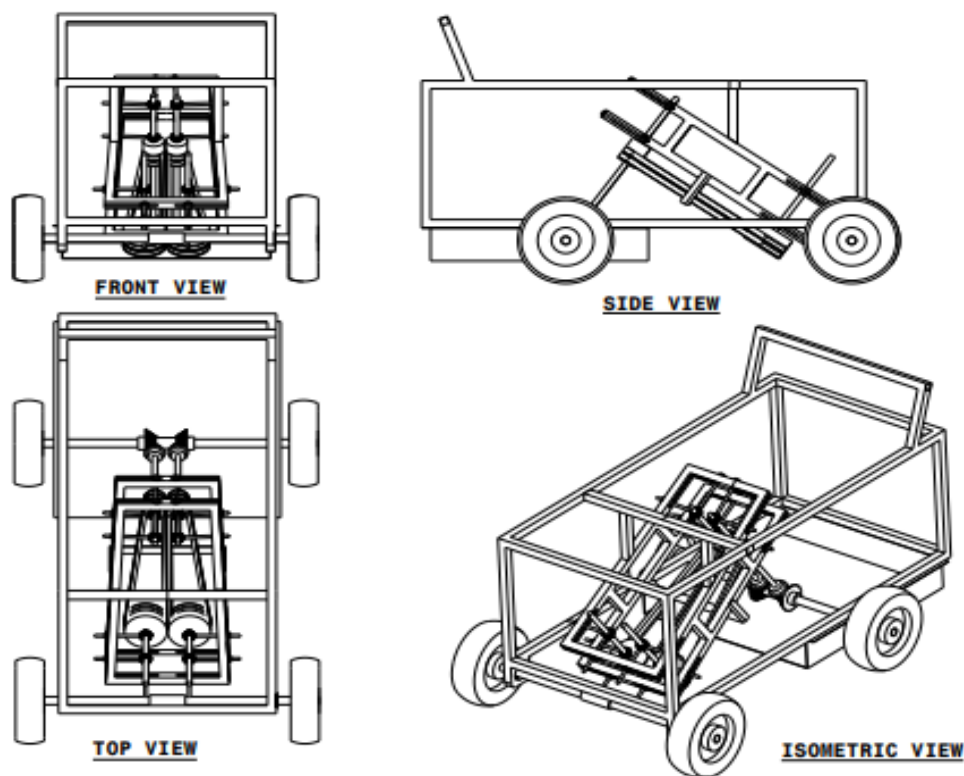


Figure 1.7 Manually Operated Onion Harvesting Machine

As shown in Fig.1.7 the Student of Department of Mechanical Engineering J.S.P.M.'S. R.S.C.O.E. Pune Design of Manually Operated Onion Harvesting Machine in they introduce how the harvesting of onion can be done by minimum efforts this the movable machine. In this project, we have seen the simplest. method of onion root and stem cutting process. In the conventional way of cutting root and stem. we require more cost and manpower comparatively & this method is fully based on the work of human effort hence

more time consuming so it requires more workers and another cost is also very high. So They are going to invent the machine which will minimize that cost and time for onion root and stem cutting and the process is also simple. Also, we succeed to make it very small and affordable to all farmers and it increases the speed of work There objective is fulfilled in this project.[2]

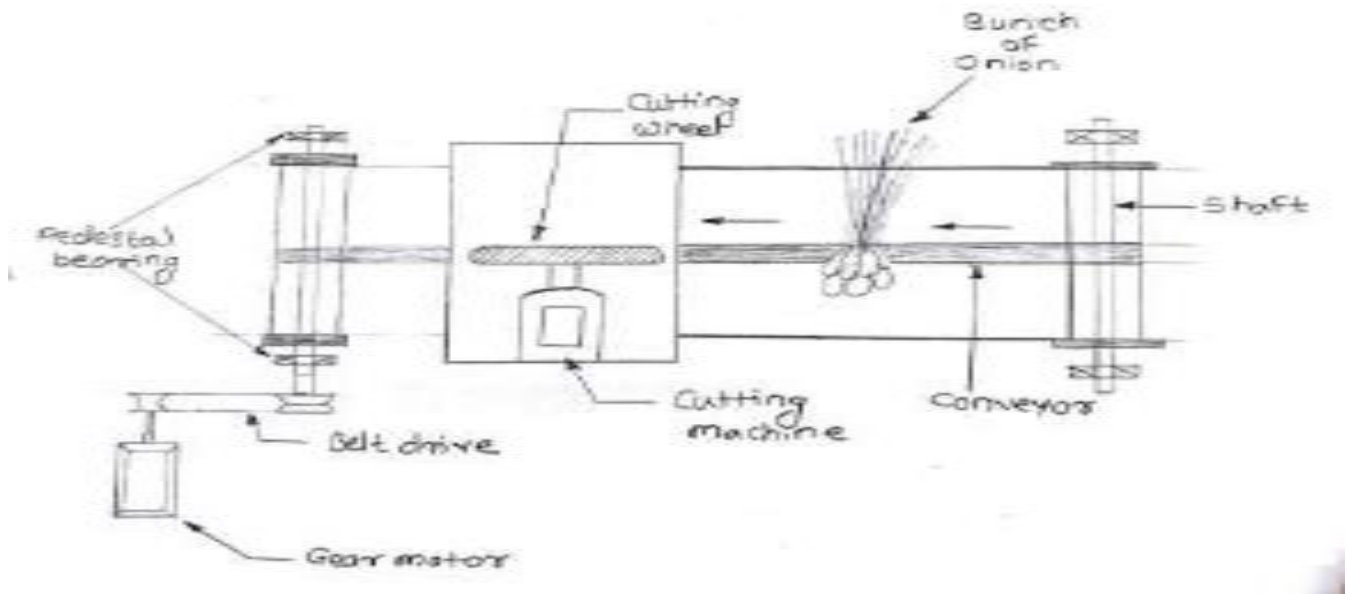


Figure 1.8 onion leaf cutting machine

As shown in Fig.1.8 the Student of Department of Mechanical Engineering SVIT, Nashik, Maharashtra work on the Design of machine for onion leaf cutting machine as shown in the above fig. this the construction of the onion leaf cutting machine it consist of the gear motor belt drive bearing cutting wheels cutting machine conveyor shaft. As we see the conveyor is moving the bunch of onion here, we manually put the bunch of onion on the conveyor system. here the bunch of onion is feeding in that manner the onion and the onion leaf-cutting separately as we can see we run the cutter by using the motor and the belt drive this a simple working of the above project[9].



Fig 1.9 onion sorting and stem cutting machine

The Student of the Department of Mechanical Engineering D. Y. Patil College of Engineering, Ambi, Pune, fig 1.9 represents the construction of the onion sorting and stem cutting machine. It consists of Cutting blades, Mainframe, Guide slot, Motor, Pulley assembly, and sorting part as shown in fig. here Cutting blades are provided with adequate sharpness to cut the onion stem efficiently. They are provided with some angles to cut by both the edges. The mainframe holds the vibrating part of the machine. Its length and width are decided by the no. of onions the machine has to sort at a time. Then no. of rows with guide slot are decided. A guide slot is provided for forwarding motion of onions towards the cutter. They are provided with a downward inclination towards cutter to use the gravity while vibrating of the machine. The motor is used to provide the vibrating motion to the machine through a belt drive. The selection of a motor depends on the weight of the frame. As the weight of the frame increases, more torque, and power of, motor

required. Pulley assembly required to transfer the motion of the motor to vibrating body Sorting part is the second half of our machine is used to sort the onions based on their size like small, medium, and large. By this simple construction, we can easily cut the leaf, and onion also sorts the onion[10].



Fig.1.10 onion harvesting

The purpose of the project is to fabricate a machine to carry out the operation like harvesting which should be helpful for the farmers having Less & Marginal Land. By the observations of the results and discussion, variation between manual method, machine method, and proposed machine method, are described below: The labors required for the proposed machine method is less than the manual method and equal to machine method. Further, the machine method cannot be suitable for small scale farmers as it is economically not feasible. The time duration required for the proposed machine method is less than the manual method and more than the machine method. Further, the machine[11] method cannot be suitable for small scale farmers as it is economically not feasible. The cost required for harvesting the one-acre land is also less by using the proposed machine method[12].

In US patent number 7,007,449 B2 Researcher Mr. Duane Kido Research about the onion harvesting machine in The present invention comprises a leaf topping System that may be used in the harvesting machine in the field or a remote location, Such as a warehouse or food processing plant. The leaf topping System includes a plurality of rotating rollers that convey the vegetable toward a cutting Station and orient the vegetable in position for cutting off the leafy or unwanted portion of the vegetable. Further, the invention may comprise a cutting Station that receives the vegetable from rollers in an inverted orientation, cuts the leaf top or unwanted portion from the vegetable for delivery to a waste removal Station. In a preferred embodiment, the leaf topping System is included in a motorized harvesting unit[13]. Preferably, the harvesting unit includes a vegetable collection apparatus, a dirt separator, a pre-inspection Station; a separation and Singulation System; an orientation System[14]; a cutting mechanism; and, a post-inspection Station. Preferably, the collection apparatus includes a digging mechanism and a first elevation mechanism. Preferably, the harvester includes a Second elevation mechanism for conveying the onions from the cutting mechanism to the post-inspection Station, and/or a bagging Station or a truck (not shown).

The harvester preferably dig/uproots the vegetables, but optionally may be adapted to collect vegetables already uprooted by another machine. In the preferred embodiment, the harvester[15] is advanced through the vegetable field uprooting the vegetables and passing the vegetables via the collection apparatus to the dirt Separator where Soil and debris are removed from the vegetables[16]. The dirt separator then delivers the vegetables to the pre-inspection Station. At this Station, the vegetables may be inspected by crew-members and remaining debris, Such as rocks may be removed by the crew-members, after which the vegetables enter the Separation and Simulation System. Preferably, the Separation and Singulation System comprises rotating cylindrical rollers, divider rollers, and partitions, which ensure that the Vegetables are Separated from one another and passed to the orientation System. Preferably, the orientation System includes counter-rotating, cooperating rollers that orient the leaf tops in an inverted position while Simultaneously moving the Vegetable in auger fashion toward the cutting mechanism. The preferred orientation System has pairs of Said counter-rotating orientation rollers, each pair having an advancing roller and an adjacent inverting orientation roller, wherein both the advancing roller and the inverting orientation roller include a spiral or other arrangement of flexible fingers or other flexible members. The advancing roller also includes a vegetable advancing member, for example, a spiral that pushes the onion or vegetable

in auger fashion towards the cutting mechanism. Preferably, the cutting mechanism comprises a plurality of cooperating, rotating, grabbing, and/or cutting members that remove the leaf tops. The vegetables are then transported by the Second elevation mechanism to the post-inspection Station, and/or bagging Station or truck. Thus it is a primary object of the invention to provide a vegetable harvester and leaf topper that is effective under all operating environments from very dry to very wet. It is also an object of this invention to provide a vegetable harvester and leaf topper that is particularly adapted for use with bulb onions. It is still another object of this invention to provide a harvester that facilitates the collection of the vegetables from the field, an inspection of the product, and its final Sacking or conveyance to a Storage bin or truck. It is yet another object of this invention to provide a harvester that has a minimal operating crew and yet has a very high productivity rate. It is yet another object of this invention to provide a harvester that is reliable and maximizes the Safety of its operating CCW[13].

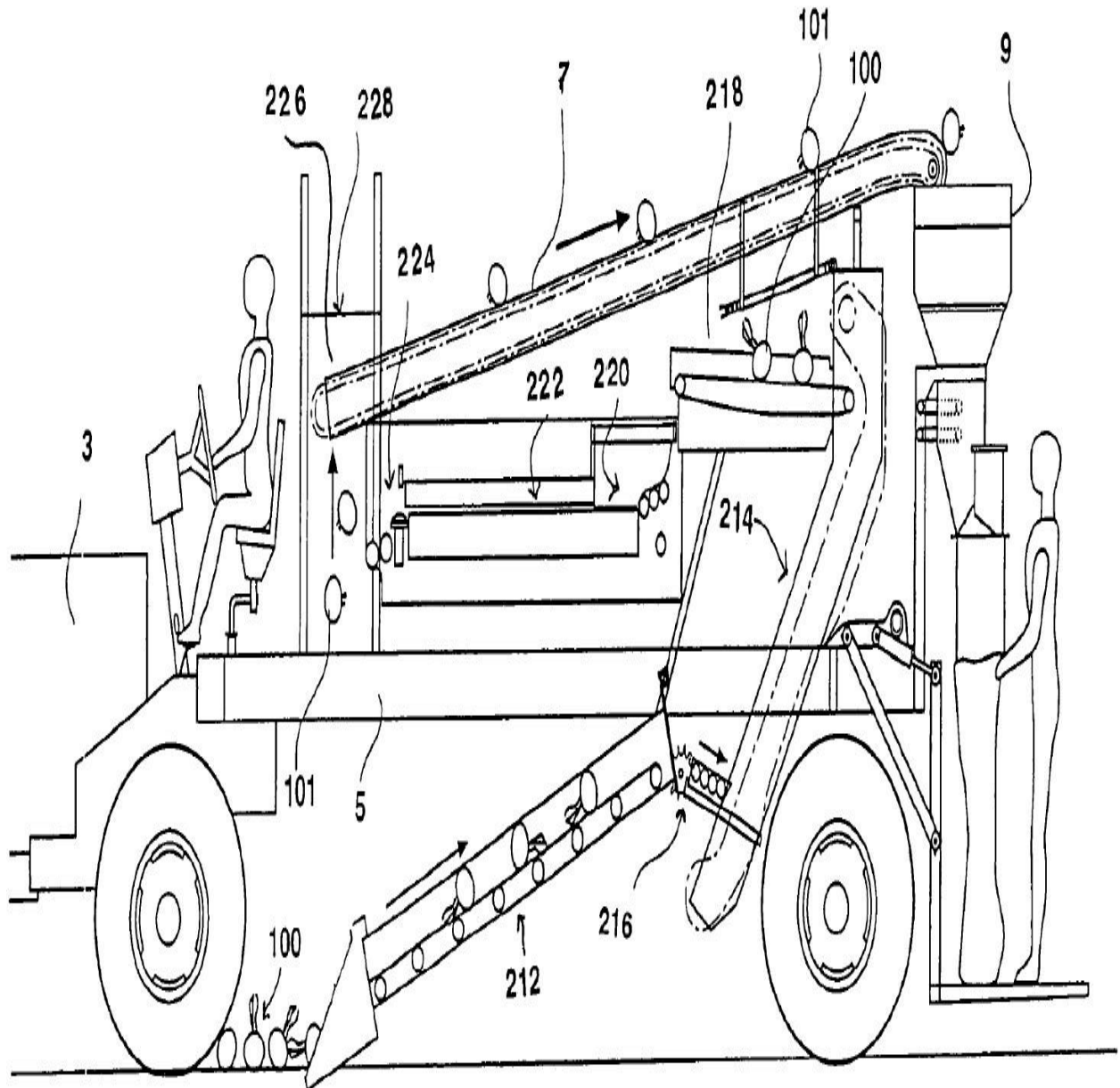


Figure 1.11 Onion harvesting machine

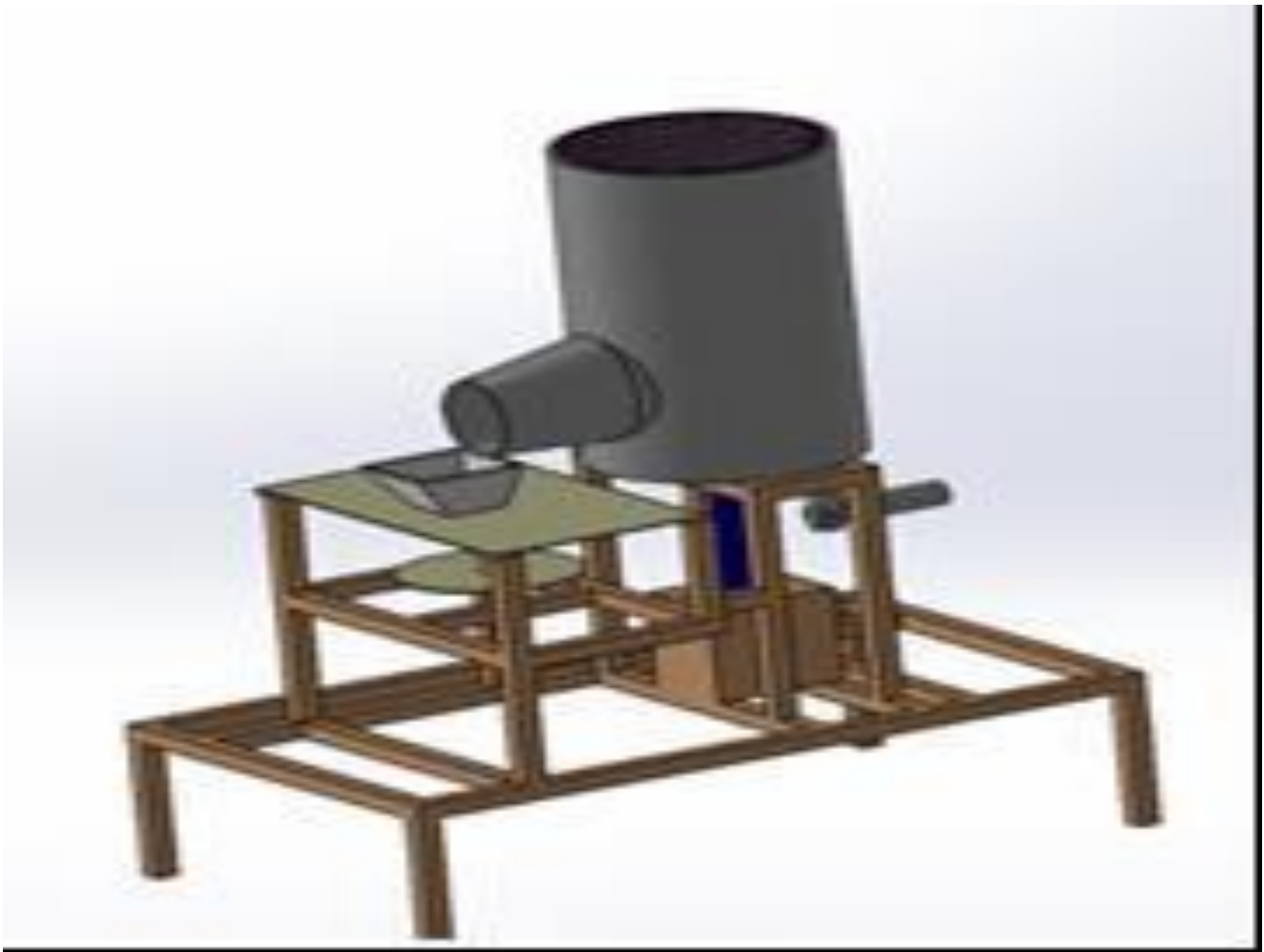


Figure 1.12 Automatic Onion Peeling and Cutting Machine

As shown in above figure P. Ravichandran, and its team Design and Fabrication of Automatic Onion Peeling and Cutting Machine in this 2 kg of onion is feed into a peeling drum which is covered by rough punched sheets and water is sprayed from the pump to the drum. After that, the top door was closed. The motor is switched on and the circular disc will rotate. Due to centrifugal force, the onion is circulating the rough punched sheet and the skin is peeled. The peeled skin is separated by the water and fed to the side gap of the circular disc. From the bottom of the drum, there is a hole which is connected by a pipe. To this extent, the peeled skin with water is coming out and collected to use as a fertilizer. Even without using the water, the onion skin is removed by using blower set up to separate the onion skin.

The peeled onion is passed to the hopper by the pathway. The cutter rotates by the belt drive from the motor pulley, which is used for peeling. And the onion is sliced and collected. When the onion falls on the hopper, hopper guides the onion to reach the cutter. The cutter is powered by the motor used for peeling operation. When the cutter blades present in the setup slices the onion when it falls on the cutter. It is rotating around 800 revolutions per minute. Various sizes of blades are used to cut the onion of different sizes for various preparations of food items. This mechanism slices the onion rather than chopping it.

A circular drum with a rough punched sheet is covered inside the drum for peeling the onion and is fixed inside utilizing nut and bolt. The circular disc is fixed at the bottom of the drum and a shaft which is extended downwards from the flat plate. The shaft is connected to the motor using a pulley. On the other end (i.e.) in the cutting section, there is a circular plate with three blades fixed 120° apart from each other is used to cut the onion. The AC motor is connected to both the using belt drive. Initially, the motor is switched ON, the cutter blade and the flat plate inside the drum also rotate at 1350 RPM. When the motor reaches the rated speed, onion is feed to a circular drum. It also starts rotating along with the plate and in addition to that water is sprayed to the drum by the submersible mini pump which is attached at the top of the drum. The rotation of circular disc at bottom of the drum creates centrifugal force, due to this force onion circulates over the punched rough sheets and the onion skin peels off slowly and it combines with the water and reaches the bottom and comes out from the hole created at the bottom. After the skin is peeled the onion needs to be taken out for that hole created at the side from that hole the onion comes out when the door is kept open. Onion is guided by the hopper to the cutting blade, it is a horizontal blade, it slices the onion into small pieces the sliced onion pieces are collected by the container placed at the bottom of the cutter blade[17].

SUMMARY OF ONION LEAF CUTTING MACHINE

Table 2 Summary of onion leaf cutting machine

AUTHOR	DRIVES	CONCEPT	MERIT	DEMERITS	REMARKS
Vaibhav K. Kale, Deepak Kawade.[7]	Cutter & belt conveyer assembly	Push the onion on belt conveyer and Cut using a cutter.	Simple support structures	Feeding by hands.	Simple working principle but the required each onion feeding.
Mutke Suraj, Rajput Monika.[10]	Motor cutter conveyor and sorting part	Here simply cut using cutter after the sorting mechanism is used.	Sorting[18] of onions beneficial.	Here also manual feeding cannot be used for large quantity	Required more power to run cutter conveyor and sorting mechanism. Hence required more power.
Prakash Vania, Chaniyara Khilan[8]	Toppling mechanism, Disk type shoot cutter, Sprocket chain drive.	By using topping mechanism guide the onion and cutting by Disk type Shoot Cutter	Efficient drive Mechanism Concept and cutting mechanism concept	Cannot use for different size of onion	Onions may be damage
Atul munde Shubham Mali.[11]	Manually operate, and power transmitted with belt and bevel gears	A portable device used the moment of wheel and drive the machine	Compact and portable device eco-friendly and also low maintenance	More power to be applied on a machine[19] and Not used in wet soil.	Here the manual effort required is more.
Akshay P. Kolekar, Harshal P. Deshmukh[9]	Grinding cutting wheel, Belt drive, and conveyor.	Bunch of onion is Cut Using Grinding cutting wheel.	A large quantity of onion may cut.	Here a bunch of onion feed in the machine hence the time required is more	Here time required is more hence inefficient process.
Prashant Kudande Deepak Khune.[1]	Cutting blades Guide slot Motor	Cutting blades with some angles to cut by both the edges.	conventional system Design with an automated mechanism	Different sizes of onion cannot cut blade may damage onion.	Cost is More. Complex to manufacture.
Pratiksha A. Yadavkar, Vijayakumar Chavan [12]	Motor chain drive	Here harvesting and cutting mechanism is effectively use.	time duration required for the proposed machine is less	cannot be suitable for small scale farmers is economically not feasible.	The size and cost of the machine are high hence cannot use for a small scale.
Duane Kido[20]	Full Harvesting Tractor	This the harvester which fully automatic with no human interference.	Efficient for large scale application with no	Cannot be suitable for small scale farmers is economically not feasible.	The cost of investment is very high.
P. Ravichandran[17]	Ac motor, Submergible pump, Steel & Sheet frame MS Plate.	Onion Peeling, Onion Cutting	the 2kg of onion in 3 minutes and for both peeling and cutting,	Efficiency is less and cutter change is required hence more maintenance cost	successfully peeled the onion and while cutting, it has 75% efficiency, but it can be overcome by the changing the cutter

IV. DISCUSSION AND CONCLUSION

Above we studied various types of different mechanisms. In this, we studied different process that help to cut the onion leaf.

Here some points we discuss while designing our project:

1. For onion cutting machine manual feed, bunch feed or one by one onion feeding is inefficient work process. Hence, we should design such system in which we can cut maximum onion at a time.
2. The onion size is varying in same farm. some onions are small some are large hence we should design such system in which we can cut the large and small size of onion.
3. Harvester machine are available in market but it cannot flexible for small farmers. the harvester machine is use for only a large operation. Hence, we should design such system which we can used for small and large applications.
4. As we study above machine, in some machine blade or cutter is used to cut the onion leaf. This blade or cutter may cause accident hence we should design such system in which less chances of accident.
5. Harvester is fully automatic but it not economical flexible, hence we should design such a system which is economical flexible as well as automatic also.
6. some of the system have a very high maintenance cost, like change blades or to change the cutter. we should design such way that we have less maintenance cost or less working cost.
7. The design of system should be operationally and ergonomically flexible

This point should consider while designing. hence here we choice one simple concept by which we can fulfil the above criteria of onion cutting machine.

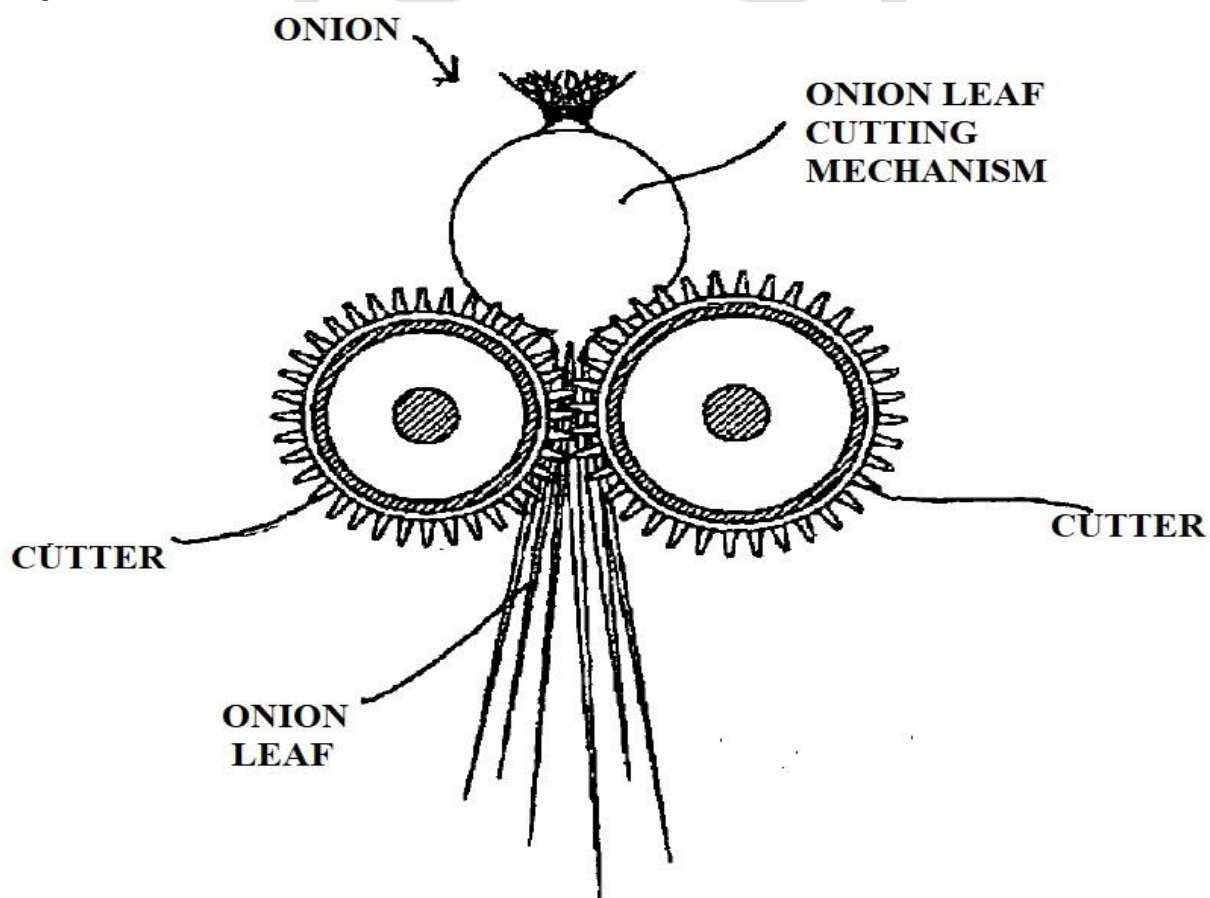


Figure 1.13 Working Concept

By using above concept, we can cut the onion leaf. the strength of onion leaf has very low, its can easily cut by applying a small amount of force. In above concept the sharp edges are used over here, but practically we are not using the sharp edges, because the sharp edges is may harm the onion hence if we remove the sharp edges then we can also effectively use this concept.

Hence, we can conclude that,

We can use two rollers without sharp edge. when the onion leaf will stucked in between the that two rollers, then rotating roller will easily cut the leaf of onion, and we will get the desired output that we required.

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