DESIGN AND MANUFACTURING OF ONION ROOT AND STEM CUTTING WITH SORTING MACHINE

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Abstract- **In a field harvester and trimmer for root crops having foliage tops growing from the crowns of the crop to be harvested and trimmed, such as large bulbous onions, turnips, parsnips and rutabagas. This project is intended to discuss the design leaf, root cutting and sorting machine. Tomato Sorting Machine is a machine used to effectively sort the onion on Size based sorting. This machine can be used for the agricultural purpose and it can be also employed in the food industries.Leaf, root cutting and sorting machine will sort the onion in three grades based on their size that is Small, Medium and Large. Leaf, root cutting and sorting machine works on belt and pulley arrangement. Onion are fed through feeding tray into the machine. India is world's second largest Onion harvested.But yet Farmers processes onion by hand labor after harvest to remove the leaves and roots. This operation is referred to as topping which is time consuming and They Can't afford New Techniques Because of the cost of Appraisal Our Motive is to supply them with effective and efficient method for harvesting to reduce human effort without damaging the onion, Efforts to date have all been in the direction of large and expensive machinery and none of these has as yet been perfected so as to reach the market. A Prototype aims at separating onion bulb from rest of the crop using two rollers and cutters to cut onions which can be collected in bags using chain conveyer for further processing or packaging The heart of the invention is in the topping mechanism itself which generally involves the following parts and steps of operation. The onion containing both roots and leaves is fed into a drum by hands. The drum grips the onion by the leaves in the vicinity of the neck of the onion and holds the body and root in a position while it is being moved along on the drum. At the discharge end of the drum cutting blades separates the leaves from the onion and sort according size.**

Index Terms- **Agricultural machinery, onion sorting, onion stem cutting, crop harvesting etc.**

I. INTRODUCTION

Onion is an extremely important vegetable crop in India not only for internal consumption but also highest foreign exchange earner among the fruits and vegetable. Being an essential food items, 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 Indian onion market in more than 10,000 corers and Maharashtra contributes nearly 30% in it.

At the present times onion are processed by hand labour after harvest to remove leaves and roots. This operation is referred as topping. Hand topping has obvious disadvantages including both cost and unclue length of time necessary to process a large quantity of onions. However, in recent times it is becoming increasingly difficult to find sufficient labour to do the job. As the result the grower can not always depend upon harvesting his entire crop when it is ripe for harvest. Further, what labour there is available is unskilled and uninterested in doing an efficient job. A fair proportion of the onions that are hand topped with this labour are non uniform and many are damaged to the extend of being unmarketable. The inherent lower productivity in sub-tropical countries vis-à-vis European counties, shortage and high prices of quality seeds, high incidence of pests and diseases typical under tropical conditions, moisture stress or excess rains during critical growth stages are factors constraining yield. Wide price fluctuations make it a risky crop

discouraging large scale adoption of input intensive production techniques and good management practices by farmers.

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.

II. LITERATURE REVIEW

1] Mr. Nikhil O. Singh1 Mr. Siddhesh A. Waman2 Mr. Hitesh S. Yadav3 Mr.Bikaschandra R. Yadav4 Prof. Ashish Chaudhari5Tomato Sorting Machine (TSM) is a machine used to effectively sort the tomatoes on Size based sorting. This machine can be used for the agricultural purpose and it can be also employed in the food industries. TSM will sort the tomatoes in three grades based on their size i.e. Small, Medium and Large. TSM works on belt and pulley arrangement. Tomatoes are fed through feeding tray into the machine.

2]Abd El-Rahman, Magda M. Agric. Eng. Res. Inst. (AEnRI); Agric. Res. Center (ARC), Dokki, Giza. Egypt**.**This research was intended to develop a small cylinder type grading machine to suit grading of onion sets crop. Two operating parameters each of four levels were studied. The studied parameters included, riddle revolving speed 35, 45, 55 and 65 rpm (0.366, 0.471, 0.576, and 0.680 m/s), and riddles feeding rates (75, 100, 125 and 150 kg/h). The effect of machine parameters on grading efficiency (%), grading productivity (kg/h) and the mechanical damage percentage, were also considered. Results showed that the machine is quite successful for grading onion sets. The best result was obtained at 55 rpm riddles revolving speeds and 125 kg/h riddles feeding rate. At these values, maximum grading efficiency of 94.34% and permissible mechanical damage of onion sets 4.66% were obtained. These results proved that, the proper operating parameters corresponded with theoretical considerations as the relevant for machine operation

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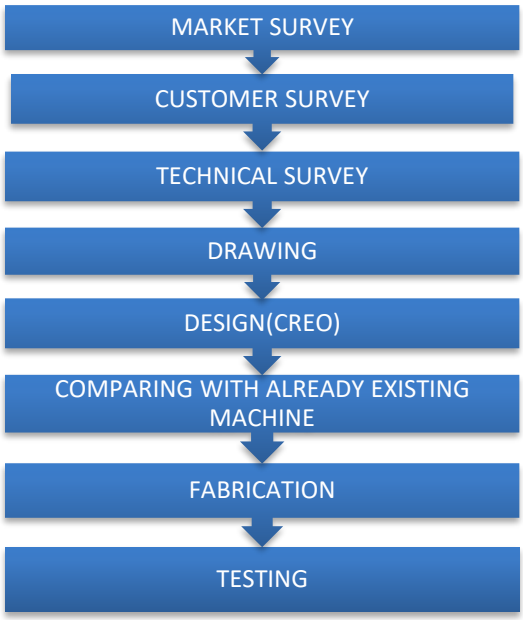
Grading of agricultural produce especially the fruits and vegetables has become a perquisite of trading across borders. In India mostly fruit growers grade the fruit manually. Manual grading was carried out by trained operators who considered a number of grading factors and fruit were separated according to their physical quality. Manually grading was costly andgrading operation was affected due to shortage of labour in peak seasons. Human operations may be inconsistent, less efficient and time consuming. New trends in marketing as specified by World Trade Organization (WTO) demand high quality graded products. Farmers are looking forward to having an appropriate agricultural produce-grading machine in order to alleviate the labour shortage, save time and improve graded product's quality. Grading of fruits is a very important operation as it fetches high price to the grower and improves packaging, handling and brings an overall improvement in marketing system. Thefruits are generally graded on basis of size and graded fruits are more welcome in export market. Grading could reduce handling losses during transportation.

III. METHODOLOGY



IV. DESIGN & CALCULATIONS

Design

Design consists of application of scientific, principles, technical information and imagination for development of new or improvised machine or mechanism to perform a specific with maximum economy & efficiency.

Hence a careful design approach has to be adopted. The total design work has been split up into two parts;

- System design
- Mechanical Design

System design mainly concerns the various physical constraints and ergonomics, space requirements, arrangement of various components on main frame at system, man + machine interaction, No. of controls, position of controls, working environment of machine, chances of failure, safety, measures to be provided, servicing aids, ease of maintenance, scope of Improvement, weight of machine from ground level, total weight of machine and a lot more.

In mechanical design the components are listed down and stored on the basis of their procurement, design in two categories namely,

- Designed Parts
- Parts to be purchased

For designed parts detached design is done & distinctions thus obtained are compared to next highest dimensions which are readily available in market. This amplifies the assembly as well as postproduction servicing work. The various tolerances on the works are specified. The process charts are prepared and passed on to the manufacturing stage.

The parts which are to be purchased directly are selected from various catalogues & specified so that anybody can purchase the same from the retails shop with given specifications.

4.1. System Design:

In system design we mainly concentrated on the following parameters:-

4.1.1. System Selection Based on Physical Constraints:

While selecting any machine it must be checked whether it is going to be used in a large - scale industry or a small scale industry. In our case it is to be used by a small scale industry .So space is a major constrain. The system is to be very compact so that it can be adjusted to corner of a room.

The mechanical design has direct norms with the system design. Hence the foremost job is to control the physical parameters, so that the distinctions obtained after mechanical design can be well fitted into that.

4.1.2. Arrangements of Various Components:

Keeping into view the space restrictions the components should be laid such that their easy Removal or servicing is possible. More over every component should be easily seen none should be hidden. Every possible space is utilized in components arrangements.

4.1.3. Components of System:

As already stated the system should be compact enough so that it can be accommodated at a corner of a room. All the moving parts should be well closed & compact. A compact system design gives a high weighted structure which is desired. Man Machine Interaction

The friendliness of a machine with the operator that is an important criteria of design. It is the application of anatomical & psychological principles to solve problems arising from Man - Machine relationship. Following are some of the topics included in this section. Design of foot lever Energy expenditure in foot & hand operation Lighting condition of machine.

4.1.4. Chances of Failure:

The losses incurred by owner in case of any failure are important criteria of design. Factor safety while doing mechanical design is kept high so that there are less chances of failure. Moreover periodic maintenance is required to keep unit healthy.

4.1.5. Servicing Facility:

The layout of components should be such that easy servicing is possible. Especially those components which require frequents servicing can be easily disassembled. Scope of Future Improvement Arrangement should be provided to expand the scope of work in future.

Such as to convert the machine motor operated; the system can be easily configured to required one. The die & punch can be changed if required for other shapes of notches etc.

4.1.6. Height of Machine from Ground:

For ease and comfort of operator the height of machine should be properly decided so that he may not get tried during operation. The machine should be

slightly higher than the waist level, also enough clearance should be provided from the ground for cleaning purpose.

4.1.7. Weight of Machine:

The total weight depends upon the selection of material components as well as the dimension of components. A higher weighted machine is difficult in Transportation & in case of major breakdown; it is difficult to take it to workshop because of more weight.

4.1.8. Mechanical Design:

Mechanical design phase is very important from the view of designer as whole success of the project depends on the correct design analysis of the problem.

Many preliminary alternatives are eliminated during this phase Designer should have adequate knowledge above physical properties of material, loads stresses, deformation, and failure. Theories and wear analysis. He should identify the external and internal force acting on the machine parts. This force may be classified as;

1] Dead weigh forces

2] Friction forces

3] Inertia forces

4] Centrifugal forces

5] Forces generated during power transmission etc.

Designer should estimate these forces very accurately by using design equations. If he does not have sufficient information to estimate them he should make certain practical assumptions based on similar conditions. This will almost satisfy the functional needs. Assumptions must always be on the safer side.

Selection of factors of safety to find working or design stress is another important step in design of working dimensions of machine elements. The corrections in the theoretical stress value are to be made according in the kinds of loads, shape of parts & service requirements.

Selection of material should be made according to the condition of loading shapes of products environments conditions & desirable properties of material.

Provision should be made to minimize nearly adopting proper lubrications methods.

In, mechanical design the components are listed down & stored on the basis of their procurement in two categories.

- Design parts
- Parts to be purchased

For design parts a detailed design is done & designation thus obtain are compared to the next highest dimension which is ready available in market. This simplification the assembly as well as post production service work. The various tolerances on the work are specified. The processes charts are prepared & passed on to the work are specified.

The parts to be purchased directly are selected from various catalogues & specification so that anybody can purchase the same from retail shop with the given specifications.

4.2. Motor Selection

The operation speed of the is about 5oo rpm, hence the power requirement of the machine can be analyzed as follows,

Design of Motor:-

- Speed: 60-120 RPM
- Torque: 2700 N-mm= 2.7 N-m.
- Power: $\frac{2\pi NT}{60} = 16.96$watt.

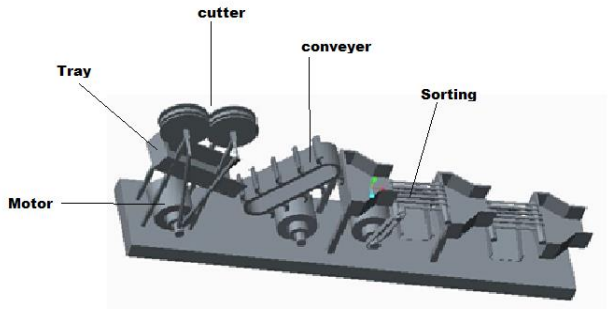
Design of Shaft:-

- Torque(design)=3.68 kNm

Design of Gear :-

- Gear teeth = 127 teeth.
- PCD = 254mm.
- Power: 17 watt.
- Gear width: 20mm.

Design:-



V. ADVANTAGES

- To reduce Human effort and Labour cost.
- To replace traditional method with efficient one.
- To reduce time period between harvesting and packaging.

- To leave onion unharmed during process with safety to operator.
- To design and fabricate semi-automated machine which will help the farmers in sorting out the onion effectively.
- It will reduce the yielding cost of farmers & it will increase his profit in trading.

VI. CONCLUSION

- In this project we have seen the simplest method of onion root and stem cutting process.
- In 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 other cost is also very high.
- So we are going to invent a 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 so our objective is fulfilled in this project.

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