Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 11, November-2019

Literature Review on Digging and Conveying System for Self-Propelled Onion Harvester

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***Abstract*- India is well known for its agriculture which affect country economy most part and India is the second largest country who produces the onion crop. But even though it is on 2nd number still it is lagging because India is still developing country among the whole world and in whole over country around 80% to 90% harvesting is carried out by traditional method. Proposed event organized by SAE INDIA which focuses on optimizing the time required to harvest onion after the completion of crop. Our aim of the project mainly focuses on the time as well as the work efficiency. This may include the time and labor cost, thus indirectly it can be compared with machine efficiency against manual efforts required. By use of digger and conveyer system the harvesting has been done. This is beneficial for more productivity of the crop. The traditional and most widely used method of harvesting onions involves undercutting and lifting onions when the foliage has collapsed to 60-70% of the plants. Onions are left on the ground to cure in the field for 1-4 weeks before the foliage is removed (topping). There is a lot of demand of Indian Onion in the world, the country has exported 14, 82,498.58 MT of fresh onion to the world, worth of Rs.3,169.63 cores, during the year 2018-19.The height of the onion crop during harvesting is 15-40 cm and the crop stem diameter is 1-2 cm. The number of shoots per plant is 10-15. During hot days when the soil is hard, bulbs are pulled out with a hand-hoe. The production of onion is 12-16tonnes in 70 to 90 days. Manual harvesting of onions is a tedious, time consuming, labor intensive and costly operation so mechanization of harvesting is essentially needed. Mechanization of onion harvesting needs as traditionally, the well-matured bulbs are harvested by hand shovel (khurpa) which requires 21.4 per cent of total expenditure of onion cultivation. About 12.5-man hours are required in manual de-topping operation of 1 MT onion bulbs. Hence, mechanical de-topping is required. Also, it is necessary to complete the harvesting operation within specified time limits, for reducing harvest losses and increasing storage life. In fact, early harvesting affects the keeping quality of onions adversely and reduces the yield, whereas delayed harvesting leads to infection caused by microorganisms. Harvesting of onion is more labor intensive and bulb damage is higher during harvesting. For the same, the optimization is be done several times to make a robust and rigid design in order to withstand drag, tractive and torsional forces against the digging effort of the vehicle. This process includes designing as well as simulation process that will give us 99% accurate result and after a various test and analysis, we came to a conclusive result that it will work in real time as Onion harvesting machine.**

Keywords: Digging, Harvesting, Onion bulb, Alluvial Soil, Convenient harvesting,

I. INTRODUCTION

India is the second largest onion growing country in the world. Indian onions are famous for their pungency and are available round the year. Indian onions have two crop cycles, first harvesting starts in November to January and the second harvesting from January to May The onion is a hardy cool-season biennial but usually grown as annual crop. The onion has narrow, hollow leaves and a base which enlarges to form a bulb. The bulb can be white, yellow, or red and require 80 to 150 days to reach harvest. The major Onion producing states are Maharashtra, Madhya Pradesh, Karnataka, Gujarat, Rajasthan, Bihar, Andhra Pradesh, Haryana, West Bengal, Uttar Pradesh, Chhattisgarh, Odessa, Tamil Nadu, Jharkhand and Telangana in the country. Onion can be grown in all types of soils such as sandy loam, clay loam, silt loam and heavy soils. However, the best soil for successful onion cultivation is deep, friable loam and alluvial soils with good drainage, moisture holding capacity and enough organic matter. In heavy soils, the bulbs produced may be deformed. Onion crop can be grown successfully on heavy soil with application of organic manure prior to planting and preparation of the field for onion cultivation should be very good. The optimum pH range, regardless of soil type, is 6.0 – 7.5, but onion can also be grown in mild alkaline soils. Onion crop is more sensitive to highly acidic, alkali and saline soils and water logging condition. Onions do not thrive in soils having pH below 6.0 because of trace element deficiencies, or occasionally, Al or Mn toxicity. By keeping all those points in consideration, the onion harvesting machine is been developed. Onion is harvested depending upon the purpose for which the crop is planted. 0nion crop is ready for harvesting in five months for dry onion. The process of onion harvesting with help of the harvester starts from losing the soil up to removal of onion with green leaves above the ground. In manual process, most of the onion is removed with damaging the any part of the onion. But this process is time consuming. In order to achieve the time as well as the clean removal of the onion this machine is develop

LITERATURE REVIEW

Swapnil S Maheshmale (SAE Tifan) *et. al.* (2019) studied the onion production all over the world and did detailed analysis over the onion production in India, Maharashtra. He also studied the lifecycle of crop, its classification of crop depending on colour, size, season,

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variety. He also understood the conventional steps for onion farming and conventional methods for onion harvesting.

Attri et al. (2015): Have explained significant variant amongst the 47 onion crops. Also, it includes the leaf length, leaf height, leaves per plant, polar equatorial radius of the onion bulb, average bulb weight, total soluble solids.

Promod Reddy et al, 2017: Have explained theoretical aspects of potato harvesting machine. In this, all efforts taken by human being that has to be reduce is considered and aspect as has been kept in front to maximize the quality of the product harvested within required time and low cost.

Sunil Shirwal et al, 2015 (3) Have explained the carrot harvester was evaluated for different levels of rake angle, soil separator length and angle of soil separator. The efficiency of removal of developed crop has also explained. The developed carrot harvester can harvest the crop 49% cost and 96% time saving, as compared to traditional.

Sungha Hong et al, 2014 (4) Have explained, mechanism of harvesting welsh onion, a process that has traditionally depend on labour, will increase productivity and efficiency through the development and use harvester which has been tested for the performance on newly developed onion in welsh onion cultivation farm.

Bendix et al. (2001) studied that mechanical harvester for harvesting, topping and Sacking bulb crops, Such as onions. The harvester extracts the onions from the ground and transports them rearward to a cutting assembly by conveyor Systems that drop out Small onions, dirt, rock sand debris. The cutting assembly comprises a Set of elongated cutting blades positioned to co-operatively accept and sever the leaves and roots from the bulb.

Gavino et al. (2018) study yielded that an onion harvester attached to the locally available hand tractor was designed and fabricated to harvest onions with a field capacity of 0.086 ha per hour and a field efficiency of 80.52%. With this machine, the required labour for harvesting onions was reduced from 122 to 69 man-hours per ha. The computed custom rate of digging and windrowing onions per hectare using the machine is PhP1,850, resulting to a decrease of about P3,300 per ha for the complete harvesting operation.

Mozaffary et al. (2019) studied the required mechanism and rotary speed of blade for cutting for removal of onion bulb top. The approximate speed which is suitable for it was from 1500 – 2000. Tests are carried out in two stages. Some parameters such as acceptable top percentage, not acceptable top percentage, not topped percentage and damaged bulbs percentage were determined and analysed. The results showed that flail topper was the most suitable mechanism for onion topping. It could give following result: 87.7% acceptable top at 2000 rpm in stage one and 83.9% acceptable top at 1500rpm in second stage.

Mohamed Ibrahim et. al. (2011) studied the development and evaluation of Potato Digger suitable for small holding. While designing, all soil parameters are considered which are necessary while designing a digging blade for a potato digger. The rack angle is also finalised for minimum draft force and minimum possible power consumption to increase field efficiency of the machine.

Brajesh Mishra et. al. (2013) studied the engineering behaviour of black cotton soil. Mishra has studied many of the properties of black cotton soil like dry density of soil, liquid limit, plastic limit, specific gravity, swelling pressure, C.B.R., Compression index and chemical composition of black cotton soil. These properties have crucial role while deciding the digging blade geometry.

RESEARCH FINDINGS/ ISSUES

1. uneven growth may occur as its manual operation starting from sowing of the seed till full growth of the crop.
2. In the order to acquire more productivity from each crop it is necessary to use proper method of removal of plant from soil without damaging the leaves as well as the bulb of the onion.
3. In traditional method, there are no specific steps for removal of the crop, since it was necessary to define a specific method for it. It may include separation of soil around the base of the crop as well as that over the bulb of the plant also it may include proper removal of the plant without damaging the leaves of the crop.
4. Since most of the time few farmers prefer to harvest their crop before there growth is been completed. Developing a harvester which can harvest the crop with less human efforts was the most important aspect. Because in orthodox method number of labours are used to harvest the crop which may take ample amount of time as well as investment.
5. As we know that, in soil some debris, stones are present which may also come along with the plant. So, it is necessary remove those debris in order to get required results.

PROBLEM DEFINATION

As the conventional method of onion harvesting is very time consuming and involves high labour cost and labour efforts. Even collecting and packaging of onion must be done which is costly and time consuming. In order to achieve more productivity from crops, the farmer must harvest the crop without damaging the onion bulb and leaves, collecting and packaging of the crop is as important as harvesting the crop from farm. A survey says that about 75-80 % of the onions crops in India are been harvested on large scale in the sense of farming area. Thus, development of **onion harvesting machine** is best option to over-come these problems.

OBJECTIVE OF PROPOSED WORK

[1] Convenaient harvesting of the crop : The onion bulb should not be damaged during harvesting by the vehicle itself.

[2] Reducing human efforts and labour: Machine should reduce the human's efforts and overall labor cost which will be profit to the farmer.

[3] Manufacturability: Machine should be simple in construction and maintenance. The parts should be cheap enough that a middle-class farmer can afford it if any fails.

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[4] Compact in size: As there are many regions in India where large no of farers owes lands in which large harvesters can be used. So, our aim is to make harvester enough compact in size than it can harvest at least 240 square meter.

[5] Reducing time expense: As large time is involved in onion harvesting physically hence machine should be able to harvest the land in less time increasing the overall productivity.

METHODOLOGY

1. Their Analysis of rules of the events.
2. As the competition itself provides guidelines in rule book prior to the competition.
3. Deign of digging blade which offers lesser draft force to the machine.
4. The damage to the onion bulb by the digging system itself should be eliminated to increase the productivity of machine.
5. Conveying of the onion should be done at constant speed with cleaning the onions efficiently as the conveyor is separating type.
6. In windrowing of onion bulbs, the bulbs should be guided to the central axis of the vehicle and should be carried up to rear end of the vehicle to avoid the crushing of onion by the wheels while taking turn.

SCOPE

1. Selection of proper material for the supporting blade having smooth surface finish.
2. Provision for the vibratory system to increase the separation index.
3. Provide the collecting system for the onion.
4. Automatic hydraulic control system for the depth adjusting mechanism.

FACILITIES AVAILABLE AND REQUIREMENTS

1. Necessary technical, experimental, testing, computing, library and internet facilities are available in the institute.
2. Necessary raw materials will be procured from vendors.
3. Necessary software's are given to us in-terms of sponsorship.

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