Design of simple clove harvesters

S ‘Audah1*, H Setiawan2, F Putriawati1 and Anhar1

1 Department of Industrial Engineering, Politeknik Aceh Selatan, Tapaktuan, Indonesia,
2 Department Computer Science, Politeknik Aceh Selatan, Tapaktuan, Indonesia

*Email: i. safridatul@yahoo.co.id; fifiputrihanum@gmail.com

Abstract. Clove plucking techniques can be done by climbing stairs and trees. Harvesting by climbing trees should not be done. Can be used ladder or pole made of bamboo while paying attention to the position of the ladder on the clove tree to avoid breaking the branching clove and not damage the surrounding leaves at the time of picking, researchers also saw cloves when they were out of reach of the hands then the clove farmers just throw it away clove should be able to be useful and increase income. Researchers tried to make a simple clove harvester design tool with the aim to facilitate the clove picking process. The results of this tool can be used on a tree height of 4 meters that can be used directly without using a ladder and can be used as a clove picker that is not reached by the hands of farmers so it is not wasted.

1. Introduction
Clove is a leading local plantation commodity which is mostly cultivated by farmers besides coconut, nutmeg, and cocoa [1]. Clove plants are plantation / industrial plants consisting of trees with the family Myrtaceae. This plant is a native plant from Indonesia [2]. Cloves (Eugenia aromatic OK or Syzigium aromaticum (L)) have tree heights reaching 20-30 m, and clove plants can live for more than 100 years. Cloves have four types of roots, namely taproots, lateral roots, fibrous roots, and hair roots [3]. Clove plants are generally cone shaped, pyramid, or double pyramid, with the main stem soaring up and many branches and dense, growth horizontally with a relatively small size when compared to the main stem. The leaves are stiff green or reddish green, and are elliptical with two pointed tips [4]. Cloves and flowers will appear at the tips of the branches and short stalks and make up. When they are young the clove flowers turn purple, then turn yellowish-greenish and turn pink again when they are old. Dried cloves will be blackish brown and taste hot because they contain essential oils. Generally, cloves first bear fruit at the age of 4 to 7 years [5].

Clove has a high selling price and has the opportunity to be developed in order to increase the country's income and increase farmers' income. Clove plants are widely traded mainly for the cigarette industry, manufacturing medicines, food and drinks [6]. Clove harvesting techniques can be done by harvesting from the outside and inside. Harvesting techniques from outside are often carried out by clove farmers although it is very difficult and high risk in safety. The technique of harvesting cloves from the outside is done by means of a farmer who will first install a bamboo ladder to climb the clove tree. The bamboo is plugged into the ground and then tied with three strings of rope from different directions to the nearest trees. So that during the harvesting process the stairs do not move [7]. Harvesting techniques from the inside are usually done by climbing cloves directly from the tree and
not using a ladder that is placed from outside the clove tree. Farmers usually climb tree cloves using ropes and baskets made of rattan or sacks [8].

In harvesting cloves farmers are still using traditional tools, following some of the tools used in harvesting cloves such as ladders, sacks and iron penggait. The process of harvesting cloves requires some preparation, understanding how to harvest, a picker also needs tools to climb the clove tree. Clove plants with a height usually planters pick them with a ladder made of bamboo sticks that are slippied in cleavage as a ladder. usually the farmer climbs the clove tree directly from the tree using no ladder that is placed from outside the clove tree. Farmers climb cloves directly from trees using ropes and baskets made of rattan or sacks. Picking by climbing trees should not be done to avoid breaking the branching of cloves and try not to damage the surrounding leaves at the time of picking, researchers also see clove when it is out of reach of the hands, the clove farmers leave it alone so that the clove should be useful and increase income then the opportunity was wasted.

The introduction of technology is needed to solve problems in picking. Making pickers can guarantee the integrity of the fruit while saving time and energy into a necessity. Design is a process of activities / activities that will be carried out by product design experts from manufacturing, then poured in the form of innovation / design ideas [9]. Design is the process of making plans to solve problems using a combination of several existing components to obtain more efficient results or produce development from existing tools [10]. Therefore, researchers try to make a simple clove harvester design tool that can be used to simplify the clove picking process.

2. Materials and methods
The study was conducted in the design phase. The steps in the design of the attachment design. The materials used for tool construction consist of: stainlees ornament pipes 100 cm and 70 cm in size, branch shears, nets, nuts and bolts, brake handles, Cable ties, spiral springs (per), Chopped Strand Matt (CSM), Resin , Catalyst, PVA (polyvinyl alcohol). The method that will be used to design simple clove picker tools is based on the following flow chart:

![Figure 1. Research flow chart.](image-url)
2.1. Stages of tool design
The steps in the tool design stage are designing the clove harvesting tool using Autocad. At this stage, design poles that have flexible properties that can be lengthened and shortened by pole lengths of 100 mm and 70 mm with pole diameters of 1 inch and 0.5 inch and pipe thickness of 0.5 mm. Then design the installation of the brake handle on the pole that serves as the blade drive lever. The length of the brake rope used is 2 meters. Then the design of a basket that has a height of 13 cm and a diameter of 20 cm, this bucket serves as a place to attach a knife and a safety net. Furthermore, the design stage of the blade used in clove harvesters, the type of blade used is branch shears.

2.2. Making clove picker construction
The steps in the process of making this tool are cutting the stainless pipe which will be used as a pole, then welding, in this process there are two parts that must be welding. The first is welding on the handle to connect the handle to the pole of a simple clove harvester. Furthermore, welding on the lock section of the connection pole so that the pole can work flexibly. The third process is the process of making a container circle, in this process using fibers, resins, catalysts and PVA. The next process is installing the brake handle on the pole, this installation process uses 10 wrenches and cable ties to tie the brake strap to the pole of a simple clove harvester. Then the process of mounting the blade on the container circle, the blade made from branch scissors attached to the container circle using bolts and nuts of size 10 and size 10 wrenches. Installation of the basket and finishing basket to get better results.

3. Results and discussion

3.1. Results of simple clove harvesting equipment design
This simple clove harvester consists of several basic components, including the basic frame / pole, blade, retaining plate and blade drive lever. The specifications of the design of a simple clove harvester are 170 cm base / pole length, 6 cm blade length, The number of blades1 pieces, the length of the retaining plate 6 cm, the weight of the tool 3 kg, the length of the lever strap 2 meters. The results of the design and specifications of the tool can be seen in Figure 2.

![Figure 2. Clove picker design.](image-url)
Functionally and structurally this simple clove harvester tool consists of 3 main parts, namely the basic frame of the tool / pole, the picking system, the collecting system.

1) Basic Tool / Pole. The basic frame of the harvester / tool serves as a place to attach other components. The base frame is made of 1 inch and 0.5 inch diameter stainlees ornament pipes with a length reaching 170 cm.

2) The picking system consists of several parts such as:
   a. The blade functions as a cutting knife that will cut cloves. 1 blade consists of scissors with branches and a blade length of 6 cm.
   b. Retaining plate is made of stainlees plate which is formed slightly curved, 35 cm long holding plate.
   c. The blade drive rope functions as a distributor of cutting power on the blade, the blade drive belt is made of brake handles that have great strength and small dimensions.
   d. Blade reversing springs that function to return the blade to its original position after plucking. This spring is made of SUP4 steel with a diameter of 10 (mm) and a wire diameter of 1 (mm).

3) Storage System functions to accommodate cloves. This system consists of:
   a. The holding circle serves as a place for laying down several components such as nets and knives. This circle is made of circular fibers with a diameter of 20 cm and a height of 13 cm.
   b. This clove-collecting net is functioning as a clove container so that the picking results do not fall to the ground.

3.2. The mechanism of work of clove harvesters

The picker can be used for the harvesting process on trees with a height of 4 meters which can be done directly without having to climb, and hook the branches of cloves. This can facilitate farmers in the process of harvesting and can avoid damage to the branches. In addition, this tool can be used to assist the harvesting process by going up the stairs so that it makes it easy for clove farmers to pick cloves that are not reachable by hand, so as to increase farmers' income. The results of manufacturing tools can be seen in Figure 3.

![Clove picker](image)

Figure 3. Clove picker.

The mechanical work of this tool is a cutting system, where to do picking begins with the erection of a simple clove harvester that is adjusted to the clove tree. Then adjustments are made until the cloves that will be picked up enter between the blade and the retaining plate. After making sure to enter the blade and the retaining plate then press the lever until the blade and the retaining plate can cut the clove well. This cutting is assisted by a spiral spring on the drive strap, so that the blade can move constantly. The obstacle faced by the author in the process of making this tool is testing the tool
directly on the clove tree to see the camping capacity, due to the clove harvest time in April-June. Each time period of flowering plants is not the same. It really depends on the local climatic conditions, the height of the place and other factors that are very influential. Then it starts flowering and the time of collection is not the same [11].

4. Conclusions
Based on the results of the design and testing of the tool, it can be concluded that this simple clove harvester consists of four main parts, namely the pole, the holding basket, the blade, and the driving lever. The specifications of the designed size are 170 cm base / pole length 1 inch and 0.5 inch in diameter, the height of the container is 13 cm and 20 cm in diameter, with an overall length of 183 cm. The materials used to make the design of a simple clove harvester are stainless steel ornament pipes, branch shears, nets, bolts and nuts, brake handles and spiral springs.

The suggestion from this research is that it can be considered for the exchange of materials or sizes to make it lighter, but still sturdy, and it is expected that further development in this research can produce a simple clove harvester that is better suited to future needs. A simple clove harvester tool needs to be tested on a clove plantation.

References
[1] Suparman., et. al 2017 Pemetaan Populasi dan Tipe Varietas Lokal Tanaman Cengkeh (Syzygium Aromaticum L) Di Kecamatan Pulau Ternate., Prosiding Seminar Nasional Penerapan Ilmu Pengetahuan Dan Teknologi., Universitas Tanjungpura, Pontianak 23-24 Mei 2017. P-ISBN 978-602-8355-48-3., pp. 239-244
[2] Orwa C, Mutua C, Kindt R , Jannadass R, S Anthony 2009 Agroforestrree Database:a tree reference and selection guide version 4.0 (http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp)
[3] Danarti dan S. Najiyati 1991 Budi Daya dan Penanganan Pasca Panen Cengkeh, Cetakan 1, Jakarta, penebit : swadaya: pp. 4-19
[4] Hapsoh, Hasanah 2011 Budidaya tanaman obat dan rempah. Medan: USU Press.
[5] Fatma et all, 2015., Factors Influencing Clove Farming Production and Income (Case Study at Ogodeide District Tolitoli Regency.), Journal Agroland, Vol. 22 (3)., pp. 216-225. ISSN : 0854-641X
[6] Luthfi., M., et al 2018 Clove Harvest Management (Syzygium aromaticum L.) at Branggrah Banaran Estate, Blitar, East Java., Journal Bul. Agrohorti., Vol. 6 (2.)., pp. 188 -197
[7] Towaha, J. 2012. Manfaat eugenol cengkhi dalam berbagai industri di Indonesia. Perspektif. 11 (2): pp. 79-90
[8] Hidayatullah 2014 Menengok Cara Kerja Pemetik Cengkeh. https://www.hidayatullah.com/foto/menengok-cara-kerja-pemetik-cengkeh.html di akses pada 9 September 2019
[9] Sangaji Akham 2018 Cara Manjat Cengkeh Di Seram Ambon Maluku. http://sangaji-akhamb.blogspot.com/2018/01/cara-manjat-cengkhi-di-seram-ambon-maluku.html di akses pada 9 September 2019
[10] Mustaqimah 2012 Perancangan Dan Pengujian Alat Pemetik Papaya Tipe Semi Mekanis. Banda aceh. Jurnal Teknologi Dan Industri Pentanian Indonesia, Vol. 4 (3).
[11] Dedi 2013 Panen dan Pascapanen Cengkeh. https://dedidoank.wordpress.com/2013/04/12/panen-dan-pascapanen-cengkeh/ di akses pada 4 September 2019