

**FULL REPORT OF FARM MACHINERY PRACTICUM
(19G04130601)**

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FOREWORD

Alhamdulillah, that is a more beautiful word as a thanksgiving to Allah SWT who has bestowed His grace, guidance and guidance, so that a complete report on the practicum of Agricultural Equipment and Power can be completed. Do not forget to always send shalawat and salam to our lord and role model the Prophet Muhammad SAW. In the preparation stage of this complete report, it is inseparable from various obstacles that hinder the preparation. However, thanks to the help and motivation of various parties, so that the obstacles and obstacles can be overcome.

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INTRODUCTION

1.1 Background

The agricultural sector has an important role for Indonesia, the most important of which is as a provider of food, raw materials for industry, a source of income and a provider of employment for the community. The agricultural sector is growing rapidly along with the development of technology and the development of the industrial world. This can be seen with the development of the use of mechanization in the agricultural sector, such as in tillage, planting, maintenance, pruning and so on.

Various problems in the agricultural sector, especially in land processing before starting planting, of course, good land is needed and in accordance with the type of plant to be planted. The thing that is done to overcome this is one of them by cultivating the land, this is very time consuming if done manually or with human labor due to the vast land to be processed, of course, such as clearing weeds, soil equalization, turning and crushing, as well as mixing organic materials and so on.

The development of agricultural mechanization is able to overcome these various problems, one of which is the use of two-wheeled tractors. The use of two-wheeled tractors is most often found in agricultural land because it is very helpful in tillage, both primary and secondary tillage. In addition, tillage using tractors is very easy and very efficient in overcoming various problems in this regard.

Based on the description above, the Two-Wheeled Tractor Operation Practicum needs to be carried out in order to know the various types of tools used in the construction or manufacture of two-wheeled tractors and their functions and uses each, can know how to operate and be able to operate a two-wheeled tractor properly and correctly according to operating procedures, and be able to do tillage using an implement or plow using a two-wheeled tractor.

1.2 Purpose and usefulness

The purpose of the Two Wheel Tractor Operation practicum is to better understand the construction of hand tractors, increase the operator's knowledge of driving a hand tractor either with a trailer or without a trailer.

The purpose of the Two Wheel Tractor Operation practicum is so that students can find out how to operate a two-wheeled tractor and can implement it, especially in agricultural land processing.

2. LITERATURE REVIEW

2.1 Agricultural Mechanization

Agricultural mechanization can be broadly and narrowly defined. Agricultural mechanization in a broad sense is synonymous with agricultural engineering, which is the study of the use and utilization of natural materials and energy to develop human work in agriculture. Agricultural mechanization in the narrow sense is synonymous with agricultural mechanization, namely all activities that use agricultural machinery whether driven by human hands, animals, motors or other mechanical things. Agricultural mechanization in a broad sense aims to increase labour productivity. The use of good tools and machines to use is also intended to increase efficiency, effectiveness, productivity, quality of results and reduce the workload of farmers in terms of agricultural mechanization. Agricultural mechanization certainly cannot be separated from human knowledge in using Farm Machinery, maintaining, maintaining, repairing and developing them (Trisnawati, 2021).

The pattern of mechanization development begins with the needs of farmers for Farm Machinery. Then it is developed towards the efficiency stage of the agricultural business system and at the last stage leads to the commercialization of agricultural business. The provision of agricultural machinery assistance is intended as an effort to increase the planting area, increase the cropping index, increase the productivity and efficiency of farming, and expand employment opportunities. Like the seed planter planting tool which is one of the seed or grain planting tools used on dry land, to increase the efficiency and effectiveness of field labor, land productivity, expansion of planting land by optimizing work on dry land, besides planting seed planter can be used as a fertilizer tool (Fitri Amalia et al., 2020).

2.1 Tillage Tools and Machinery

Tractor-based farming usually uses implements or plows which then use forks and rotary plows for leveling. If conditions are wet or irrigated for a long time, rotary machines can be used to cultivate the land, which can shorten the processing time. Tillage should take into account the minimum lifting of the plow implements

due to the turning process. Agricultural land processing using two-wheeled tractors has several patterns in its application. The usual patterns include edge, center, alpha, spiral, back and forth tight and around patterns. As for what is commonly done and more effective and efficient in use and maximum results is the spiral pattern, because this pattern makes it very easy for plowing to be carried out continuously and repeatedly without lifting implements. In an effort to realize food sovereignty in Indonesia, the application of agricultural mechanization must also be increased. The use of Farm Machinery needs to be pursued and must continue to be developed and all farmers must feel and use it, so that agricultural production can be more developed and increased and minimize crop losses (Nurhikmah, 2021).

Tillage is important because at this stage the land is prepared to be planted with a particular commodity. Tillage is influential because it is closely related to the next stages, namely planting seeds, fertilizing plants, treating plants from weeds, irrigation systems and up to the harvest stage. The first tillage, which is usually carried out using a circular plow or disk plow, has different results depending on the type of soil, the speed of operation of the two-wheeled tractor, and the skill of the operator who runs it. The first tillage using a prong plow and disk plow is usually done to a depth of between 20 to 30 cm. The use of a hand tractor with the application of an outcrop plow or a disk plow can reduce the laboriousness of work by manual labor. Two-wheel tractors can save labor performance time from 142 hours/ha to 17 hours/ha (Handayani, 2017).

2.2 Two Wheel Tractor

Hand tractor or Two Wheel Tractor is a tractor with diesel motor or gasoline motor, two wheels (rubber tires or plus steel cage wheels), single shaft, has a main clutch, without or by using a steering clutch that functions to pull and or move agricultural equipment and also as a driving resource. Two Wheel Tractor (Hand Tractor) and its implements have an important meaning in tillage, where the tractor as a driving force and implements in the form of an outcrop plow for tillage according to the desired depth, with the existence of mechanical devices like this, the tillage process is faster, so that the processing of soil depth is more uniform, compared to using conventional tools in the form of hoes, crowbars, shovels and so on (Azzuhra et al., 2019).

2.4 Operation of Two Wheel Tractor

The type of propulsion that is often used is a diesel motor, but there are also those that use gasoline or kerosene (kerosene) motors. The motor is mounted on a frame with four fastening bolts. The bolt holes in the frame are made lengthwise so that the motor position can be moved back and forth. The goal is to get the balance of the tractor and to adjust the size of the v-belt in use. The tractor will be heavier forward if the motor position is shifted forward and vice versa. The tractor drive motor starts the diesel motor using a crank, while for gasoline and kerosene motors it uses a starter rope. Most hand tractors use diesel motors. The use of diesel motors is generally cheaper, both during operation and maintenance. Diesel motors are more durable than other types of motors, as long as maintenance is carried out properly and correctly from the beginning of its use (Hadiutomo, 2018).

The framework functions as a place for the transmission drive motor and other tractor parts. The transmission functions to move the rotation power from the driving motor to other moving tools. There are several types of transmissions used, such as pulley, v-belt, clutch, gear, chain and so on. Power from the motor in the form of shaft rotation is channeled through the pulley and v-belt to the main clutch. The main clutch forwards the power to the gear gear to drive the wheel shaft. The main clutch is operated from the main clutch lever, when the lever is pulled to the neutral position, the motor power is not channeled to the gear. As a result, the tractor will stop even though the condition of the drive motor is turned on. In addition to the main clutch, there are two steering clutches. The steering clutch is located under the gear teeth at the base of the second shaft. The wheel steering clutch is operated through the right and left steering levers. If the right steering clutch is pressed, the gear rotation is not connected to the right wheel shaft, so the right wheel will stop and the tractor will turn to the right and vice versa if the left clutch is pressed (Hadiutomo, 2018).

Before doing work using a Two Wheel Tractor, you should check the tractor to be used in order to further improve the performance of the tool and avoid work accidents. The things that must be considered before starting the operation of the Two Wheel Tractor according to Hadiutomo, (2018), are as follows:

- a. Checking nuts or bolts (25 working hours)

All nuts or bolts and other fasteners must be checked. Any looseness will result in greater damage. The Breyjan brezp of the tractor may come loose or break.

b. Checking the v-belt (25 working hours)

The tension of the v-belt must be correct. Belts that are used long enough will expand so that they are loose. Loose belts will cause slippage, while those that are too tight will be easily damaged and inhibit engine rotation.

c. Checking the fuel.

The tank must be filled with enough fuel. Tanks that are left empty when stored will cause condensation, this condensation water will enter the combustion chamber and damage the motor.

d. Checking the fuel filter (25 working hours).

The type of tractor commonly used is a diesel motor. The fuel that enters the combustion chamber must be clean. Dirty fuel will clog the nozzle holes. The air filter must be in good condition in order to filter the air perfectly.

e. Checking the cooling system.

Usually, tractor motors use a water cooling system, either radiator or condenser type. Check the presence of water and the cleanliness of the radiator ram.

f. Checking the control levers or controls

All control levers must operate properly so that the operator can operate properly as well. There are several control levers that can be adjusted freely such as the main clutch, brake, steering clutch and gas.

g. Checking tire pressure

Checking tire pressure Tire pressure should be standard (+16.5 psi). It should not be too hard or flat. The pressure of both tires should also be the same.

h. Checking the lubrication system

Rubbing parts need to be lubricated to prevent friction and heat. The part of the hand tractor that needs to be lubricated is the inside of the motor. Motor oil is stored in the crankcase and can be checked with a dipstick. Whether or not the oil is sufficient and dirty needs to be checked.

i. Checking the implements

The implements to be operated must be properly prepared. The completeness of the implements needs to be checked. Moving implements need to be lubricated.

Preparation of hand tools Frequently used hand tools, especially those used to operate the implements, should be brought along.

2.5 Benefits of Agricultural Mechanization

Mechanization is needed in agricultural production because it is very helpful in the process, saving energy and time. Based on the statement (Trisnawati, 2021) there are several benefits of agricultural mechanization, namely as follows.

- a. Increasing agricultural labor productivity. Applying agricultural mechanization such as the use of machinery in agricultural activities can help farmers to increase their productivity.
- b. Increase the productivity of agricultural land by using mechanization technology, such as the rice transplanting robot, farmers can save a lot of energy and time in the transplanting process.
- c. Lowering production costs agricultural mechanization is developed to increase agricultural efficiency and productivity.

3. METHODOLOGY

3.1 Time and Place

Two Wheel Tractor Operation Practicum was held on Sunday, September 25, 2022, at 10:00 a.m. until completion, at the Experimental Farm, Faculty of Agriculture, Hasanuddin University, Makassar.

3.2 Tools and Materials

The tools used in the practicum of Two Wheel Tractor Operation are Two Wheel Tractor, wooden stakes, outcrop plow implements, meters, stopwatches, cellphone cameras and stationery.

The materials used in the practicum of Two Wheel Tractor Operation are diesel fuel.

3.3 Practicum Procedure

The Practicum Procedure for the Two Wheel Tractor Operation practicum is as follows:

3.3.1 Without Trailer

1. Identify the parts of the two-wheeled tractor and check whether they are in good condition for use.
2. Positioned the transmission lever in the unconnected position, then started the tractor by cranking.
3. Increase the rotation of the tractor by adjusting the gas lever which is usually located on the right steering wheel.
4. Holding the steering wheel by slightly pressing it, so that the waist limit in order to obtain balance, attach the transmission lever to the desired speed.
5. Holding the steering wheel with one hand, the other hand pairs the main clutch so that the tractor moves, immediately both hands hold the steering wheel and follow the motion of the tractor by stepping.
6. Turning direction by pressing the clutch on the steering wheel if you want to turn to the right then press the right handlebar clutch and when turning left press the left handlebar clutch.

7. Stop the engine by pulling the main clutch lever, turn the throttle lever so that the motor is idling, put the transmission lever in the neutral position. Attach the standard lever and turn off the drive motor.
8. Record the data that has been obtained.
9. Documenting practicum activities.

3.3.2 With Trailer

- 1 Identify the parts of the two-wheel tractor and check whether they are in good condition for use.
- 2 Attach the outcrop plow trailer to the center hole on the tractor.
- 3 Positioning the transmission lever in the unconnected position, then starting the tractor by cranking.
- 4 Increase the tractor's rotation by adjusting the throttle lever, which is usually located on the right steering wheel.
- 5 Holding the steering wheel with a little pressure, so that the waist limit in order to obtain balance, attach the transmission lever to the desired speed..
- 6 Holding the steering wheel with one hand, the other hand puts the main clutch so that the tractor moves, immediately both hands hold the steering wheel and follow the motion of the tractor by stepping.
- 7 Turning direction by pressing the clutch on the steering wheel if you want to turn to the right then press the right handlebar clutch and if you turn left press the left handlebar clutch..
- 8 Stop the engine by pulling the main clutch lever, turn the throttle lever so that the motor is idling, put the transmission lever in neutral. Fit the standard lever and turn off the drive motor..
- 9 Recording the data that has been obtained.
- 10 Documenting practicum activities.

3.4 Formula Used

The Formula Used in the practicum of Two Wheel Tractor Operation is as follows:

- a. Calculating KLT (Theoretical Field Capacity)

$$KLT = 0,36 (V \times Lp)$$

Description:

KLT = Theoretical Field Capacity (Ha/h).

V = Average speed (m/s).

Lp = Average plowing width (m).

b. Calculating KLE (Effective Field Capacity)

$$KLE = \frac{L}{Wk}$$

Description:

KLE = Effective Field Capacity (Ha/h).

L = Treated land area (Ha).

Wk = Working time (hour).

c. Calculating Field Efficiency (Eif)

$$Eif = \frac{KLE}{KLT} 100\%$$

Description:

Eif = Field Efficiency.

KLE = Effective Field Capacity (Ha/h).

KLT = Theoretical Field Capacity (Ha/hour).

d. Wheel Slip (SI)

$$SI = 1 - \frac{Sb}{So} \times 100\%$$

Description:

Sb = Distance traveled during tillage in 5 turns of the traction wheel (m)

So = Distance traveled by tractor without load in 5 turns of traction wheel (m).

4. RESULTS AND DISCUSSION

4.1 Results



Gambar 1-1. Two Wheel Tractor right view

Tabel 1-1. Two Wheel Tractor parts left view and function

No	Part Name	Function
c1	Silencer	Minimizes the sound produced by the motor.
2	V-belt	Reducing the rotation speed of the motor and connecting the transmission to the tractor wheel gear pulley.
3	Pulley	Component or connecting the rotation received from the electric motor.
4	Buffer	Supporting the front of the tractor
5	Fuel tank	Fuel reservoir.



Gambar. 1-2. Two Wheel Tractor left view

Tabel 1-2. Two Wheel Tractor parts right view and function

No	Part name	Function
1	Crank	Rotates the crankshaft.
2	Crankshaft	Converts the up and down energy of the piston into rotary energy.
3	Fuel filter	Filters fuel impurities from the tank.
4	Buffer	Supports the front tractor
5	Fuel tank	Fuel reservoir.
6	Crankcase	Oil storage.
7	Gas lever	Raising and lowering the gas on the motor.
8	Compression lever	Eases engine rotation when cranked.
9	Air filter	Filters the air entering the combustion chamber.



Gambar 1-3. Two Wheel Tractor Parts Rear View.

Tabel 1-3. Two Wheel Tractor parts rear view and function

No	Part name	Function
1	Handle helper	Assist in driving the tractor.
2	Gas lever	Raises and lowers the throttle on the motor.
3	Main handle	As a handle while driving the tractor.
4	Right clutch	Turns the tractor to the right.
5	Outcrop plow	Turning the soil or plowing the soil.
6	Wheels	Running the tractor.
7	Left clutch	Turning the tractor to the left.

4.2 Discussion

Based on the results obtained in the table of tractor parts and functions, it can be seen that the tractor has various parts that are very important to support the performance of the tractor in processing the soil. Of course, each part of the tractor has its own function and use and this is very important when the tractor will be operated or when it is operated, such as fuel which must be considered first in the fuel tank, radiator water which also needs to be paid attention to before operating the tractor so that the engine does not over during long-term use and the lubricating oil part which is very important to keep the engine good at work and prevent the engine from experiencing wear that can damage and shorten the life of the engine technically, besides that it also avoids work accidents. This is in accordance with the statement of Hadiutomo (2018), which states that before doing work using a Two Wheel Tractor, you should check the tractor to be used in order to further improve the performance of the tool.

The operation of the Two Wheel Tractor to cultivate the land is by starting the tractor engine by rotating the crankshaft using a crank that has been specially designed to rotate the crankshaft on the engine, in line with that the compression lever is also raised to facilitate rotation on the crankshaft and simultaneously each is released so that there will be a piston movement and will be combustion in the tractor engine cylinder block. The tractor that will be moved starts by pulling the transmission lever so that the v-belt will tighten and will rotate by the pulley on the engine shaft and connect with the pulley on the tractor wheel gear. In addition, to turn the tractor the right and left clutches are used on the tractor handlebar. When pressing the right clutch, the tractor will turn to the right as well and vice versa when the left clutch is pressed, the tractor turns to the left as well. This is in accordance with the statement of Hadiutomo (2018), which states that the transmission functions to transfer rotation power from the driving motor to other moving equipment.

5. CLOSURE

Based on the practicum that has been done, it can be concluded that the use of Two Wheel Tractor begins with checking the fuel, lubricants and so on that can support the performance of Two Wheel Tractor. The work efficiency of the tractor itself can be seen from how heavy the load is used on the tractor, if the load pulled is getting bigger then the work efficiency will also be slower due to the amount of pressure and wheel slip that occurs on the tractor so as to shorten the mileage and increase the work time done in tillage.

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APPENDIX

APPENDIX 1-1. Two Wheel Tractor Calculation

$$\begin{aligned}v &= \frac{S}{t} \\ &= \frac{10,44 \text{ m}}{14,9 \text{ s}} \\ &= 0,7 \text{ m/s}\end{aligned}$$

$$L_p = 1 \text{ m}$$

- a. Calculating KLT (Theoretical Field Capacity)

$$\begin{aligned}\text{KLT} &= 0,36 (v \times L_p) \\ &= 0,36 (0,7 \times 1) \\ &= 0,252 \text{ Ha/Hours}\end{aligned}$$

- b. Calculating KLE (Effective Field Capacity)

$$\begin{aligned}\text{KLE} &= \frac{L}{Wk} \\ \text{KLE} &= \frac{0,001}{0,005} \\ &= 0,2 \text{ Ha/Hours}\end{aligned}$$

- c. Calculating Field Efficiency (Eif)

$$\begin{aligned}\text{Eif} &= \frac{\text{KLE}}{\text{KLT}} \times 100\% \\ &= \frac{0,2}{0,252} \times 100\% \\ &= 0,7936 \times 100\% \\ &= 79,36 \%\end{aligned}$$

- d. Wheel Slip (SI)

$$\begin{aligned}\text{SI} &= 1 - \frac{S_b}{S_o} \times 100\% \\ &= 1 - \frac{10,44}{19} \times 100\% \\ &= 1 - 0,549 \times 100\% \\ &= 45,1 \%\end{aligned}$$

APPENDIX 1-2. Documentation of Two Wheel Tractor Operation Practicum.



Gambar 1-4. Documentation of Two Wheel Tractor Operation practicum

1. INTRODUCTION

1.1 Background

The increasing need for food makes agricultural production increase as well, but along with the development of technology and the advancement of civilization, it has greatly eroded the interest of youth and society to plunge and work directly on agricultural land. This is due to the existence of technology that makes the indigenous population lazy in doing work, due to the ever-growing thoughts of getting things instantly, thus reducing interest in working directly on agricultural land. The current era of technological development has also triggered the development of population growth and increased food needs and on the other hand, labor in agriculture itself has become less.

Planting machine tools are one of the most advanced human technologies in overcoming the labor crisis in the agricultural sector. This tool makes it possible to increase work time for example corn which is usually planted in a period of days can now be done in just a few hours due to the help of technology tools and planting machines. One of the planting tools and machines is a seed planter where this tool is used to plant grains or seeds. The working principle of this tool is very simple and is able to plant seeds up to several kilograms in one hour of use, so it is said that this tool can save up to 70% of working time compared to planting seeds manually. Seed planter is only used for plants that have seeds or are produced without seeding first, so that the seeds of the plant will be directly spread and planted in the ground according to the spacing that has been adjusted on the planter.

Based on the description above, the Seed Planter practicum will be carried out to find out the function of each part of the seeder planter tool, understand and understand how the seeder works in planting seeds and know and understand how to operate the seeder.

1.2 Purpose and usefulness

The purpose of the Seed Planter practicum is to find out how a mechanical planting tool works in an effort to place a seed in the soil so that the seed gets optimal conditions for growth.

The purpose of the Seed Planter practicum is to be able to know the use, operation and function of each part of the seeder tool so that it can be applied to agricultural land for planting seeds or grains.

2. LITERATURE REVIEW

2.1 Seed Growing Tools

Planting is one of the most important activities in secondary crop cultivation. Until now, planting is generally still done traditionally using makeshift tools, namely tugal. In addition to tiring planting with tugal requires time and expensive costs, to overcome this problem, a grain planter machine is available. The planting machine has the advantage of being able to do the activities of tugal, dropping seeds, and closing seed holes at the same time so as to save time, energy and costs. One of the planting machines is a seeder, which is a tool for planting plant seeds in the form of grains. The seeder has the function of placing the seeds to be planted at a certain depth and amount with relatively high uniformity. Most of the planting tools are equipped with soil closure. When seeds are planted using a planting tool, the mechanism of the tool will affect the placement of seeds in the soil, namely affecting the planting depth, the number of seeds per hole, the distance between holes in the row and the distance between rows. In addition, there is a possibility of seed damage in the process of seed flow in the planting tool. There are various kinds of seeds, such as peanuts, corn, soybeans, mung beans and others, all of which have different shapes, sizes and sizes. etc., all of which have different shapes, sizes, agronomic strengths, for which planting tools are needed that have different planting strengths according to the type of seed (Safridatul et al., 2017).

2.2 Working Principle of Seeder

A seeder is a tool used to plant seeds according to the desired depth and quantity. There are several seed planting methods including broadcasting. Drill seeding (random planting), precision drilling (set distance), hill dropping (group placement) and cheek row palting (uniform placement). A lot of grain planting machines have been made to speed up the planting process to help farmers including the centrifugal broadcast seeder, in this tool the seeds are rationed from the hopper through a variable orifice. An agitator is placed above the variable orifice to prevent jamming due to seed bridging, as well as for continuous seed flow. Sometimes a fluted wheel is used as a seed rationer. The seed results are then dropped onto a rotating disk,

and due to the shape of the disk, the seed is accelerated and thrown flat due to centrifugal force. The width of the scatter depends on the diameter of the disk, the shape of the barrier and the density of the seed. Two disks spinning in opposite directions (counter disk spinning) can be used for a wider spread. The seed rate is controlled by the size of the opening, tractor forward speed and spread width. Centrifugal spreader is a fairly flexible tool because it can be used to spread in the form of granules (Kadirman, 2017).

2.3 Types of Seed Planter.

Penanam benih dapat digolongkan berdasarkan tenaga penggerakannya yakni secara manual menggunakan tenaga manusia dan juga menggunakan tenaga penggerak mesin. Jenis penanam benih yaitu sebagai berikut:

1. Tugal

Tugal is a very simple planting tool that is operated by hand. Tugal is very suitable for planting seeds that have a wide spacing, both tugal and modern corn planter have a similar working system, which requires a hole-making system, seed channel, seed drop, and also CLOSURE of the planting hole. The majority of farmers use tugal or this simple corn planter, but in its application simple tugal requires more time and more energy in planting seeds (Sukmawati et al., 2021).

2. Kentheng

Kentheng comes from the Javanese language, meaning a rope or mine that is stretched out. Kentheng is made from wood or bamboo and connected to the bottom with a rope made of spun waru bark fiber (lulub). In the traditional rice farming process in Magetan Regency, kentheng is used during planting, its function is to guide the rice to be planted straight and as a benchmark for organizing the rows of rice planted. The part of the kentheng that is used to guide the rice to be planted straight is the wooden pathok (acir). The lower end of the acir is pointed to be stuck into the ground, while the upper part is given additional wood for hand grip. Kentheng is equipped with a mine to regulate the rows, which is made from spun waru bark fibers (lulub). The planting distance on the kentheng is bundled or marked with starch rope. The planting distance for kentheng in the past was as long as an adult's hand (sakilan) or as long as the sole of an adult's foot (sapecak). The

size is approximately 20-25 cm. Kentheng is a traditional equipment specifically used in rice farming (Ali, 2017).

3. Drum seeder

Drum seeder is a seed reservoir is one of the components of direct seed planting tools that function to accommodate seeds. The designed seed container is able to accommodate 2 kg of seeds, to facilitate the process of falling seeds, the container or drum is designed not to be completely filled with seeds, but there is empty space, which is 1/3 of the total volume of the seed container, besides that there is an iron shaft with a diameter of 2 cm in the middle of the drum so that to get a drum capacity of 2 kg of seeds, the drum size is determined based on the above considerations. The seed container is made of PVC pipe with a seed container diameter of 16.5 cm, which consists of 2 tubes separated from each other. The choice of plastic material as a seed container material because it has properties that are lightweight, elastic, easy to shape, and easily available. Based on the Pipe Design and Construction (PVC) handbook states that PVC pipes are non-conducting electrical materials and are immune to electrochemical reactions caused by acids, bases and salts, found in every part of the pipe. The seed container (drum seeder) consists of several parts, namely, the seed ejection hole consists of 20 holes in total. Located on each of the right side of the 5-hole container and the left side of the 5-hole container with the number of seed containers, namely 2 tubes. The position of the holes is circular in the seed storage tube with a distance between holes from the front of 3.3 cm while the distance from the side is 24 cm. The distance between holes is adjusted to the ideal planting distance for rice plants, which is about 25 cm between plants, so that the seeds that grow can produce many tillers (Aziz et al., 2022).

4. Paddy power seeder

Paddy power seeder is a rice seed planting machine that can be used to make modifications. This rice seed planting machine has a type of penakar or matering device is inclined disk, in the application of rice seed planting tools is expected to overcome the scarcity of existing labor, able to reduce the clarity of work and efficiency of planting time. This mechanical rice seed planting machine is a prototype designed to continue to be able to plant rice seeds in medium processed land conditions (land that has not been perfectly processed, where the land surface

is still not flat). To get the performance of this planting machine, it is better if the paddy field has been processed perfectly or has been done perfect tillage. Overall, the operation of this rice seed planting machine is quite easy to move, but it is still a bit heavy in withdrawal, so this rice seed planting implements are designed double, which can be coupled or pulled with Two Wheel Tractor (hand tractor or trd) or four-wheeled tractor (Budiman and Hidayat, 2017).

2.4 Seeder Part

According to Azis et al., (2022) the tool parts of the drum seeder are as follows:

a. Frame section

The main part of the direct seed planting tool is the frame. The frame is a part that functions to connect all parts of the atabela, starting from the handle, drum seeder and wheels. The frame consists of several parts, namely the handle which is used to pull the tool when operated. The size of the handle is 110 cm long by 40 cm wide made of hollow iron with a size of 2x4 cm. Lava (bearing) is the part that supports the shaft that has a load, so that it can rotate smoothly without damaging the tool. The type of bearing used is a rolling bearing that uses a rolling element to overcome the friction of two moving components..

a. Seed chute

The seed channel on the direct seed planting tool functions as a pathway to drop the seeds right into the groove that has been made by the groove opener. Making seed channels is because the atabela tools that are often used by farmers do not have seed channels so that the seeds fall irregularly. The material used in making seed channels is pipe. The size is determined based on the calculation of the distance to the furrow opener if it is too short then the seeds will fall scattered while if it is too long it will hinder the performance of the land leveler. The seed channel section is directly connected to the seed container (Drum seeder) and hole closure. The closure hole is made of plastic pipe that is easy to shape so that it can be coiled in half of the seed container (drum seeder), the function of the closure groove is to close the seed hole so that it does not fall scattered on the planting field. The working mechanism of the hole closure is that the ejection hole consists of 5 when operating the hole closure will close the part of the hole that is not in line with the seed channel.

b. Soil leveler

Soil leveler Soil leveler is a part that functions to flatten the soil on the planting field to facilitate the making of grooves by the groove maker. Soil conditions that are usually uneven or wavy sometimes make it difficult to make furrows. The material used by the soil leveler is made of acrylic with a size based on the size of the seed container. The selection of molded acrylic material because it has good quality is ideal for use in places where the rupture of the material causes fatal consequences. The working mechanism of the soil leveler is that the acrylic material is mounted on an iron frame. The land grader can move because of the shaft that moves so that it can move flexibly.

c. Wheels

The wheel is part of the Atabela which functions to drive a specially designed tool to rotate properly in the rice field. The wheel section is designed by adding spokes to the inside of the wheel circle to make the wheels sturdier if they are in a planting field that is not in the field.

3. METHODOLOGY

3.1 Time and Place

Seed Planter Practicum was held on Sunday, October 2, 2022 at 7.00 WITA until completion at Teaching Ex-Farm, Agricultural Engineering Programme, Department of Agricultural Technology, Faculty of Agriculture, Hasanuddin University, Makassar.

3.2 Tools and Materials

The tools used in this Seed Planter practicum are seeders, cellphone cameras, stopwatches and writing utensils.

The materials used in the Seed Planter practicum are grains.

3.3 Practicum Procedure

The procedures in the Seed Planter practicum are as follows:

1. Prepare Tools and Materials.
2. Measure the area of land to be processed.
3. Analyzing the parts and functions of the seeder.
4. Start planting by holding the control lever and pushing the seeder forward.
5. Calculated the working time needed to reach the end of the field.
6. Recorded the measurement results.
7. Documenting the practicum activities.

2.3 Formula Used

The formula used in the Seed Planter practicum is as follows:

Calculating KLE (Effective Field Capacity)

$$KLE = \frac{L}{Wk}$$

Description:

KLE = Effective field capacity (Ha/Hours).

L = Results processing land area (Ha).

Wk = Working time (hour).

4. RESULTS AND DISCUSSION

4.1 Results



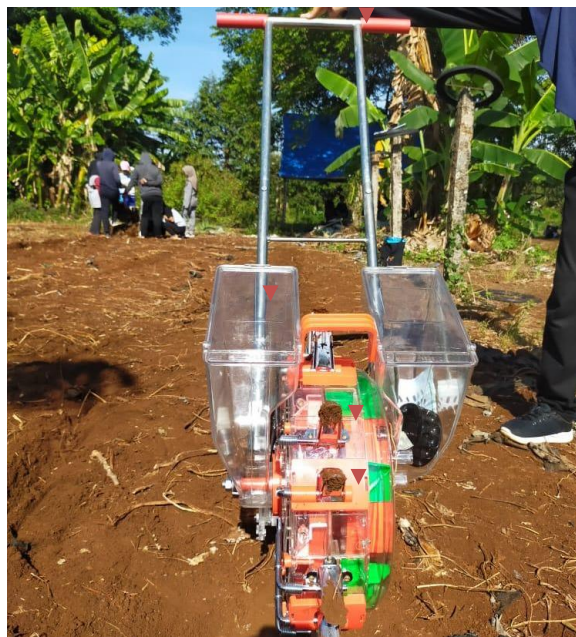
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Gambar 2-1. Left view of seeder

Tabel 2-1. Seeder parts and functions

No	Tool Parts	Function
1.	Seed box (hopper)	Collects seeds before planting and provides conditions so that the seeds can flow properly to the seed drop regulator.
2.	Matering device	Drops a certain amount of seeds and to produce a certain planting distance.



1

2

3

4

Gambar 2-2. Front view of seeder

Tabel 2-2. Seeder parts and functions

No	Tool Parts	Function
1.	Pegangan sandaran tangan	Controlling the machine and maintaining the stability of the machine through the operator.
2.	Kotak pupuk	Accommodates fertilizer before it is dropped onto the ground and as a counterweight to the hopper component.
3.	Pembuka alur (pupuk)	Opens the groove on the ground where the fertilizer is dropped from the planting tool.
4.	Pembuka alur (biji)	Opens the planting furrow on the ground where the seeds are dropped from the planting tool.



Gambar 2-3. Right view of seeder

Tabel 2-3. Seeder parts and functions

No	Tool Parts	Function
1.	Spring	Transmitting the seeder.
2.	Converging device	Closing the planting furrow after seed dropping.
3.	Wheels	Drive the machine and level the soil.

Tabel 2-4. Calculation Results

No	Calculation	Results
1.	KLE (Effective Field Capacity)	45,07 Ha/Hours

4.2 Discussion

Based on the practicum that has been carried out, the seed planter includes a tool used to plant seeds directly in the soil, operated by being given a push and using human power to move it. This type of seed planter is usually used to plant corn seeds on plantation land. The use of seed planter can save energy and work time because in its use it is able to plant a large number of seeds at the same time as planting seeds, simultaneously this seed planter can provide fertilizer directly into the planting hole so as to save the use of fertilizer. The results of planting seeds will be automatically covered with soil because of the tools used specifically to flatten and cover the seed planting holes. This is in accordance with the statement of Safridatul et al (2017), that one of the planter machines is a seeder, which is a tool for planting plant seeds in the form of grains. The seeder functions to place the seeds to be planted at a certain depth and amount with relatively high uniformity.

Based on the results obtained, it can be seen that the parts contained in this seed planter tool are the hopper used for seed containers in the seed planter tool, the metering device for dropping seeds in a certain amount, the furrow opener which functions to open the planting furrow on the ground, the hand rest grip which is used to control the tool through the operator, the fertilizer box for storing fertilizer and dropping it to the ground through the metering device, the spring for transmitting the seeder and regulating the opening and closing of the seed and fertilizer dispensing groove, the converging device for closing the planting groove and the wheels for moving the tool and leveling the soil on the seed planter.

These parts are very important to support the work of seeder tools in planting plant seeds. This is in accordance with the statement. This is in accordance with the statement of Kadirman (2017), which states that in this tool the seeds are rationed from the hopper through a variable orifice. An agitator is placed above the variable orifice to prevent jamming due to interlocking seeds (seed bridging), also so that the flow of seeds can be continuous continuously.

5. CLOSURE

Based on the practicum that has been carried out, it can be concluded that the seeder planter is a type of tool used to plant seeds directly whose working principle is that the seeds will come out of the furrow opener after being adjusted by the metering device in accordance with the rotation of the seeder so that the seeds will fall regularly according to the planting distance that has been adjusted on the seeder tool. The use of this tool is done by using human power to push the tool so that the seeds will regularly fall on the seed ejection hole so that it will match the planting distance and in addition to planting, fertilization can also be done directly.

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APPENDIX

APPENDIX 2-1. Effective Field Capacity Calculation

Length = 10,44 m

Widht = 0,05 m

Calculating KLE (Effective Field Capacity)

$$KLE = \frac{L}{Wk}$$

$$KLE = \frac{0,522}{0,01158}$$

$$= 45,07 \text{ Ha/Hours}$$

APPENDIX 2-2. Documentation of Seed Planter Practicum.



Gambar 2-4. Documentation of Seed Planter practicum

1. INTRODUCTION

1.1 Background

Modern agriculture today focuses on production, labor duration, quality and sustainability of agricultural products. Results are expected to continue to increase and be maintained. Agricultural land is quite labor intensive, especially in terms of planting and weeding. Dependence on rainfall means that labor for planting and weeding is increasingly limited because it has to compete with other commodities. On the other hand, the availability of agricultural labor in rural areas is starting to be limited due to shifts outside the agricultural sector. Therefore, weeders are needed to increase labor productivity and cost efficiency. Technical and economic studies are intended to assess the performance of these tools and machines and their ability to be economically profitable.

Cultivators are a much-needed tool in terms of secondary tillage. This tool has the ability to loosen the soil after plowing on agricultural land. When compared to the secondary tillage process that is still manual, of course cultivators have greater advantages, such as the time needed to do the processing is shorter, the processed results obtained are smoother and flatter and the process carried out is constant for one work area.

The work that can be done by cultivators is not only in the form of chopping the soil but also weeding the land that is being processed. Weeds are nuisance plants that live with cultivated plants. Plant care and maintenance is very important in the implementation of cultivation on agricultural land. One of the ways that farmers usually do is by weeding (controlling) weeds.

Based on this, the Cultivator practicum is carried out so that students can find out the working principles, utilization and construction of cultivators and students understand and are able to operate cultivators in secondary tillage.

1.2 Purpose and usefulness

The purpose of the Cultivator practicum is to learn mechanical weed eradication techniques using equipment operated by agricultural tractors and measurements for weeding work in the field.

The purpose of Cultivator practicum is to know how to operate the cultivator so that it can be used on agricultural land.

2. LITERATURE REVIEW

2.1 Tillage

Tillage is an effort to prepare land for plant growth by creating soil conditions that are ready for planting. Although tillage has been carried out by humans since time immemorial and has undergone such rapid development in both the methods and equipment used, but until now tillage can still not be said to be an exact science (exact) that can be expressed quantitatively. There is no satisfactory method available for assessing the yield produced by a particular tillage tool, nor can a specific yield requirement be determined for various dryland crops. The second tillage is done after plowing, with the second tillage, the soil becomes loose and flat, the water system is improved, the remains of plants and nuisance plants are destroyed and mixed with the topsoil may also be made grooves for planting (Zulkarnain, 2017).

Tillage in crop cultivation aims to create a state of soil or land ready for planting both physically, chemically, and biologically, so that cultivated plants will grow well. Soil processing activities ready for planting are divided into two stages according to Azahari and Hadiutomo (2022), namely as follows:

- a. Pengolahan tanah pertama (pembajakan) berfungsi untuk pemotongan tanah. Kemudian tanah dibalik agar sisa tanaman dan gulma yang ada di permukaan terpotong dan terbenam ke dalam tanah. Alat mesin pengolahan tanah pertama meliputi bajak singkal, disk plowan, bajak rotary, bajak chisel dan bajak subsoil.
- b. Pengolahan tanah kedua (penggaruan dan pengglebegan) bertujuan untuk menghancurkan bongkahan tanah. Results pengolahan tanah pertama menjadi lebih kecil atau hancur, sisa tanaman dan gulma yang terbenam dipotong lagi menjadi lebih halus, sehingga akan mempercepat proses pembusukan dan meratakan tanah. Alat-alat pada pengolahan tanah kedua meliputi garu piringan, garu paku dan garu rotary.

2.2 Cultivator

Cultivators are Farm Machinery used for secondary tillage. Cultivators work by using teeth that stick into the ground while being pulled by a driving force source,

generally a tractor. Cultivator operation can be done by applying or using several kinds of tools that will be pulled on the soil surface with a certain depth, so as to destroy young weeds and protect plant growth. The working principle of the cultivator is that the fuel is channeled into the combustion chamber in the engine so that the motor produces power which is converted into rotary power which is then channeled to the rotor so that the rotary tiller rotates and cultivates the soil. In determining the type and size of cultivator needed depends on the area or area, type of crop, soil conditions, rainfall, type of farming and type of power usage. Generally, cultivators are coupled to the center or central part of the tractor in a forward direction. In addition, there are also those that are installed on the side (right or left) or at the front or at the back of the tractor (Siahaan, 2018).

2.3 Cultivator Parts

According to Zubaidi (2012), the main parts of the cultivator consist of the following:

- a. Fuel tank, as a place to store fuel reserves used as an energy source.
- b. Fuel tap, functions to open and close the connection between the fuel tank and carburetor. When using the fuel tap tool must be in the on position so that the engine can run and after turning off the engine, the fuel tap lever is in the off position.
- c. Radiator, functions to maintain the temperature of the motor used to keep it cool and able to work properly.
- d. The choke lever, this lever functions to open and close the choke valve in the carburetor. When using the cultivator, the position of the choke lever is in the on position while when not in use this lever is in the off position.
- e. Engine switch, functions to control the ignition system contained in the motor.
- f. Starter handle, used to start the engine that can be done by pulling the starter handle so that the start coil can be rotated and can start the engine.
- g. Clutch lever, the main clutch lever has the function of controlling (pressing and releasing) the transmission in controlling the speed of the tool.
- h. Handlebar, functions to adjust the height of the handlebars to match the operator's height..

- i. The transmission lever, used to determine the direction of movement of the cultivator between forward, reverse or neutral. The position of the transmission lever can be adjusted according to the designation on the transmission panel.
- j. Hitch point, functions to install a tow bar or other additional tools if needed in the process.
- k. Throttle lever, throttle lever is used to control the rotation speed of the engine. The position of this lever is adjusted to the expected rotation speed.

2.4 Cultivator Transmission System

The transmission system used in cultivators is very diverse, there are types of cultivators that use pulley and belt transmission, there are also types of cultivators that use sprocket chains and some even use both. Cultivator transmission options consist of forward, neutral and reverse speeds. To adjust the direction of the speed of the tool can be done by moving the transmission lever according to the direction on the transmission panel so that the tool can move forward, backward or neutral. The first forward speed results in a slower forward speed when compared to the second forward speed. Selection of forward speed either the first or second forward speed must be adjusted to the condition of the land being processed. Forward speed can also be affected by the throttle lever. In using or operating the tool it is also important to adjust the position of the transmission lever with the throttle lever to prevent control errors when using cultivator tools (Buharman and Harnel, 2017).

The long distance between the two shafts does not allow direct transmission to occur on the pulleys and belts on the cultivator. In such cases, another way of transmitting rotation or power can be applied, where a flexible belt is wrapped around the pulleys on the shaft. Most belt transmissions use v-shaped belts because they are easy to handle and inexpensive. Belt speeds are planned for 10 to 20 m in general and up to 25 m maximum. The maximum power that can be transmitted is approximately up to 500 (kW). The part of the belt that is wrapped around the pulley bends so that the inner width of the pulley will increase. The friction force can also increase because it is influenced by the wedge shape, which can result in large power transmission (Buharman and Harnel, 2017).

2.5 Cultivator Application

Cultivators are Farm Machinery used for secondary tillage. Cultivators work by using teeth that dig slightly into the soil while being pulled by a driving force source, generally a tractor. Another type of cultivator (rotary tiller) uses rotating discs and teeth to achieve the same results. Cultivator churn and break up large clods of soil, both before planting (to aerate the soil) and after seeds or seedlings are planted to kill weeds. Unlike the harrow that stirs most of the soil surface, the cultivator stirs only a portion of the soil carefully so as not to disturb agricultural crops (Abadi, 2018).

Utilization in agriculture cultivators were often used to carry out tillage activities or smooth the soil. This activity can be carried out both before planting and for weeding and loosening the soil after the plants have started to grow, it can also be used to make beds. Generally, plants on dry land need beds as a growing medium, in this case a cultivator is needed to improve the condition of the soil and to create a suitable condition for the plants to be planted. In addition to smoothing and leveling the soil, cultivators are also often used to destroy weeds so as to protect plant growth from competition with weeds. The application of cultivators in agriculture can solve the problem of labor shortages needed in farming in carrying out secondary tillage processes (Abadi, 2018).

The use of cultivators is intended to process and smooth the soil, both before planting and for weeding and loosening the soil. After the plants have started to grow, it can also be used to make mounds or beds. Crops that require making mounds include cassava, tubers, various types of secondary crops and vegetables that grow in tropical climates (Abadi, 2018).

2.6 Weeding

Weeding is an activity carried out by farmers by pulling weeds that disturb cultivated plants. Meanwhile, weeding is defined as an activity carried out by farmers to loosen the soil, so that the process of transporting water, nutrients or nutrients takes place effectively from the roots to all parts of the plant organs that are being cultivated. Mowing and weeding are two important combinations that must be applied by farmers to obtain optimal cropping results in accordance with the land area and results that should be (Nazution, 2020).

Weeding is one of a series of rice farming activities in the field that can influence the determination of the main harvest results. Weeding weeds conventionally using human labor turns out to require quite high costs and a long time. Weed weeder machine is one alternative way of weeding in addition to other conventional weeding methods pulled directly by hand, with hedgehog tools and others. Rice weeder machine, is a prototype designed in such a way that it can be used for weeding activities in rice fields up to the age of 40 days. The scarcity of productive labor in the agricultural sector is currently a problem that hampers the productivity of agricultural crop cultivation results. Hand weeding involves pulling the weeds around the crop. This method is effective against young weeds, weeds that grow in clumps and between rows of rice plants, but this method requires quite a lot of labor (Nazution, 2020).

3. METHODOLOGY

3.1 Time and Place

Cultivator Practicum was held on Sunday, October 09, 2022 at 08.00 WITA until completion, located at the Experimental Farm, Agricultural Engineering Programme, Faculty of Agriculture, Hasanuddin University, Makassar.

3.2 Tools and Materials

Tools used in Cultivator practicum, namely cultivators, cellphone cameras and writing instruments.

Materials used in Cultivator practicum are fuel.

3.3 Practicum Procedure

The working procedures of the Cultivator practicum are:

1. Prepare Tools and Materials.
2. Turn the off switch to the on position.
3. Starting the cultivator engine by pulling the stater lever.
4. Shifting the gears to position 2 for forward and R for reverse.
5. Pulling the clutch lever to transmit power from the engine to the shovel.
6. Adjusting the throttle lever to the desired speed.
7. Operate the cultivator.
8. Documenting practicum activities.

4. RESULTS AND DISCUSSION

4.1 Results



Gambar 3-1. Cultivator right view

Tabel 3-1. Function cultivator parts top view

No.	Parts	Function
1.	Gear lever	Regulates the engine speed and reverses the engine and stops the engine.
2.	Silencer	Reduces the noise level of the engine.
3.	Fuel tank	Fuel reservoir.
4.	Air filter	Filters the air entering the carburetor.
5.	Starter	Starts the motor.
6.	Rotary plow	Crushes soil and kills weeds.
7.	Clutch	Regulates engine speed.
8.	Gas lever	Controls the engine rotation speed.
9.	Handle	Deflects the cultivator.



Gambar 3-2. Cultivator front view

Tabel 3-2. Function cultivator parts front view

No.	Parts	Function
1.	Pulley	Engine to cultivator transmission system.
2.	On/off switch	Engine electrical system connectors and disconnectors.



Gambar 3-3. Cultivator left view

Tabel 3-3. Function cultivator parts left view

No.	Parts	Function
1.	Implement	Loosening the soil.
2.	V-belt	Engine transmission system.

4.2 Discussion

Based on the practicum that has been carried out, secondary tillage is also used for weeding for nuisance plants or weeds using a cultivator. It is necessary to do tillage before planting so that plants can grow well. The introduction of the main parts of the cultivator is carried out in this practicum. These parts consist of the gear lever, silencer, fuel tank, air filter, starter, plow, clutch, gas lever, handle, pulley and v-belt. Cultivator consists of several main parts that have specific functions and tasks to produce work in secondary tillage. This is in accordance with the statement of Azahari and Hadiutomo (2022), which states that tillage in plant cultivation aims to create a state of soil or land ready for planting both physically, chemically, and biologically, so that cultivated plants will grow well.

The working principle of the cultivator is that the fuel is channeled into the combustion chamber in the engine so that the motor produces power which is

converted into rotary power which is then channeled to the rotor so that the rotary tiller can loosen the soil by turning and pulling weeds on the land carried out by the part of the cultivator tool. Cultivator operation can be done by applying or using several kinds of tools that will be pulled on the soil surface with a certain depth, so as to destroy young weeds and protect plant growth. From the cultivator practicum that has also been carried out, it can be seen how the transmission system of the cultivator is using a v-belt transmission. The cultivator transmission system consists of forward, neutral and reverse speeds. This is in accordance with the statement of Siahaan, (2018), that as for the working principle of the cultivator, the fuel is channeled into the combustion chamber in the engine so that the motor produces power which is converted into rotary power which is channeled to the rotor so that the rotary tiller rotates and cultivates the soil.

5. CLOSURE

Based on the practicum that has been carried out, it can be concluded that cultivators are agricultural tools and machines used for secondary tillage, as for the working principle of cultivators, namely fuel is channeled into the combustion chamber in the engine so that the motor produces power which is converted into rotary power which is then channeled to the rotor so that the rotary tiller rotates and cultivates the soil. Cultivators can be used for secondary tillage and weeding to get good agricultural production results.

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APPENDIX

APPENDIX 3-1. Cultivator Practicum Documentation.



Gambar 3-4. Cultivator practicum documentation

1 INTRODUCTION

1.1 Background

Rice farmers generally plant rice seedlings manually with human labor. On the one hand, the interest of the younger generation to continue their livelihood as farmers is decreasing, they prefer to work as laborers in the public or private companies. This situation is certainly very concerning for the government in improving food security. This condition requires the technology of rice transplanting tools and machines, one of which is a rice transplanter. Rice transplanter technology can speed up the planting time of rice seedlings and overcome the problem of labor scarcity of planting rice seedlings.

Technology in agriculture is becoming increasingly developed. Several planting tools and machines can now be used to place seeds, plants, or plant parts in a prepared area either inside or above the soil surface automatically. Transplanter is one example of a machine used to transplant rice seedlings in rice fields that are ready for planting. The use of Farm Machinery aims to produce regular cropping patterns and in a fast time.

The existence of transplanter is one of the solutions in planting rice seedlings in order to obtain uniform crop time with efficient costs and neat planting results. However, all the advantages of rice transplanter will be achieved if the operator has knowledge in rice cultivation and skills to operate the machine properly. The cultivation knowledge includes the transplanting time of the seedlings, the number of seedlings per planting hole, planting depth, planting distance, and planting pattern. Machine operation skills include controlling the machine, adjusting the machine equipment so that the planting arrangement is as desired.

Based on the description above, it is necessary to do a Rice Transplanter practicum so that students can find out the tools and agricultural machinery of the rice transplanter type, and can operate these agricultural tools and machines in planting rice in rice fields.

1.2 Purpose and usefulness

The purpose of Rice Transplanter practicum is to know the parts of rice transplanter agricultural tools and machines and be able to operate rice transplanter.

The usefulness of Rice Transplanter practicum is to be able to understand the tools and agricultural machinery of rice transplanter and can implement rice transplanter tools to be used in agricultural cultivation.

2 LITERATURE REVIEW

2.1 Alat Tanam Bibit

The use of Farm Machinery can also reduce saturation in the work of farmers, and labor can be allocated to carry out other farming or non-farm activities that are more continuous in nature. Agricultural mechanization can be more effective in reducing labor costs and the goal of effective mechanization is to increase the income of small farms or farmer households through reduced production costs. Planting equipment is a tool used to place plant seeds, namely seeds, seeds, stems or some other plant bodies above or below the soil surface. The planting tool is designed to have a function to speed up the planting process on corn land and make it easier and less time consuming. This tugal is expected to be able to overcome the problem of plantations, namely limited time. The semi-mechanized corn planter tugal uses a spring when the tugal eye enters the ground. The seed ejection regulator is pressed upwards by the soil surface. Then push the spring stalk, so that the seed hole opens and the seeds fall down made by the tugal eye. Furthermore, when the tugal is lifted from the soil surface, the tugal returns to its original position due to the work of the spring (Iskandar et al., 2017).

In this planting process, in general, farmers often use the traditional method of planting by hand to immerse the seeds. The manual planting process requires a lot of labor with low uniformity and efficiency and is limited by its availability. The use of Farm Machinery in the production process is intended to increase efficiency, effectiveness, productivity, quality of results, and reduce the workload of farmers. The less labor available in agriculture, mechanical planting tools are needed. The transformation process in the development and utilization of alsintan technology from pre-planting to post-harvest and processing Results, some have not been able to be adopted by farmers so as to increase the efficiency of rice farming in reducing production costs and saving labor (Iskandar et al., 2017).

2.2 Rice Transplanter

Rice transplanter is a rice planter machine tool that is used to plant rice seedlings that have been sown in a special area with a certain age, in an area of paddy soil in ready-to-plant conditions, the machine is designed to work on muddy land (puddle), so this machine is designed with light weight and equipped with a floating device so that the rice transplanter can be operated on swamp land which has a depth of mud reaching tens of cm above the ground or swamp surface. Types of rice planter machine tools commonly used by humans according to Saleh and Muqwin, (2018) that the types of rice seedling planter machine tools based on the driving force, including:

1. Manual rice seedling planter, this rice seedling planter uses human labor.
2. Animal power rice seedling planter, this rice seedling planter uses animal power sources.
3. Tractor-coupled rice seedling planter, this rice seedling planter uses the driving power source of the tractor.
4. Self-propelled rice seedling planter, a rice seedling planter unit that has an engine drive. This rice seedling planter is widely produced by Asian countries.

Generally, there are two types of rice seedling transplanting machines that are distinguished based on the method of seeding and preparation of rice seedlings according to Saleh and Muqwin, (2018), namely as follows:

1. Rice seedling planting machine with washed root seedlings. The machine has the advantage that it can be used without having to change the way seedlings are traditionally sown, the disadvantage is that the working capacity is smaller because the time needed to take the seedlings is longer.
2. A rice seedling planting machine in which the seeds are sown in a special nursery box, with soil as the medium, watered and fertilized. This model of nursery in Japan is widely practiced by agricultural cooperative centers, so that farmers do not have to bother preparing rice seeds themselves. Seedlings sown in this way have more uniform seedlings.

Parts rice transplanter and function according to Saleh and Muqwin, (2018) are as follows:

1. Road Device

This component functions to move the rice planter machine forward and backward.

2. Diverter Device

Flow device which consists of a part that has its role and function, namely:

- a. A seed conveyor that functions as a place to place the seedlings to be planted.
- b. The seedling holder works as a tool to hold the seedlings contained in the seedling tray.
- c. Seedling diverter to move the seedling tray to the right and left so that the seedlings are evenly distributed.

3. Planting Device

An embedding device that consists of a part that has functions and uses, namely:

- a. Planter arm whose function is to work to drive the planter fork or planting fork.
- b. Seedling taker, which is a tool that functions to take seedlings from the seedling tray.
- c. The operating device is an operating control device consisting of a motor, clutch, gear, verseneling, brake and operating lever.

2.3 Planting Pattern

Cropping pattern is the arrangement of crop land use in a certain period of time. Cropping pattern is a part or subsystem of the crop cultivation system, then from this crop cultivation system can be developed one or more cropping pattern systems. This cropping pattern is applied with the aim of utilizing resources optimally and to avoid the risk of failure. However, it is important that the growing requirements between two or more plants on the land should be close to the same. The use of plant spacing in crop cultivation will provide sufficient space for plants to meet the needs of the plant environment such as air, water, solar radiation intensity and plant nutrients. Proper plant spacing allows plants in one stretch to get optimal plant environmental needs so that maximum production can be achieved as well. A tool for making plant spacing for planting rice with a distance of 40×20×12.5 cm in the jajargow system (Donggulo et al., 2017).

Planting patterns are divided into two types based on the form of planting according to Amarullah et al. (2019), namely as follows:

1. Monoculture

Monoculture comes from the word mono and culture. The word mono means one and culture means management or processing. Therefore monoculture cropping pattern is a land management effort on an agricultural land with the aim of cultivating one type of plant in a certain time (1 year). In summary, monoculture is a cropping pattern by cultivating only one type of plant in one farm for a certain time.

2. Policulture

Policulture comes from the words poly and culture. Poly means many and culture means cultivation. So, policulture is the planting of more than one type of crop on a farm in a certain time, where the planting can be in one time or can also be in several times but in one year. Policulture cropping patterns are considered to be able to increase soil fertility naturally, thereby increasing the yield of the main commodity. Policulture cropping patterns are divided into two types, namely first, intercropping is the planting of more than one crop at the same time or during the planting period in the same place. Intercropping policulture cropping patterns have the advantage of preventing or reducing the void of the growing season, improving nutritional balance, applying minimal tillage, increasing added value and reducing crop failure if one crop fails. Second, multiple cropping is a crop cultivation technique by planting more than one crop in one season, then continuing to plant more than one type of crop in the following season on the same land within one year. Intercropping is intercropping that is done sequentially and more than one planting period.

2.4 Working Principle of Indo Jarwo Transplanter

The use of mechanized agricultural machinery (alsintan) such as transplanter jarwo as a planting machine in swamp land is currently not fully implemented, especially in some swamp areas that have not been irrigated or due to the marginality of the land itself. The transformation process in the development and utilization of alsintan technology from pre-planting to post-harvest and Results processing, some have not been able to be adopted by farmers. Transplanter Jarwo

is a rice planting machine that is used in ready-to-plant rice fields to plant rice seeds from Results seedlings that use trays or dapogs with a seedling age of about 15 days or a certain seedling height. This planting machine is designed to operate on muddy land (puddle) with a depth of less than 40 cm. Therefore, this machine is lightly designed and equipped with a floatation device to be able to plant in swamps and other wetlands (Umar et al., 2017).

Indo Jarwo transplanter is a modern machine for planting rice seedlings with a 4-row simultaneous planting system. The overall length of the Indo Jarwo Transplanter machine is 2.48 m, width 1.70 m and height 86 cm. The drive motor used is a 4-stroke combustion motor, 3.5 kW and 4.6 HP at 3600 rpm. In one wheel rotation motion, this machine can make 4 lanes with a distance between lanes of 20 - 40 - 20 cm. The use of this machine is relatively easy where the planter fork (picker) takes rice seeds and then plugs them into flat land. There are advantages of Indo Jarwo Transplanter according to Umar et al. (2017), which include the following:

1. Supports a 2:1 jajar legowo system with 4 rows of planting. The planting distance between rows is 20 cm, the legowo planting distance is 40 cm.
2. High planting capacity of 6 hours/ha.
3. Planting distance within the row can be adjusted to 10 - 18cm.

3. METHODOLOGY

4.2 Time and Place

Rice Transplanter Practicum was held on Sunday, October 16, 2022 at 07.00 WITA until completion, located at the Experimental Farm, Agricultural Engineering Programme, Department of Agricultural Technology, Faculty of Agriculture, Hasanuddin University, Makassar.

3.2 Tools and Materials

The tools used in Rice Transplanter practicum are rice transplanter and cellphone camera.

The materials used in the Rice Transplanter practicum are fuel.

3.3 Practicum Procedure

The procedures in the Rice Transplanter practicum are as follows:

1. Prepare Tools and Materials.
2. Checking oil and fuel.
3. Changing the switch from the off position to the on position.
4. Starting the rice transplanter engine by pulling the stater.
5. Adjusting the throttle lever to the desired speed.
6. Shift the gear lever fully to the right or second gear.
7. Raise the main clutch lever to start the rice transplanter engine.
8. Moving the planter clutch to get the planter running.
9. Pressing the left clutch lever to turn the rice transplanter towards the left and the right clutch to turn towards the right.
10. Documenting the practicum activities.

4. RESULTS AND DISCUSSION

4.1 Results



Gambar 4-1. Rice transplanter front view

Tabel 4-1. Parts and functions of rice transplanter front view

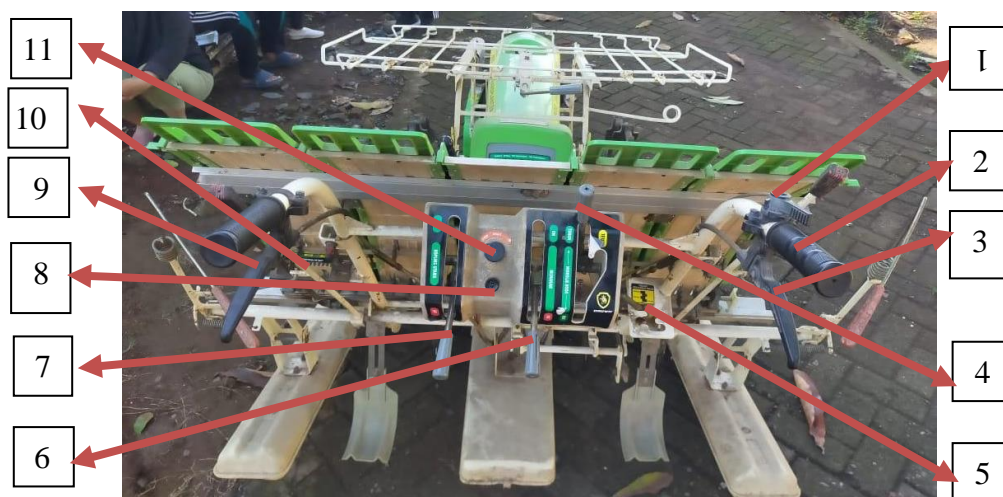
No.	Part name	Function
1.	Lights	As a light when operating the engine.
2.	Fuel tank	As a place for fuel.
3.	Planter fork (picker)	To stick or plant rice seedlings into the ground.
4.	Buoy	To hold the machine from sinking on muddy land.
5.	Visir	As an indicator of the straightness of the machine when in operation.



Gambar 4-2. Rice transplanter side view

Tabel 4-2. Parts and functions of rice transplanter side view

No.	Part name	Function
1.	Seedling holder	As a place to place and control the seedlings so that they do not fall into the planting clamp.
2.	Side visir	As an indicator to keep the machine straight.
3.	Gear lever	To adjust the speed of the machine and to reverse and stop the machine.
4.	Planting table (Tray)	To place spare rice seedlings before transferring them to the seedling holder.
5.	Wheels	To drive the machine.



Gambar 4-3. Rice transplanter rear view

Tabel 4-3. Parts and functions of rice transplanter rear view

No.	Part name	Function
1.	Gas lever	To adjust the gas level.
2.	Handle	To control the direction of the engine.
3.	Right clutch	To turn the engine to the right.
4.	Hydraulic lever	To adjust the height of the machine by raising or lowering the float based on the water depth.
5.	Planting lever	To adjust the planting process on the machine.

6.	Planting depth lever	To adjust the depth of the rice seedlings when they are planted.
7.	Main clutch	To start and stop the engine.
8.	Choke	To feed more fuel to the engine.
9.	Left clutch	To turn the machine to the left.
10.	Seedling count adjustment lever	To adjust the number of seeds to be planted.
11.	On/off switch	To connect and disconnect the engine electrical system.

4.2 Discussion

Based on the practicum that has been carried out, it can be seen that the transplanter is used as a tool used to plant rice where the existing rice seeds will be planted directly into the soil so as to facilitate the planting process and can streamline the time used. This can reduce the amount of labor in agriculture. The manual planting process requires a lot of labor with low uniformity and efficiency and is limited by its availability. Each part on the transplanter has its own function and usefulness in the work process. This is in accordance with the statement of Saleh and Muqwin (2018), which states that rice transplanter is a rice planter machine tool used to plant rice seeds that have been sown.

Rice transplanter, which has a more complex working principle and a faster seed planting process, is generally used by farmers with a large scale of land with a duration of work that does not take so long. The use of this tool greatly supports the work efficiency of farmers in planting, thereby improving the quality, results and quality of rice cultivation results because of its easy and efficient use. This is in accordance with the statement of Iskandar et al. (2017), that the use of Farm Machinery in the production process is intended to increase efficiency, effectiveness, productivity, quality of results, and reduce the workload of farmers.

5. CLOSURE

Based on the practicum that has been carried out, it can be concluded that the rice transplanter is a tool used in transplanting. The way this tool works is very efficient both in processing time and in saving the use of energy, because it is able to plant rice seeds directly on the ground with a distance and planting pattern that has been specially designed on the tool. However, there are also things that must be met in planting rice seeds, namely the seedlings used must be sown elsewhere and sown in a special way so that they can be planted using a rice transplanter tool..

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APPENDIX

APPENDIX 4-1. Documentation of Rice Transplanter Practicum



Gambar 4-4. Documentation of Rice Transplanter practicum

1. INTRODUCTION

1.1. Background

The need for food is currently increasing due to the greater development and population growth in Indonesia. On the other hand, in the food supply sector, of course, the agricultural sector has become more declining and its productivity level has decreased due to technological developments that make some people more reluctant to work and rely more on the sophistication and reliability of technology in cultivating land and so on, especially for the agricultural sector itself. In addition to this, the narrowing of agricultural land, reduced levels of soil and water productivity and the distribution of tools in remote areas, especially for villages that can be used to plant and cultivate agricultural crops. Lack of interest and community and the achievement of information that is still minimal about the use of tools and the introduction of existing technology.

Overcoming problems related to some of these things can be done by developing and utilizing technology as well as possible. As one example with the development of technology in the form of tools and machines that can be used for cultivating land, land clearing, construction and so on, namely 4-wheeled tractors. 4-wheeled tractors include Farm Machinery that are very efficient in carrying out work in land processing, both for land clearing and secondary and primary soil processing. The 4-wheeled tractor itself has enormous power ranging from 25 to more than 105 Horse Power (HP) which can be coupled with a heavy implements according to the power of the 4-wheeled tractor. The use of this 4-wheeled tractor is very helpful for tillage of very large agricultural land which can be completed within a few days compared to using a Two Wheel Tractor or manual tillage.

Based on the description above, a four-wheeled tractor practicum will be carried out to find out and understand the function of each part of the four-wheeled tractor construction and be able to operate a four-wheeled tractor.

1.2 Purpose and usefulness

The purpose of the Four Wheel Tractor practicum is so that students can know the parts, characteristics and functions and how to operate of a four-wheeled tractor.

The usefulness of the Four Wheel Tractor practicum is being able to operate a four-wheeled tractor properly and correctly on a land as needed and can apply it to agricultural land.

2. LITERATURE REVIEW

2.1 Agricultural Mechanization

Agricultural mechanization development is a discipline of system thinking. The development of agricultural mechanization is a socio-technical system that is influenced by many factors, both internal and external. Agricultural mechanization is called a socio-technical system because agricultural mechanization cannot be approached only from a technical perspective, but includes social interactions within the system. The implementation of agricultural mechanization development in Indonesia is also influenced by the development of economic development, because it will give birth to the form and direction of government policies related to agricultural progress (Sulaiman et al., 2018).

The use of Farm Machinery to support the operational process of farming, starting from land clearing, planting preparation, planting, plant maintenance, harvesting to post-harvesting is known as agricultural mechanization. The application of agricultural mechanization is able to increase time efficiency, cost efficiency, work effectiveness, reduce work fatigue, improve the quality of Results, and reduce the loss of Results during the process or activity. The application of agricultural mechanization that is able to increase efficiency, effectiveness and reduce the loss of Results has an impact on increasing the productivity and performance of farming can be categorized as the main technology. The importance of time efficiency and effectiveness of activities in farming is well recognized. Moreover, there are labor limitations and the occurrence of natural disaster disturbances due to the influence of climate anomalies. Currently, the application of agricultural mechanization as the main technology component in farming in Indonesia is still relatively low and its distribution is still minimal (Sulaiman et al., 2018).

Agricultural mechanization is an option that must be taken to spur increased production, productivity, efficiency and competitiveness. Another factor as a reason for the importance of mechanization is the decreasing availability of labour (young age) in agricultural business activities. So that in its development, the development

of tools and machines such as tractors, tools and machines for weeding, planting, maintenance and so on. (Sulaiman et al., 2018).

2.2 4-Wheel Tractor

Tillage is an effort to prepare land for plant growth by creating soil conditions that are ready for planting. Several studies have concluded that tillage is an important issue to obtain optimal agricultural production. Good soil conditions are one of the factors for the success of agricultural cultivation and to get good soil conditions, agricultural tools are needed to process it. Although tillage has been done by humans since long ago and has developed both from the methods and equipment used. Therefore, there is a need for technology to help farmers do tillage to get good and efficient results. One of the equipment that has the function of processing soil is a 4-wheel tractor (Arum and Mahrus, 2020).



Gambar 5-1. 4-Wheel Tractor
Source: (Arum dan Mahrus, 2020)

4-Wheel Tractor is a self-propelled machine in the form of a diesel motor, four wheels (rubber tires or plus steel cage wheels) which has 3 points of coupling, functioning to pull, move, lift, push implements or agricultural tools such as disk plows, rotary plows, outcrop plows and also as a source of driving power. According to Hadiutomo, (2018), the following plows are often used for 4-wheel tractors, namely as follows:

1. Mouldboard Plow

Moldboard Plow is the first land processing tool (plowing) in the form of an outcropping that is coupled at three coupling points behind the tractor and functions to cut, lift, turn over and break up chunks of soil Results of plowing where the angle of the plow determines the depth, while the number of plowshares and the width of the plowshares determine the width of the plowing done.

2. Disk Plow

Disk plow is the first land processing (plowing) tool mounted on a frame composed of one or more disks coupled to three coupling points behind the tractor. Berfunction for the option of lifting, turning, soil and breaking up chunks Results plowing at an angle of inclination determines the width of density.

3. Rotary plow

Rotary plow is a land processing tool that is coupled at three points of coupling behind the tractor, consisting of several knives linked to a rotating shaft after being connected to the rotary power source of the Power Take Off (PTO) tractor which has the function of chopping and destroying light soil or chunks of soil Results of plowing with Moldboard Plow or disk plow where the width of the shaft determines the width of the soil treatment.

4. Subsoil Plow

This plow can be used on moderately hard or very hard soil with a depth of 20-36 inches to reach subsoil. Parts of the plow consist of a subsoil blade and a plow retaining bar which is classified as a grid bar. Therefore, it can be used to break up hard layers in the soil and improve drainage.

5. Plow Chisel

This plow is chisel-shaped and arranged on a frame. It is used to break up hard soil to a depth of 18 inches. It has wheel that function to adjust the depth of the soil fragments. This plow does not turn the soil but only breaks the soil so it is widely used before plowing the soil.

6. Giant plow

This plow has a very large size and is used for soil turning at a depth of 60-180 cm. By using this tool fertile soil in the soil can be lifted to the surface of the soil. Can be shaped Moldboard Plow or disk plow.

Classification of 4-Wheel Tractor based on the amount of diesel motor drive and 3-point coupling category according to Hadiutomo, (2018), which is as follows:

1. Mini tractor with motor drive power of 9-15 kw with 1 category of 3 coupling points.
2. Small tractors with motor drive power of 15-35 kw with 1 category of 3-point coupling.

3. Medium tractors with a motor drive power of 30-75 kw with 2 categories of 3-point coupling.
4. Large tractors with motor drive power of 60-168 kw with 2 and 3 categories of 3-point coupling.
5. Very large tractors with a motor drive power of 135-300 kw with 3 and 4 categories of 3-point coupling.

Based on the number of tractor wheel drive shafts can be classified into two types according to Hadiutomo, (2018), namely as follows:

1. Two Wheel Drive (2WD) single-axle tractors are tractors that are driven by both rear wheels.
2. Tractor with double drive shaft Four Wheel Drive (4WD) is a tractor that is driven by all four wheels, namely 2 rear wheels and 2 front wheels.

2.3 Soil Tillage

Tillage is all the introductory work before planting to make the soil in the best possible condition for root growth until it is ready for planting. The main objective of tillage is to create soil conditions suitable for plant growth with minimum effort. As the beginning of agricultural cultivation activities before other activities are carried out, this activity needs to be pursued effectively and efficiently, because it involves the quality of results and the timeliness of tillage. Tillage activities can be divided into primary tillage and secondary tillage (Santoso, 2018).

Primary tillage activities aim to disassemble the soil into chunks in order to capture air, water and sunlight for the weathering process so that the soil is free from weeds and to prepare for secondary tillage. The secondary tillage process aims to destroy chunks of soil to make it loose and suitable for good plant growth media (Santoso, 2018).

The purpose of tillage according to Santoso, (2018), which states that the purpose of tillage is as follows:

1. Create the soil structure needed for seedbeds and seedlings. Compacted soil is treated until it becomes loose so that it accelerates water infiltration, has good ability to retain rain, improves aeration and facilitates root development.
2. Increase the speed of soil infiltration to reduce run off and reduce the danger of erosion.

3. Inhibit or kill nuisance plants.
4. Sinking vegetation and garbage above the soil surface into the soil.
5. Killing existing pests by changing the place of residence and the sun.
6. Makes it easier to organize cropping patterns.
7. Simplifies the maintenance path when the planting pattern is appropriate.
8. Prepare the land as a good plant growth medium.

2.4 Benefits of Agricultural Mechanization

Mechanization is needed in agricultural production because it is very helpful in the process, saving energy and time. Based on the statement (Trisnawati, 2021) there are several benefits of agricultural mechanization, namely as follows.

- a. Increase agricultural labor productivity. Applying agricultural mechanization such as the use of machinery in agricultural activities can help farmers to increase their productivity.
- b. Increase the productivity of agricultural land by using mechanization technology, such as the rice transplanting robot, farmers can save a lot of energy and time in the planting process.

3. METHODOLOGY

3.1 Time and Place

4-Wheel Tractor Practicum was conducted on Sunday, October 23, 2022, at 07.00 WITA until completion, located at the Experimental Farm, Agricultural Engineering Programme, Department of Agricultural Technology, Faculty of Agriculture, Hasanuddin University, Makassar.

3.2 Tools and Materials

The tools used in the 4-Wheel Tractor practicum are 4-Wheel Tractor and camera.

The materials used in the 4-Wheel Tractor practicum are diesel fuel and a plot of land.

3.3 Practicum Procedure

Whatever the procedure in the 4-Wheel Tractor practicum is as follows:

1. Prepare Tools and Materials.
2. Start the tractor by turning the starter to the right.
3. Step on the clutch pedal.
4. Raise the PTO lever to rotate the rotary plow shaft and can adjust the speed on the rotary plow shaft.
5. Step on the clutch pedal.
6. Raise the transmission lever and insert the sub gear.
7. Stepping on the accelerator pedal slowly.
8. Lowering the implement by lowering the hydraulic lever
9. Start operating the machine by controlling the steering wheel according to the land to be cultivated.
10. When finished cultivating the land, raise the implement back up by pulling the hydraulic lever up.
11. Move all levers to the neutral position.
12. Turn off the tractor engine by turning the starter to the left.
13. Documenting practicum activities.

4. RESULTS AND DISCUSSION

4.1 Results



Gambar 5-2. 4- Wheel Tractor side view

Tabel 5-1. Parts and functions of 4-Wheel Tractor side view

No	Part name	Function
1	Front wheel axle	Turning place for the front wheels of the tractor
2	Front wheel	Supports the front of the tractor
3	Ballast	Balancing between the front of the tractor and the rear
4	Lights	Lighting the road when working at night
5	Clutch	Smoothing the transmission gear shift
6	Engine CLOSURE	Protect the engine from the heat of sunlight and rain and other disturbing things
7	Motion control lever	Regulates the forward or backward motion of the tractor
8	Roof	Protects the operator from rain and sunlight and protects the tractor steering controls
9	Rear wheel	Supports the rear of the tractor and drive

10	Footing	The operator's foothold when boarding the tractor
11	Rear wheel axle	Rotating place for the rear wheels of the tractor
12	Rotary plow	Crushes and loosens soil



Gambar 5-3. Rear view of 4-Wheel Tractor

Tabel 5-2. Parts and function 4-Wheel Tractor rear view

No	Part name	Function
1	Power take off	Channeling transmission to rotate the rotary
2	Top link	Coupling the upper coupling point of the implements
3	Left turn signal	Informing the operator of a left turn
4	Fuel tank Cap	Closes the fuel intake section from outside into the tank
5	Right turn signal	Informs the operator of a right turn.
6	Brake light	Informs the tractor to stop or brake
7	Fuel tank	Collects diesel fuel for the tractor engine
8	Lower link	Raising and lowering implements with hydraulic up and down motion
9	Draft link	Coupling and balancing the right and left implements



Gambar 5-4. Control of 4-Wheel Tractor

Tabel 5-3. 4-Wheel Tractor parts and control functions

No	Part name	Function
1	Hydraulic lever	Lowering and raising the draft link to adjust the rise and fall of the rotary plow
2	Seat	Operator's seat when controlling the tractor
3	Speed lever	Set the tractor speed (high or low)
4	Rotary lever	Channeling the transmission to rotate the rotary plow with a certain rpm
5	Steering wheel	Turning the tractor right and left
6	Transmission gear lever	Setting the transmission gear
7	Indicator screen	Informing fuel condition and other indicator lights
8	Speed lever	Set the tractor speed (high or low)
9	Stater lock	Start the tractor engine
10	Brake pedal	Stopping the tractor
11	Gas pedal	Adjusting the tractor speed

4.2 Discussion

Based on the practicum that has been done obtained Results that 4-Wheel Tractor is a tractor that has a large driving force and is able to do tillage very quickly compared to using Two Wheel Tractor. 4-Wheel Tractor can be coupled with large implements as well depending on the type of 4-Wheel Tractor used which is adjusted to the amount of driving power that can be researched by the engine it uses. The practicum that has been carried out the tractor used is a tractor with a driving power of 30-40 Horse Power (HP) which is coupled with a rotary plow to loosen the soil. This is in accordance with the statement of Arum and Mahrus (2020), which states that one of the alsintan that has the function of processing soil is a 4-wheeled tractor.

Based on the results obtained, it can be seen that the parts of the 4-Wheel Tractor have their respective functions and uses and are designed according to their purpose in the process of operation when cultivating the soil. The working principle of this tractor is by channeling engine rotation to the rotary plow through the Power Take Off (PTO) which functions to channel engine power to rotate the plow, besides that the plow used is certainly coupled with the 4-wheel tractor which is mounted on a three hitch point, this component has three parts namely top link, lower link and draftlink which functions to lift and lower the plow with a hydraulic tube intermediary controlled by a hydraulic lever by the operator who plows the land with 4-Wheel Tractor. In addition to these parts, other 4-wheel tractor parts also have their respective functions and purposes. This is in accordance with the statement of Hadiutomo (2018), which states that the 4-Wheel Tractor is a self-propelled machine in the form of a diesel motor, four-wheeled (rubber tires or plus steel cage wheels) which has 3 points of coupling function to pull, move, lift, push implements or agricultural tools such as disk plowan, rotary plow, Moldboard Plow and also as a source of driving power.

5. CLOSURE

Based on the practicum that has been carried out, it can be concluded that the 4-Wheel Tractor includes tractors with driving power ranging from 25 to >105 Horse Power (HP) which can be coupled with heavy implements so that in the process of cultivating agricultural land becomes faster, saves time and the use of energy and its versatile use on dry land and wet land depending on the type of construction that is adjusted to the type of land.

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APPENDIX

APPENDIX 5-1. Documentation of 4-Wheel Tractor Practicum.



Gambar 5-5. Documentation of practicum 4-Wheel Tractor

1. INTRODUCTION

1.1 Background

Mower machines are very suitable as a substitute for sickle tools in harvesting rice. This mower machine is not only able to harvest or cut rice stalks, but the mower is also able to harvest other types of plants such as corn, soybeans, and wheat. Mowers usually have two cutting edges that function to cut plant stems including a blade made of iron which has two blades and nylon. Cutting edges using nylon are safer to use but the nylon must be replaced when the nylon has become tangled. Tools or machines used in tillage such as tractors. Tractors are usually used together with implement in the form of rakes or plows. While the tools commonly used in harvesting agricultural crops such as rice are commonly called Mower. Mower machines are very suitable for replacing sickle tools in harvesting rice.

This Mower machine is not only able to harvest or cut rice stalks, but Mower is also able to harvest other types of crops such as corn, soybeans, and wheat. Mower, usually there are two cutting blades that function to cut the stems of plants including a blade made of steel which has two blades and nylon. With the availability of this machine, the time to cut or harvest rice can be shorter and the threshing process can take place simultaneously with cutting. The development of lawn mowers that are often found in the community uses fuel oil for its energy consumption. Looking at its use and the terrain where the grass is, the lawn mower can be divided into two types, namely, pushed and carried lawn mowers. And also the grass cutter still depends on PLN electricity as its energy supply.

Based on the description above, a Mower practicum will be carried out so that students can recognize the construction of a tool or lawn mower or mower, are able to know the function of each mower part and students can operate a mower machine tool on agricultural land to carry out weeding or harvesting.

1.2 Purpose and usefulness

The purpose of the Mower practicum is to learn mechanical grass cutting techniques and know the parts and working principles of the mower and the application of the mower in agriculture.

The usefulness of this practicum is that students are able to operate a mower with the right techniques as applied in agriculture in carrying out the weeding process or eradicating weeds.

2. LITERATURE REVIEW

2.1 Mower

Mower or lawn mower is a tool used to cut grass or plants. This tool is commonly used to tidy up and also to clean the land from weeds or similar grass, lawn mowers can also facilitate human work. This lawn mower consists of a cutter, engine, walking wheels, walking knife mechanism, knives and control parts. Lawn mowers are in great demand by some people because according to their function this lawn mower can facilitate human work quickly (Yanto et al, 2020).

A lawn mower that is widely used to cut grass in sports fields or parks is a rotary type lawn mower using a gasoline motor as a driving force. Rotary lawn mowers use gasoline fuel with an internal combustion system and generally move manually with the engine only rotating the cutting blade. Rotary lawn mowers use fuel and are costly, make noise, have high gasoline fuel consumption and cause fatigue for the operator during prolonged operation. Lawn mowers using gasoline motors are not equipped with control devices such as switches that will turn off and slow down or speed up the rotation of the gasoline motor (Kahar, 2018).

A rotary type mower is a grass cutter that cuts based on the impact of the blade against the grass (free cutting) with a high rotation speed. The mower's rotational speed and blade sharpness will greatly affect the quality of the cutting results. The cutting results of a rotary mower are not as good as a reel mower, however, a rotary mower can provide acceptable cutting results in almost all types of cut area conditions, can be treated a little more roughly while still maintaining the cutting results, and is not as complicated and expensive as a reel mower (Kahar, 2018).

2.2 Types of Mowers

The types of mowers according to Yanto et al (2020), are as follows:

1. Hand-held lawn mower

A riding lawn mower is a lawn mower that is used by being carried or on the back of a riding lawn mower This riding lawn mower can cut grass in a yard with uneven or bumpy ground.



Gambar 6-1. Carrying mower
(Source: Yanto dkk., 2020).

2. Push lawn mower

A push lawn mower is a lawn mower that is used by pushing. This machine is suitable for use on lawns and fields with flat ground.



Gambar 6-2. Push lawn mower
(Source: Yanto dkk., 2020).

3. Electric lawn mower

There are 2 types of electric lawn mowers, namely with electrical installation (cable) and with batteries (without cable). Its use is easier and lighter because there is no engine vibration.



Gambar 6-3. Electric lawn mower
(Source: Yanto dkk., 2020).

2.3 Parts Mower

There are parts on the mower that have their respective functions and uses to support the work of the lawn mower according to Miftakhudin (2021), which are as follows:

1. Fuel tank

The fuel tank is the part that functions as a container for fuel. The fuel tank is located at the very top of the mower. However, some are located at the bottom of the engine according to the type of mower.

2. Carburetor

The carburetor is the part that is responsible for supplying fuel to the combustion chamber in the cylinder block.

3. Air filter

Air filter or air cleaner is a part to filter the air entering the combustion chamber..

4. Recoil starter

Recoil starter is a part that functions to crank the initial rotation of the engine when it will be started..

5. Lining (clutch)

Kampas (clutch) is a part that functions as a clutch. The working system of the camp itself is to expand when the engine rotation becomes fast. So that the development of the lining will continue the rotation of the engine to the propeller of the lawn mower.

6. Capacitor Discharge Ignition System (CDI)

CDI is the part in charge of ignition results that increase the voltage and then forwarded to the spark plug into a spark. The ignition that occurs is a collaboration between the CDI and the rotation of the magnetic wheel on the lawn mower.

7. Magnetic wheel

The magnetic wheel is a wheel that acts as a counterweight to the engine as well as a place for the magnet to be attached. In the lawn mower, the magnetic wheel has a fan that serves as a cooling machine.

8. Lawn mover

A lawn mower is a mechanical device and an electrical device that transmits or converts energy to perform or assist and facilitate human work..

9. Seal

There are two oil seals located on the left and right side of the oil chamber, the oil seal functions as a barrier so that oil does not escape from the engine room. But on a 2 stroke lawn mower, the oil seal functions as a cover for the engine compression chamber.

10. Bearing housing

The housing is a part that serves as a link between the engine and the handle of the lawn mower..

11. Tuas mata pisau

Function tuas mata pisau untuk mengatur pemakanan pemotongan rumput.

12. Baling-baling pembabat

Baling-baling pemotong adalah alat yang berfungsi sebagai pembabat rumput. Ada dua jenis baling-baling pembabat yaitu plat baja dan tali.

13. Tombol chooke otomatis

Menyemburkan bahan bakar lebih banyak ke karburator untuk mempercepat proses pembakaran pada blok silinder.

14. Tuas start

Dihubungkan dengan kabel yang berfungsi untuk menarik gas yang terhubung dengan karburator untuk mengatur rpm mesin awal mesin dihidupkan

15. Handle kopling

Digunakan untuk memutuskan dan menghubungkan transmisi putaran mesin pemotong rumput dorong.

16. Handle rem

Digunakan untuk menghambat putaran roda mesin pemotong rumput dorong.

2.4 Mower Benefits

The process of harvesting rice in order to obtain rice yields requires a long process, from preparing the land, seeding, planting, maintenance then harvesting and milling processes. If this is not done properly, it can affect the reduction of both Results and quality of production. Rice harvesting in this description is all the process of activities carried out in the field (on farm). Rice harvesting begins with cutting the

old rice grains from the tree trunk, then threshing is done by releasing the grains from the panicle. Especially in the application of technology in agriculture, namely rice harvesting machines. The need for a mini portable rice cutting tool is needed by rice field farmers, this tool is designed and has been done in previous research. In some aspects this rice cutting machine works well where tools that can be operated directly by farmers have been designed before (Efendi, 2021).

The development of rice harvesting machine technology has undergone development, large-scale cutting machines have begun to be applied in farmers' fields, nowadays tools and rice harvesting machines with modern technology have developed. So that the development of technology in agriculture, especially in the field of rice harvesting, is very helpful for farmers. There are several modern technology harvesting machines that are commonly known by the people and farmers of Indonesia. If the ordinary sickle or serrated sickle is referred to as an agricultural tool, then the type of rice harvesting technology in the form of a sickle machine (mower) can be called an agricultural machine, because the driving force is a 2-stroke gasoline engine (engine) 2 HP 6000 rpm, fueled by mixed gasoline. The sickle mower is a modification of a similar machine produced in China. Works similar to a grass cutter to cut stands of rice plants in the field when harvest arrives with a work capacity of 18 to 20 hours per hectare (Efendi, 2021).

Harvesting tools and machinery consist of many kinds and types, which are classified according to the type of crop and driving force, as well as according to traditional and semi-mechanized to modern methods. According to the type of plant, harvesting tools and machinery are classified for Results crops in the form of grains, sugar cane, grasses, cotton and tubers. Mean while, for Results crops in the form of grains are divided into types for rice, corn, beans. However, because it is tailored to the needs. Designing a mower machine can further improve performance (Sumardi, 2020).

3. METHODOLOGY

5.1 Time and Place

Mower Tractor Practicum was held on Sunday, October 30, 2022 at 07.00 WITA until completion, located at the Experimental Farm, Agricultural Engineering Programme, Department of Agricultural Technology, Faculty of Agriculture, Hasanuddin University, Makassar.

5.2 Tools and Materials

The tools used in this Mower practicum are mowers, rope ties and cellphone cameras.

The materials used in the Mower practicum are fuel (gasoline), oil and a piece of grassy land..

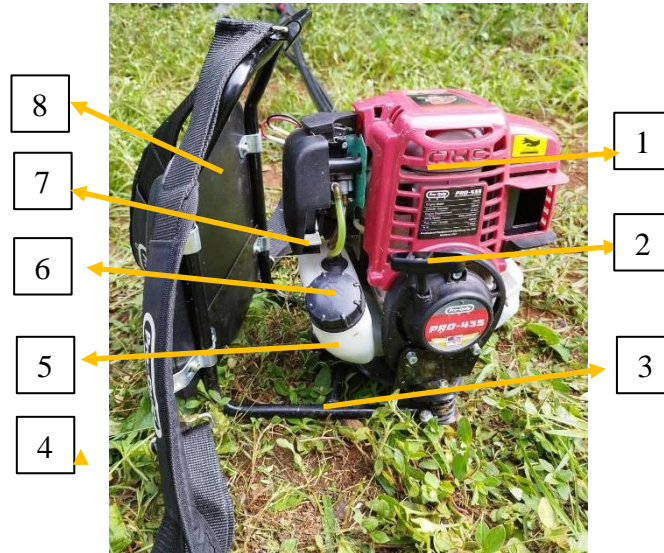
5.3 Practicum Procedure

The working procedures of the Mower practicum are:

1. Mengisi bahan bakar.
2. Menekan tombol on/off ke posisi on
3. Menaikkan tuas chock.
4. Menyalakan stater mower dengan cara menarik tuas penyalaan.
5. Menurunkan tuas chock.
6. Menggendong mower di punggung dan memposisikan bagian pemotong dengan benar.
7. Menekan pengunci gas dan gas secara bersamaan agar putaran pisau stabil.
8. Mengarahkan mower pada rumput yang akan di potong.
9. Mematikan mower dengan menekan tombol off.
10. Mendokumentasikan praktikum

4. RESULTS AND DISCUSSION

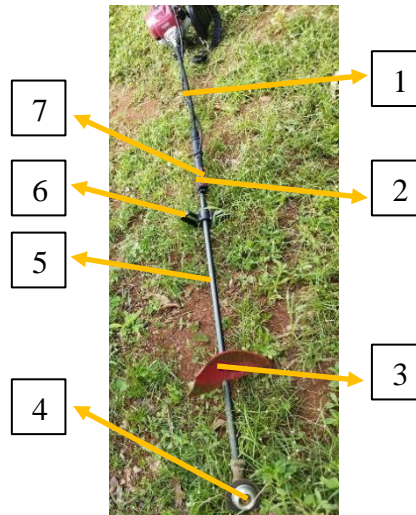
4.1 Results



Gambar 6-4. Mower side view

Tabel 6-1. Side view of mower parts and functions

No.	Part name	Function
1.	Engine	Source of mower power.
2.	Stater	Mower electrical source.
3.	Holder	The seat of the mower.
4.	Carrying belt	To carry the mower.
5.	Fuel Tank	As a fuel reservoir.
6.	Fuel Tank Cap	To close the fuel tank.
7.	Chock lever	Regulates the amount of fuel entering the carburetor.
8.	Backrest	As a backrest when carrying the mower.



Gambar 6-5. 4.3 Mower cutter parts

Tabel 6-2. Mower parts and functions

No.	Part name	Function
1.	Flexible Shaft	Transmits rotary motion.
2.	On/off button	Turns the mower on and off.
3.	Guard	Protects the operator from grass clippings.
4.	Gear System and Blade Lock	As a place to install the blade that will be used.
5.	Stick	As a place to attach mower components.
6.	Handle	As a hand grip when you want to control the stick.
7.	Gas Lever	To adjust the rotational speed of the mower.

4.2 Discussion

Mowers include tools used to cut grass and other plants that do not have hard stems. Mower has parts that are very important in supporting performance in the operation of the mower. If one of the mower components is damaged, it will interfere with the performance of the tool and even unable to operate, such as the sharpness of the blade used will affect the cutting results of the plant. This is in accordance with the statement of Kahar (2018), that the mower engine has a rotating speed and the sharpness of the blade will greatly affect the quality of the cutting results.

Mowers have parts that are in accordance with their functions and uses such as protectors that function to protect users from grass that is thrown while operating the mower. In addition, the mower engine also has a backrest on the Tool Parts which functions as a part that provides comfort when using or operating the mower

engine. The mower also has a gas part that functions to regulate the fast or slow rotation of the mower blade and other parts that support each other in the operation of the mower. Mower machines are very helpful in jobs such as weeding and harvesting rice and corn because they are easy and fast tools in doing this. This is in accordance with the statement of Yanto et al. (2020), which states that lawn mowers are in great demand by some people because according to their function this lawn mower can facilitate human work quickly.

5. CLOSURE

Based on the practicum that has been carried out, it is concluded that a mower is a tool and machine specifically used to cut grass or plants, whose working principle relies on the rotation of a gasoline motor engine which is channeled through a flexible shaft which then rotates the blade or rope on the rotating shaft, so that it can cut plants quickly. Mowers can also be used for harvesting such as rice, corn, elephant grass and so on according to the modification of the mower designed and created.

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APPENDIX

APPENDIX 6-1. Mower Practicum Documentation.



Gambar 6-6. Mower practicum documentation

1. INTRODUCTION

1.1 Background

The rapid development of technology including in agriculture, the tools used mostly no longer use manual tools but have been assisted by machines. Likewise with sprayer machines that are no longer done manually because nowadays sprayers have been made combined with machines. There are two types of sprayers that are commonly used, namely knapsack sprayers or sprayers that are used by carrying the tool on the back which has the function of breaking the liquid in the water storage tank or pesticide liquid.

Sprayers are important for eradicating and controlling pests and plant diseases, with a relatively short time and the energy required is not too large either. The sprayer is used to break the liquid or active chemical solution to eradicate pests and plant diseases into small liquid granules resembling dew and spray the liquid evenly over the protected object. Result indicators are determined by proper application techniques, use of spray equipment and knowing the solution that must be given to plants. Carry-type sprayers are the most popular sprayers and are used by lower-class farmers, because carry-type sprayers have relatively low prices so that they are affordable for lower-class farmers and easy maintenance because they still use simple technology, in knapsack sprayers and other types of sprayers have several parts that need to be known in the sprayer or knapsack sprayer, including a nozzle that functions to break the liquid into particles.

Based on the description above, it is necessary to conduct a Sprayer practicum so that students can know the parts of the sprayer, the types of sprayers and their differences, and know the working principle of the sprayer so that students can easily operate it in spraying and exterminating pests and plant diseases.

1.2 Purpose and usefulness

The purpose of the Sprayer practicum is to know the parts of each sprayer and their functions and to understand the working principle of the sprayer.

The usefulness of the Sprayer practicum is that students can operate the sprayer and apply it in everyday life, especially in agriculture.

2. LITERATURE REVIEW

2.1 Sprayer

A sprayer is a tool or machine that has the function to break down a solution or liquid into droplets or spray. Sprayer is a tool used to apply pesticides which are needed in order to control and eradicate plant diseases and pests in plants. The performance of the sprayer is determined by the suitability of the size of the liquid droplets that can be released in by the tool with a certain unit of time and in accordance with the provisions of the use of pesticide doses to be sprayed on plants. Sprayers are commonly used in applying several active chemicals to eradicate pests and diseases dissolved in water to spray objects such as leaves, stalks and fruits and other pest and disease spray targets. The efficiency and effectiveness of this sprayer is largely determined by the quality and quantity of active chemicals used in the application of pesticides as well as the content in each grain of spray solution (droplet) attached to the object and target of spraying pests and diseases in plants (Diin, 2018).

2.2 Types of Sprayers

In agriculture, three types of sprayers are known, namely knapsack sprayers, motor sprayers and CDA sprayers. The functions of each of these sprayers according to Diin (2018), are as follows:

1. Knapsack sprayer

Knapsack sprayer is the most commonly used tool among farmers both in rice fields and plantations. The working principle of this knapsack sprayer is that the solution comes out of the holding tank due to the air pressure generated from the pump power by the up and down movement of the pump handle driven by the person using the tool. The up and down movement of the pump handle causes the pressure in the tube to increase, forcing the solution out of the holding tank into the air tube which then the chemical or pesticide solution in the holding tank comes out through the valve and goes to the nozzle and is directed to the target object. The air pressure generated by the sprayer pump must be kept constant so that the pesticide solution is given to the plant according to the needs of the plant, to keep the pump

pressure stable, the pumping is carried out every time two steps, the pump must be moved once up and once down. The tank capacity of the knapsack sprayer varies and ranges from 13, 15, 18 and 20 liters depending on the type of sprayer.

2. Motor Sprayer

This type of motor sprayer uses an engine as its driving force to remove the liquid in the holding tank. The method of operation of this sprayer varies according to the brand and type, including those pulled by a vehicle, carried and placed on the ground. The advantage of using this type of motor sprayer is that the capacity is very wide so that the time used is relatively short, can penetrate the target weeds even though the plants that are given pesticides are very dense and less labor. There are also disadvantages of this sprayer, namely the price is relatively expensive because it uses the engine as its driving force and the cost of operation and maintenance is also expensive, it is not recommended for small and young plants because it is feared that drift can damage the plant because the solution coming out of the tank has a high speed so this tool is recommended for use in plants that have been planted for a long time, and the motor sprayer must be maintained regularly.

3. CDA *sprayer*

Controlled Droplet Application (CDA) sprayer is a sprayer that is different from knapsack sprayer and motor sprayer, this CDA sprayer does not use air pressure to release the solution in the tank but based on gravity and disk rotation. The way it works is that the solution flows from the tank through the hose to the nozzle, is received by the rotation of the serrated disk (spining disc) and is spread towards the target field of spraying pests and diseases on the target plant.

2.3 Sprayer Application Efficiency

Sprayer is a pesticide applicator tool that is indispensable in the context of eradicating and controlling pests and plant diseases. Pesticides that are applied do not all reach the target, but some will be lost during application. Pesticides that are lost before reaching the target are called drift. Based on the size of the lost particles, drift can be divided into two types, namely endodrift or exodrift. Endodrift consists of large particles that immediately fall to the ground due to gravity. Exodrift consists of fine particles that move away from the target because they are carried by the wind or evaporate before reaching the target. The amount of drift in pesticide

applications using sprayers is often quite large. If the application is done in an inappropriate way and time, the amount of drift will be even greater, reaching 50 percent or more. The amount of drift is influenced by many factors, namely spraying pressure, particle or droplet size, specific gravity, nozzle design, evaporation rate, distance between the nozzle and the target field, horizontal and vertical air movement, temperature and humidity (Lukito et al., 2010).

Factors that affect the efficiency of using a sprayer for spraying pests and diseases on plants according to Lukito et al (2010), are as follows:

1. Pressure

Droplet size is affected by pressure, but the folding configuration is much more affected by pressure. The greater the pressure, the smaller the droplet size and thus the better the folding. But the more sensitive to the influence of wind, the more drift will occur, by reducing the pressure, the larger the droplet size, thereby improving drift control. However, the folding configuration will be reduced. The pressure must be adjusted and kept constant so that it is neither too large nor too small to obtain the best results (even coverage and little drift). In order to achieve this, insecticide and fungicide applications require relatively high pressure (minimum 4 atmospheres). While herbicide applications require lower pressure (maximum 2 atmospheres) in order to avoid herbicide fog that can poison the main crop or the main part of the crop.

2. *Nozzle*

In drift control, nozzle is more important than pressure. This is because the nozzle helps control dosage, droplet size uniformity, evenness and safety of pesticide application. Nozzles should be selected that are suitable for the needs, can be installed properly, and maintained.

3. Performance

The nozzle is the key to total system performance in most sprayer systems. Factors to consider in nozzle selection are nozzle type, nozzle size, nozzle condition, nozzle position on the support, and distance between nozzles on the support (for sprayers using multiple nozzles). Coarse spray droplets reach the target field faster and drift less than fine spray droplets. However, the number of droplets

per unit area of coarse droplets will be less so that the coverage is less even when compared to fine spray droplets.

4. Distance between nozzle and target plane

A long distance between the nozzle and the target plane can expand the field of coverage. But too much distance can increase drift, and the distance between droplets becomes looser. Therefore, to make pesticide application more effective and efficient, the applicator must determine the balance between nozzle size, pressure, distance between nozzles, and target. If the pressure is increased, the speed at which the spray liquid is released will also increase. In order to keep the dosage constant the nozzle size must be lowered.

5. Horizontal and vertical air movement

If conditions are calm (weak wind), pesticide application is normal. However, field conditions can change at any time. Weather conditions can directly affect the direction, pesticide demand and drift distance. Warm weather conditions can increase thermal airflow, which can lift small spray particles above the target area. Horizontal air movement can also carry spray droplets to a certain distance from the target field. Therefore, spraying in the middle of the day should be avoided, so as not to be burned by sunlight and there is not much drift.

6. Temperature and humidity

The evaporation rate of droplets is determined by temperature and humidity. If the droplet diameter decreases, the ratio of surface area to volume increases and the evaporation rate is faster. The length of time for drift through evaporation increases with decreasing droplet size. Since the fall of the droplet to the target plane is slower.

2.4 Parts Sprayer

The use of sprayers that generally use gasoline motors or batteries as a power source, will further increase the operational and maintenance costs which are relatively higher, in contrast to knapsack sprayers which have relatively cheaper parts. Sprayers that use motors have the advantage over knapsack sprayers that the operator no longer pumps the sprayer because the pumping process is carried out by the motor. Parts of knapsack sprayers and motorized sprayers almost have the same parts and components that have their respective functions and uses according

to the type and type of sprayer. For example, parts such as nozzle, carrying strap, tank, stick, tank cap, engine, starter and so on.

3. METHODOLOGY

3.1 Time and Place

Sprayer practicum was held on Sunday, November 06, 2022 at 07.00 WITA until completion, located at the Experimental Farm, Agricultural Engineering Programme, Department of Agricultural Technology, Faculty of Agriculture, Hasanuddin University, Makassar.

3.2 Tools and Materials

Adapun alat yang digunakan pada praktikum Sprayer yaitu knapsack sprayer, motor sprayer dan kamera handphone.

Bahan yang digunakan dalam praktikum Sprayer adalah bahan bakar (bensin), oli dan air.

3.3 Practicum Procedure

The working procedures of the Sprayer practicum are:

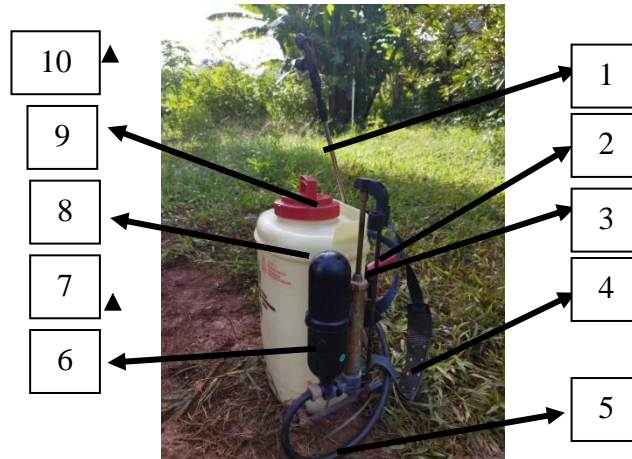
- A. Knapsack sprayer working procedure.
 1. Prepare knapsack sprayer and water.
 2. Filling water into the knapsack sprayer tank.
 3. Lifting and carrying the sprayer on the back.
 4. Pumping the sprayer by pumping the pump lever 8 times.
 5. Directing the stick nozzle at the plant.
 6. Pressing the liquid dispensing lever on the handle.
 7. Documenting the practicum.
- B. Working procedure of motor sprayer.
 1. Prepare the motor sprayer and water.
 2. Filling water into the sprayer motor tank.
 3. Turning up the gas on the engine.
 4. Starting the engine by pulling the starter.
 5. Lifting and carrying the sprayer on the back.
 6. Aiming the stick nozzle at the spraying target.

7. Adjusting the liquid output speed by using the regulator tap.
8. Opening the dispensing faucet on the stick
9. Documenting the practicum

4. RESULTS AND DISCUSSION

4.1 Results

a. Knapsack Sprayer Parts



Gambar 7-1. Knapsack Sprayer Parts

Tabel 7-1. Function of knapsack sprayer parts

No.	Part name	Function
1.	Stik	Attachment of spring and nozzle.
3.	Spray spring	Spraying regulator on the nozzle.
2.	Pumping stick	To pump the sprayer.
4.	Carrying belt	To carry the tool on the operator's shoulder.
5.	Hose	As a liquid channel from the tank to the nozzle.
6.	Hydraulic tube	To store the wind from the hydraulic lever.
7.	Hydraulic pump	Pressing air to drain the liquid.
8.	Liquid tank	To collect the liquid.
9.	Tank lid	Closing the liquid tank to prevent spillage.
10.	Nozzle	Convert liquid into particles.

b. Sprayer motor side view.

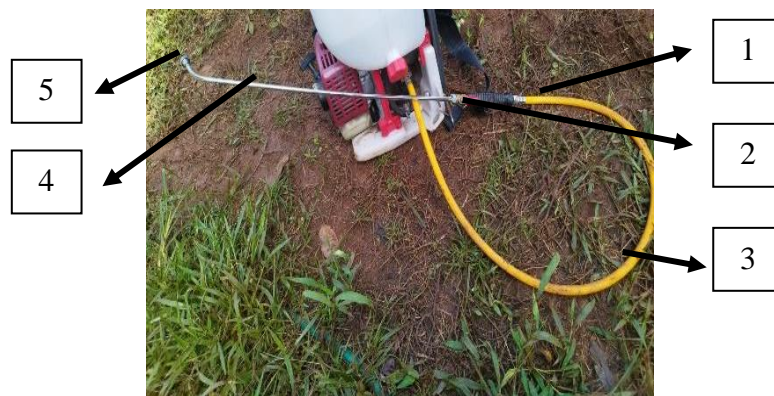


Gambar 7-2. Side view of sprayer motor.

Tabel 7-2. Functions of sprayer motor parts side view

No.	Part name	Function
1.	Gasoline motor	As a source of sprayer pumping power.
2.	Starter	To start the engine.
3.	Fuel tank	To store gasoline motor fuel.
4.	Off button	To turn off the engine.
5.	Gas lever	Regulate the high and low speed of the motor.
6.	Belt	Carrying the engine.
7.	Liquid tank	As a place to hold liquid.
8.	Close the liquid tank.	To close the tank so that the liquid does not spill and maintain air pressure during the pumping process.

c. Sprayer motor sprayer parts.



Gambar 7-3. Sprayer part of sprayer motor

Tabel 7-3. Function of sprayer motor spraying part

No.	Part name	Function
1.	Dispensing channel	As a liquid dispensing channel.
2.	Faucet	Regulates the liquid output of the nozzle.
3.	Rubber hose	Channeling liquid from the tank to the faucet then to the nozzle.
4.	Stick nozzle	Channeling liquid from the rubber hose to the nozzle.
5.	Nozzle	Spraying and breaking the liquid into fine grain particles.

4.2 Discussion

Based on the sprayer practicum that has been carried out, parts are obtained. The tools used are knapsack sprayers and motor sprayers, which have an agricultural tool that can be used to eradicate pests and diseases in plants using chemical liquids that can increase the productivity of agricultural results. The type of sprayer used can be used on all types of plants. The working principle of this sprayer is that the solution in the tank will be pumped to the pump unit and will cause the air to increase in the tube, which then breaks the solution into particles and comes out through the nozzle. This is in accordance with the statement of Diin (2018), which states that an atomizer is a device or machine that has a function to break down a solution or liquid into liquid droplets or spray.

Based on the results obtained, it can be seen that there are parts of the sprayer tool used which are components or arrangement of the sprayer manufacturing contract itself, which are designed and used according to their respective functions. The difference between these two tools is the pressure on the sprayer, where the knapsack sprayer uses a manual pump and the motor sprayer uses an engine to create pressure.

5. CLOSURE

Based on the practicum that has been carried out, it can be concluded that the sprayer includes agricultural tools and machines that are used specifically for spraying, one of which is to spray cultivated plants and eradicate pests and diseases in plants, knapsack sprayers and motor sprayers are two tools that have almost the same working principle, namely by using air pressure to release liquid to the nozzle, the difference between these two tools is in the air pressure results, where the knapsack sprayer uses a manual pump and the motor sprayer uses an engine.

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APPENDIX

APPENDIX 7-1. Sprayer Practicum Documentation.



Gambar 7-4. Sprayer practicum documentation

DRONE SPRAYER

1.1 History of Drones

The design of unmanned aircraft or commonly referred to as drones has been planned since 1849 which is used for military purposes. The design of the drone was first initiated by the Austrian State to fly balloons containing explosives to destroy the city of Venice in Italy. The use of these simple drones is still a lot off target and caught in the wind. It can be said that the use of this simple drone can be said to have no results and raises the desire to create an unmanned aircraft that is easier to use.

Santos-Dumont in 1899 and Zeppelin 1900-1909, as well as those that can be controlled remotely by Otto Lilienthal 1890-1896 which continued to be developed rapidly during World War I and II (Mohammad et al., 2021).

Some of the designations of unmanned vehicles or aircraft throughout history are; UAV (Unmanned Aerial Vehicle), RPV (Remotely Piloted Vehicle), UCAV (Uninhabited Combat Aerial Vehicle), UCAV / S (Uhinhabited Combat Aircraft Vehicles / System), RPA (Remotely Piloted Aircraft), RPH (Remotely Piloted Helicopter), Aerial Robotics, MAV (Micro Aerial Vehicle) and Drone. Along with technological developments, drones have now developed in terms of use where the initial use of drones was used for military purposes, now it has begun to be used in various things such as business, industry and logistics. Some of the current uses of drones are monitoring physical infrastructure (factories, ports and power grids), package delivery, firefighting in forest areas, exploration to find mine sites, mapping agricultural areas, mapping forest areas and mapping industrial areas (Mohammad et al., 2021).

1.2 Definition of Drones

A drone is an aircraft without a pilot, where the aircraft is controlled automatically through a computer program that can be connected to a remote control or smartphone with iOS and Android platforms and is equipped with two cameras located in front of the fuselage and under the fuselage. The development of technology makes drones also begin to be widely applied for civilian needs,

especially in the fields of business, industry and logistics. In the business industry, drones have been applied in various services such as infrastructure monitoring, package delivery, forest firefighting, mining exploration, mapping of agricultural areas and industrial areas (Hidayat et al., 2019).

1.3 Drone Sprayer

Agri drones are an innovation used for more precise application of pesticides, liquid fertilizers and watering so as to avoid excessive use of fertilizers and pesticides. Drone sprayers are "unmanned" aircraft that function to spray pesticides in the process of eradicating plant pest organisms. The drone is able to work independently according to the desired pattern. The pattern is created using an android device and guided by GPS. The technical specifications are the carrying capacity of up to 20 liters, 1 hectare of land can be sprayed within 10 minutes with a spray speed of 3 km / hour and a height of 1.5-2 meters from the ground, a working width of 4 meters so that it results in a working capacity of 1.2 Ha / Hour. The spraying dose can be adjusted as needed by adjusting the spraying faucet opening. Supported by surveillance drones, land mapping can also be done. From the results of mapping in the form of photos and videos, farmers can find out the condition of the plants on their land (Rika, 2020).



Gambar 8-1. Drone sprayer
(Source: Khoirunisa dan Fitrianingrum, 2019)

1.4 Working Principle of Drone Sprayer

Spraying organic fertilizer using unmanned aircraft can provide benefits, especially in time efficiency and minimizing negative impacts on the health of farmers. Unmanned aircraft controlled by remote control is an effective and efficient step. The working principle of the drone sprayer is to spray pesticides at a distance of 1.5-2 meters above the ground with a remote control system (Muji et al., 2021).

1.5 Benefits of Drones in Agriculture

According to Rika (2020), there are many uses of drones that have currently developed, ranging from use in the industrial sector, forest mapping to utilization in agriculture. Some of the benefits of drones in agriculture are:

a. Drones for Land Mapping

Drones or Unmanned Aerial Vehicles (UAV) are a development of technology in the field of mapping where the use of unmanned aircraft in aerial photography is utilized with GIS technology to map a land. Drones usually use four driving motors. The use of drones in mapping is usually used for plantation mapping projects, mapping rice fields, calculating palm trees, mapping project areas, mapping settlements or cities. The advantages of drones for mapping are to get an image of the latest appearance, low cost for mapping small areas compared to high-resolution images, efficient in time because shooting can be immediately seen Results. Drones are very effective for mapping with an area category of 0-350 ha with a maximum flight height of 200 meters can produce high-resolution images with object size (cm). Mapping using drones for one flight is approximately 20-50 ha, for 15-25 minutes per flight.

b. Siscrop 1.0

The Ministry of Agriculture has made use of radar or SAR data from the Sentinel 1 satellite. This data is then processed into a standing crop information system to monitor rice plants called Siscrop 1.0. Siscrop 1.0 is a system that can provide information and data on the factual condition of rice plants and other plants on agricultural land. The development of the Siscrop 1.0 model is based on remote sensing, which is the result of collaboration between the Ministry of Agriculture, the National Institute of Aeronautics and Space (LAPAN) and other related ministries and universities. The advantage of Sentinel 1 is that it uses radar data so that it can penetrate clouds and can be used to monitor planting area, harvest area, productivity, and cropping index in real time. Siscrop information can be used for technical purposes such as anticipation and appropriate cultivation actions according to crop conditions. Policy makers can determine the amount and distribution of fertilizers, seeds, pesticides and water. Siscrop 1.0 helps policy makers and technical officers in the field to carry out fertilizer, pesticide and water

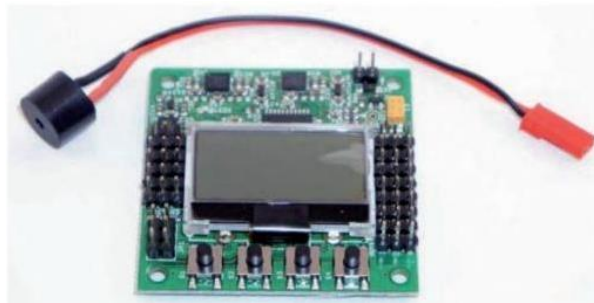
efficiency, help farmers to determine the most appropriate type of crop to be planted in a particular area because it can be informed spatially, mobilize alsintan and help the government to identify areas that are surplus so that they can help areas that are minus.

1.6 Drone Components

According to Beginer et al. (2018), there are several drone components, namely:

a. Flight Cotrol Board (FCB)

Flight control board (FCB) is the main part of a quadcopter drone that functions to stabilize the aircraft. Some of the features that FCB carries are usually like gyro, GPS, Acceleometer, Magnetometer and so on. The gyro feature is used so that the aircraft can hold the position at a certain height that we want, we can use the GPS feature to set the aircraft to fly in a certain position..



Gambar 8-2. Flight Cotrol Board (FCB)
(Source: Beginer dkk., 2018).

b. Frame

There are many types of quadcopter frames, ranging from wood, aluminum and carbon fiber. The shape also varies from tricopter, quadcopter, or hexacopter. The things that need to be considered in choosing a frame are the number of motors used and the weight of the frame material and the precise shape of the frame.

c. Motor

The motor is the part that drives the propeller. This motor is usually available in motor dimensions and power in units of kv or rpm/v. Motor selection is adjusted to the propeller and ESC used. Note that the greater the power unit, the greater the power required.

d. Electronic Speed Control (ESC)



Gambar 8-3. Electronic Speed Control (ESC)
(Source: Beginner dkk., 2018).

This part is quite important in regulating the speed of each motor. ESC will usually automatically adjust the speed or current to each motor, simply put, when the position of the aircraft is tilted, the ESC will automatically send or make one or more motors spin faster in order to maintain the balance of the aircraft. In a quadcopter, 4 ESCs are required according to the number of motors.

e. Propeller

In a quadcopter there are two propellers that are made to rotate clockwise, and two more rotate counterclockwise. Propeller selection emphasizes on size, material, and precise shape. This will affect the balance of flight. Propeller size usually states length x pitch, for example for a quadcopter size 250 usually uses a 50x30 propeller. Commonly used materials include nylon, composite, and carbon fiber.

f. Battery and charger

The next component is the power source, the battery. The commonly used battery is the Lithium Polymer (LiPo) type, and for use in multicopters usually uses a softpack type of packaging to minimize the load. What is needed in battery selection is based on the number of cells and their capacity, and adjusted to the power required by the motor and ESC that will be used together. Battery chargers have many choices with various features, for example, some are equipped with a feature to charge several batteries at once or some can do balance charging. Using a good charger, with good charging techniques can make the battery life longer.

g. Remote Control

The thing to consider in choosing a quadcopter remote is the number of channels that can be controlled by the radio transmitter. A quadcopter needs at least 4 channels to control throttle, yaw, pitch and roll. Additional channels can be used

for other purposes, such as changing the flight mode, or moving the gimbal to take aerial photos or videos.

h. Camera and stabilizer

The camera is one component that has benefits for unmanned aircraft, namely as a reconnaissance and to take pictures and videos. Meanwhile, the camera gimbal has a function to adjust the camera's motion and stabilize the camera in taking pictures.

1.7 Advantages and Disadvantages of Drones

Drones are defined as aircraft without a pilot or crew. It is controlled automatically through a designed computer program or through remote control by a pilot. Drones have been developed and utilized in various fields such as agriculture. The functions of drones are controlling crop quality, spraying crops, planting seeds, monitoring land security, fertilizing crops and monitoring soil quality. Drone sprayer is one of the tools that has been innovated in agriculture which is used to apply fertilizer to plants on a large area of land (Simatupang et al., 2021).

According to Simatupang et al. (2021), drone sprayers have advantages and disadvantages, including the following:

- a. The advantages of drone sprayers are reducing costs used in agriculture, work can be done remotely, work is faster, reducing the danger of pesticide liquids, reducing the number of workers, reducing the risk of pesticide and fertilizer poisoning, spraying pesticides can be more evenly distributed.
- b. The disadvantages of drone sprayers are dependence on weather, higher initial investment costs, need special skills for repairs and need training if there is a malfunction.

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