



KEMENTERIAN PENGAJIAN TINGGI



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WHEEL SPRAYER

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DIPLOMA IN MECHANICAL ENGINEERING

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DECLARATION OF ORIGINAL WORK AND INTELLECTUAL PROPERTIES

TITLE: WHEEL SPRAYER

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2. I acknowledge that the 'Wheel sprayer' and its intellectual property are the original work/copy of our work without taking or imitating any intellectual property from others.

3. I agree to give up the intellectual property ownership of 'Wheel sprayer' to the Polytechnic in order to meet the requirements for awarding us Diploma in Mechanical Engineering.

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At 21/6/2021, on 10.00PM)

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(LECTURER IC))

as the project supervisor on the date:)

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Finally, we want to define our sense of recognition to everyone who is directly or indirectly involved in this project.

ABSTRACT

The project applied the use of observation based on the manual method currently used using poisoning of various pests. The objective of this project is to design a device that is capable of producing a more effective pesticide sprayer for use in small or rural industries in the agricultural sector. Additionally, there are several research scopes that have been defined in this project, producing and developing ergonomic wheel sprayers. To reduce spraying time in vegetable gardens or orchards and to increase spraying efficiency as it contains more than one nozzle during spraying. All these are set to solve some of the problems that arise with the use of existing methods among which, the existing sprays cannot be effective and require additional time for spraying. The material for this project also requires special properties that do not rust and do not affect plants, based on the literature review conducted stainless steel is the most suitable for this project. While for the component formation process, the research methodology is used for the project production process by using flow charts as a guide to plan the production and testing of the project. As a result, the whole project was successfully produced with the additional rate of time saving of traditional methods. Based on these results, the results of analysis and discussions conducted, it can be concluded that this sprayer wheel has achieved the objectives discussed. In addition, this tool is also proven to be able to save time differently the traditional way.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Farmers use the same methods and equipment to plant seeds, spraying pesticides. The method used by gardeners perform the process of spraying pesticides and herbicides. Gardeners need to cover their gardens with pesticides and pesticides to ensure that no shrubs grow and are used free of insects, caterpillars, and other pests. While gardeners will use a Knapsack manual sprayer to spray their garden, this may take a long time to finish spraying their garden. In addition, this manual Knapsack sprayer uses only one nozzle.

There is a need for the development of effective spraying and weeding machines to increase productivity. Small farmers are particularly interested in manually operated backpack sprayers because of their flexibility, cost, and design. With a wheel spray pump combined with wheels and easier to move makes the working system very easy. This one trolley system by using this we can reduce the maximum effort required to spray pesticides as well as we can spray pesticides in any direction or around the plant at crop height. This paper shows a model of a wheeled spray pump that will perform spraying at the maximum rate in the minimum time.[1]

1.2 RESEARCH BACKGROUND

There many types of sprayers have been invented since 1947, by Ray Hagie, the founder of Hagie Manufacturing. Automatic sprayers and sprayer motors are used by large agricultural industries to perform many spraying activities on their farms. Unlike small industries or vegetable gardens, they are accustomed to using manual Knap sack sprayers. Through this research, to transform a manual backpack sprayer into a mechanical sprayer will require more rewarding and faster working time to all gardeners working in small industries.[2]

Sprayer is well known by all people in nowadays. There is various type of sprayer that have been invented until 2021 such as Plastic Knapsack Sprayer, Pressure Water Sprayer, Ogawa sprayer, Shizuka Sprayer, 2L Pressure Sprayer and Typical Garden Sprayer. These sprayers usually used by gardeners and small farming industries to spray pesticide or to watering their plants in farms and gardens.

Finally, this study also allows other researchers to conduct further research that is more focused to help gardeners in Malaysia and other countries to do their best in spraying activities in the garden.

1.3 PROBLEM STATEMENT:

- Existed spray is unable to spray effectively and need extra time for spraying.
- Prolonged use has detrimental effect on the body of the user because the sprayer is heavy and may causes back pain if used in a long time.

1.4 RESEARCH GAP:

- Wheel sprayer`s nozzle has one nozzle holder to spraying plants.
- Make a good functional product

1.5 OBJECTIVE:

- To design and develop an ergonomic wheel sprayer.
- To reduce the spraying time in the vegetables garden or fruit garden
- To increase efficiency on spraying because it contains more than one nozzle During the spraying process.

1.6 SIGNIFICANCE OF STUDY:

- Making it easier for farmers to do work easily and ergonomically.
- Saves spraying time in large areas.

1.7 SCOPE:

- Limited to small scale garden areas in the range of 800m²
- To be Used by small industries such as the small medium enterprise (SME)

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Normal Pesticide sprayer need more time complete the pesticide spraying. For wheel sprayer, it can speed up the spraying process to the plants. Applications of wheel sprayer is to make the work more effective, uniformly, and cheaper. This pump is ideal for large fillings of liquids at low pressures.

2.2 THEORY/CONCEPT

Sprayer is a device used to spray moldy liquids against plants, where sprayers are typically used for insecticides, plant performance materials, pest control chemicals, as well as manufacturing and production materials. In agriculture, sprayer is an equipment used to apply herbicides, pesticides, and fertilizers to agricultural crops. Sprayer sizes range from a human portable unit (usually a backpack with a spray gun) to an indoor sprayer connected to a tractor, to a self-propelled unit similar to a tractor. Wheel sprayer is able to speed up the time to spray the plants with a nozzle height of 110 cm. This can help facilitate daily work for gardeners or farmers to complete the work faster [1].

2.3 EXISTING CONCEPTS

Pesticide sprayer is an agricultural tool that is widely used in the agricultural sector. A mechanical poison sprayer works by pumping out poison water. Typically, small farmers use pesticide sprayers because they are cheap, easy to maintain, and high efficiency because they use a very simple working system. While the wheel sprayer uses the wheel and you just need to pushes to spray. Wheel sprayer also reduces the burden on farmers as well as reduces the time to spray pesticides over large areas.

2.3.1 CONCEPT 1

Backpack Sprayer

The principle behind the backpack sprayer is the pressure difference created by hand operated lever. It generally has a single nozzle through which liquid pesticides is forced out in fine droplet form. The Capacity of backpack sprayer is less than 20 liters. The components of backpack sprayer are the tank, piston pump, hose, spraying handle and a nozzle.



Figure 2.1 : Backpack sprayer

ADVANTAGES

The main advantages of the backpack sprayer are can be fit up to 20 liters of water/poison. Besides, the backpack sprayer also low price, convenient maintance and low price of accessories.

DISADVANTAGES

The are several disadvantages of the backpack sprayer. For examples, very heavy to lift and carry also low efficiency. The backpack sprayer also repair rate is high too much trouble.

2.3.2 CONCEPT 2

Ogawa Knapsack Sprayer

Shizuka sprayer can be fill with 20 Liters amount of liquid. It also functions like manual knapsack sprayer but comes with an engine to generate more power.



Figure 2.2 : Ogawa knapsack sprayer

ADVANTAGES

The main advantages of the Ogawa knapsack sprayer are had a high efficiency because have a motor. Also, the Ogawa knapsack sprayer no need to generate a pressure by hand.

DISADVANTAGES

The are several disadvantages of the Ogawa knapsack sprayer. For examples, this sprayer is heavy to carry same like backpack sprayer. Besides, the Ogawa knapsack sprayer also need petrol to generate pump.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

The wheel sprayer can be used on a small scale in the gardens and vegetable farms. Target small scale gardeners to get the best yields for plants to become more fertile and not easily damaged. This can be used in large industries, but larger industries should put more pressure on spraying because of the large field size and usually use machine tools to make the spraying session faster. So, the target consumer is for smaller industries and small gardens. Why choose a smaller industry because usually gardeners will use a heavy manual backpack sprayer and have to lift on their back to do the spraying session, but with this product they only need to push back and forth. In addition, this product can be spray both parts of the border, so the time taken is less than that required by a regular backpack sprayer. Wheel sprayer can make it more ergonomic than a manual backpack sprayer which reduces pain after spraying pesticide on crop.

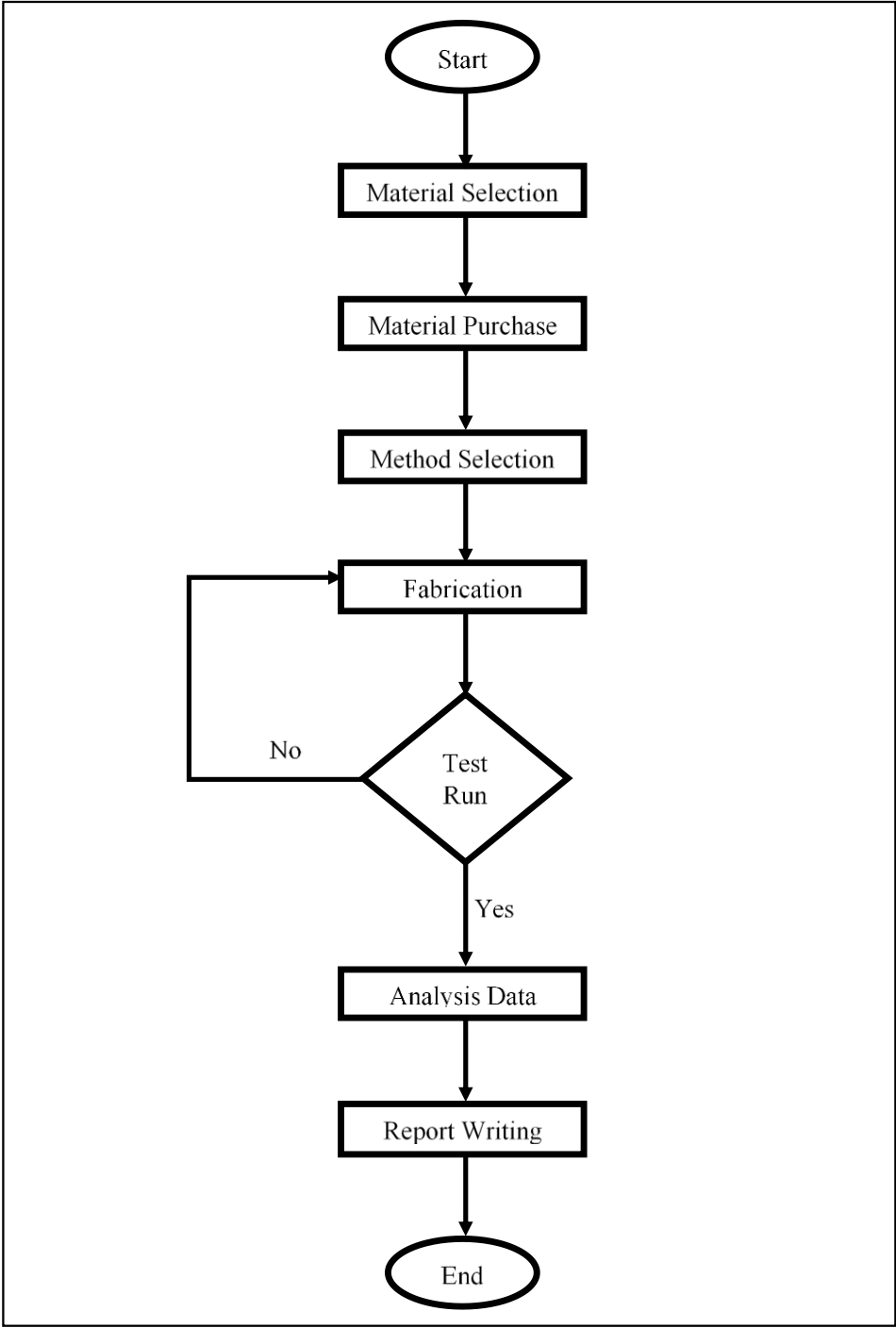


Figure 3.1 Research methodology

3.2 PRODUCT DESIGN

Wheel sprayer is a machine that can spray poison widely but on a small scale. The design made is to design and develop the ergonomic machine. The size is made based on the diagram, which is 168cm long, 110 cm high and 50cm wide. This reciprocating pump uses a single sliding crank mechanism, in which the wheel gears act as a crank. There are two sprockets mounted on two different axles where one sprocket is mounted directly to the wheel axle. The connecting rod is attached to the other sprocket axle via a disc. In this power is given to the reciprocating pump piston through the rotation of the wheel. The connection link is engaged to the piston of the sprayer pump which moves forward and backward to give pump action and increase pressure inside the pump which is further used to spray the pesticide when the valve is opened on the sprayer pipe.

3.2.1 DESIGN 1

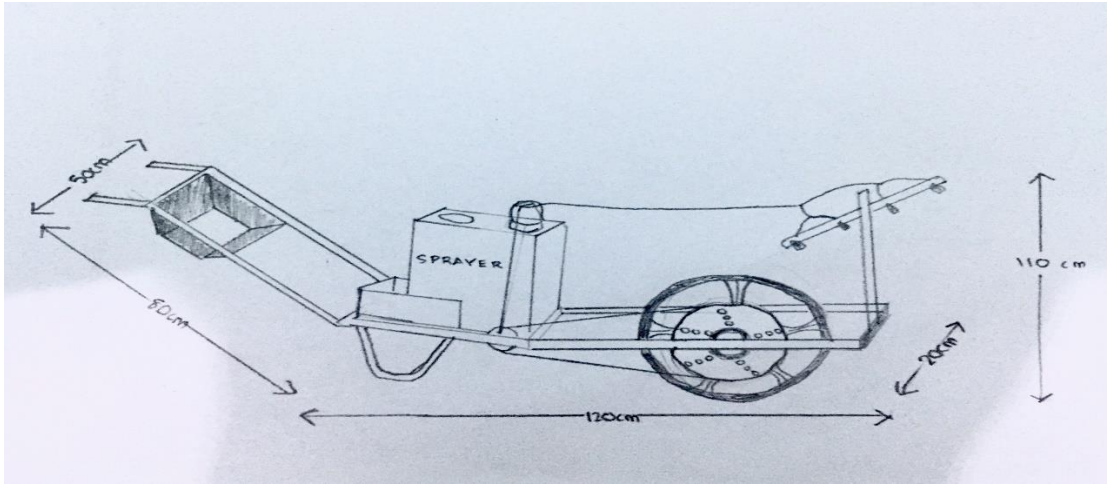


Figure 3.2: Diagram sketch

3.2.2 DESIGN 2

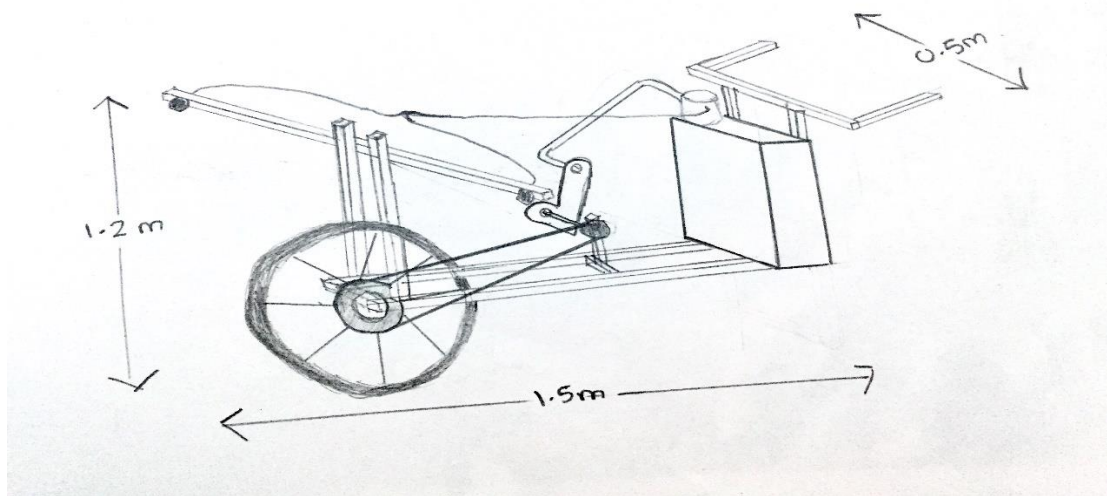


Figure 3.3: Diagram sketch

3.3 MATERIAL SELECTION

3.3.1 Mild Steel

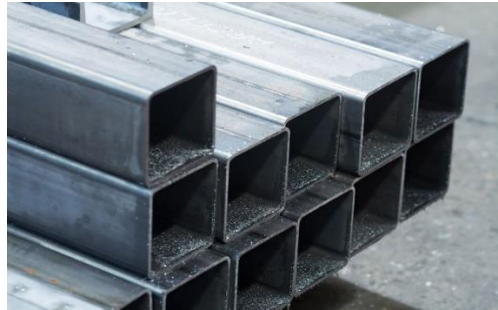


Figure 3.3.1

Figure 3.3.1 above shows a hollow mild steel. Hollow mild steel is used to make frame or body parts. This material was chosen because it is more resistance to corrosion.

3.3.2 Plastic



Figure 3.3.2

Figure 3.3.2 above shows a pesticides tank. Plastic is used to make the pesticides tank. Plastic is typically low densities, whereas their mechanical characteristic is generally dissimilar to metallic and ceramic materials and suitable to be used because plastic will never rust.

3.3.3: Rubber



Figure 3.3.3

Figure 3.3.3 above shows a bicycle tyre. Rubber is used to make a tyre for the project. Tyre is also known as a rebound, the ability of rubber to return to its original size and shape following a temporary deformation. Rubber also not corroded when contact to water. Is this case, rubber is good material to make the product tyre and host.

3.4 Fabrication work



Figure 3.4

Figure 3.4 above shows a MIG welding on mild steel. Lot of fabrication work need to be applied to make sure the project done well and satisfying. The main adhesive agent that has been used are welding, which is MIG welding. Metal inert gas or known as MIG is widely used by fabrication industries. The main reason why MIG is applied to the project is because it is an easy welding process compared to others. Other than that, MIG also produce a good weld surface and clean.

3.5 Power Transmission Part

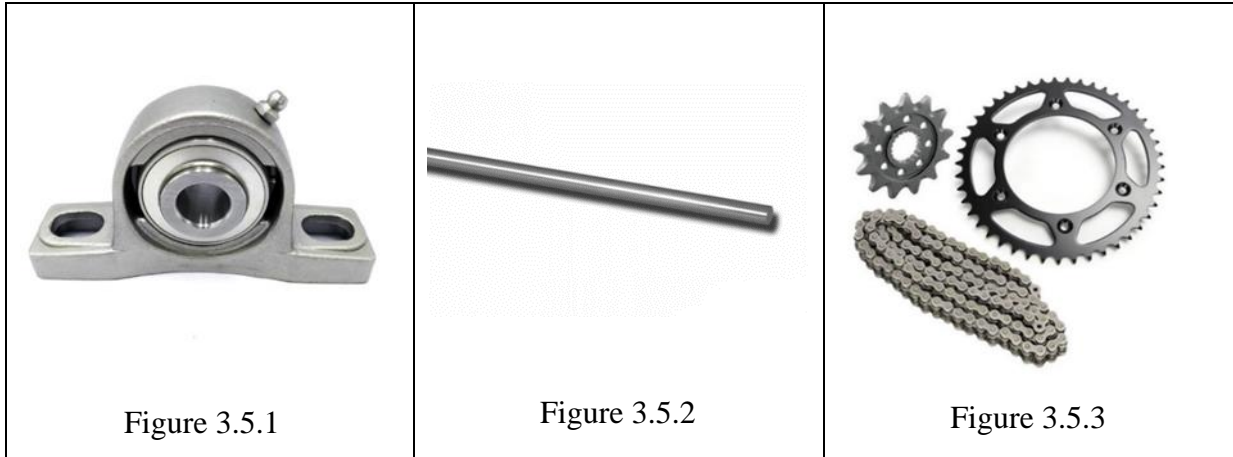


Figure 3.5.1 shows a pillow block bearing. Pillow block bearing is used to provide load support for a rotating shaft. Figure 3.5.2 shows a stainless-steel shaft. Stainless steel shaft is used as a connecting rod to transfer the power to pump. Figure 3.5.3 above shows a set of sprockets. Mechanically power transmission was applied to the Wheel Sprayer to ensure this project is free from any power source from battery or petrol. When there is no use of dry cells and fuel, this project is also environmentally friendly. Things that are combined to make the transmission part are bearings, a set of sprockets and a shaft. So, when the Wheel Sprayer is push forward or backward, this transmission part will make the tank mechanically pump.

3.6 Accessories



Figure 3.6.1

Figure 3.6.1 shows a nozzle. This nozzle has been used to provide ergonomic spraying sessions for gardeners. This material was chosen because it can spray more efficiently. The main advantage of these over other types of misting nozzle is that they can form a fog pattern with very low flow rates and pressures. Then, when it is in low pressure, it causes the chemical to squirt the nozzle quickly.

3.7 Analysis

WHEEL SPRAYER will prove the time of spraying is faster and more efficient compared to the normal type of hand sprayer. Besides, this WHEEL SPRAYER can spray pesticides and herbicides in large quantities because it designed by using 2 nozzles compared to the existing sprayer using only 1 nozzle only. After that, WHEEL SPRAYER also can make the farmers more comfortable when to do the spraying session because farmers just need to pull, and push based on their comfort level and don't need to bend their back.

3.8 PROTOTYPE

The final design was chosen is design 1. This design was chosen because it has a simpler mechanical system compared to design 2. Besides, it provides more ergonomic spraying sessions for gardeners to make sure they do not have to carry the heavy normal pesticide anymore. The handle is design based on range of high of farmers in Malaysia. So, they can hold the handle on their comfort level zone. The design also provided with stand to make sure gardeners can stand the product when they are exhausted while spraying or stand the tank when they are finish spraying.



Figure 3.8.1: Isometric view



Figure 3.8.2: front view

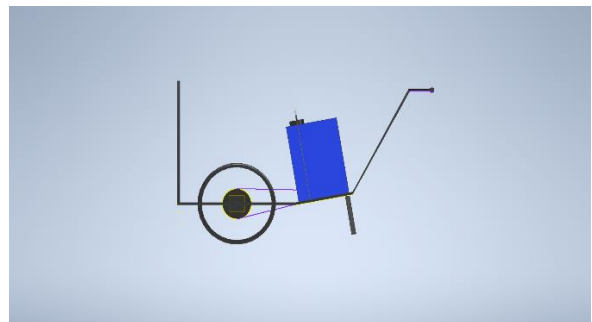


Figure 3.8.3: side view

CHAPTER 4

PRELIMINARY FINDINGS OF THE STUDY

RESULT AND DISCUSSION

4.1 INTRODUCTION

The study focused on gardeners and farmers to spray liquids such as pesticides, herbicides, and water onto their crops. There are so many ways how they spray their crops regularly the most common is by using a manual plastic backpack sprayer. Having studied for this project, found that the objective to create this product has been achieved. First, it reduces the time it takes to spray the poison almost three times faster than a manual backpack sprayer. Next, it also managed to add more efficiency to spraying by using two nozzles on the front of the sprayer. It is more efficient because as the product moves, it will produce pressure to the pump to spray onto the plant.

4.2 FINDINGS/DATA/PRELIMINARY INVESTIGATION OF THE STUDY

Preliminary findings of the study present the results and achievements of the study/project either achieve objectives or otherwise, as well as planning and expectations for completion upcoming studies/projects. The disadvantages and advantages should be stated briefly and right. Here are some things that can be deduced, however depends largely on the type of study/project being carried out requires a detailed description:

4.2.1 EVALUATION

Every gardener or farmer faces the problem of crop control. For prevention, shrubs and trees are treated with a variety of chemicals that help fight harmful insects. Ineffective handling of crops manually, and time consuming. Wheel sprayer are the way out of this situation. It can be used to spray crops with pesticides. Using the wheel sprayer allows the chemical to be sprayed onto the plant surface with a thin layer to control pests. It can also be used to fertilize soil or crops.

4.2.2 ANALYSIS

As a result of the study that has been conducted, it is found that wheel sprayers can solve the problem of workers, time and cost in spraying crops or soil in the garden or farm area. With the use of wheel sprayers, the productivity of the country's crops can be increased. However, early planning is very important to ensure the smooth operation that will be carried out such as farm design planning that should be suitable for use for wheel sprayers.

Lack of dependence on workers is a major target by every farmer entrepreneur or worker. By using a wheel sprayer, only one worker is required for one use of this wheel sprayer. The use of many workers will indirectly increase the cost of production each planting season. Although the use of wheel sprayers requires a relatively high start -up cost but the return on the cost will be obtained in a short time and will be more profitable when compared to the existing operation.

4.2.3 INTERPRATATION

based on the results of the study, found that 38 people was responded. The pie chart that was produced showed several types of questions about wheel sprayer which showed 42.1% of respondents aged 20-30 years old while 57.9% were 18 years old and above. Besides, 86.8% is male and 13.2% is female.

The first question is whether common poison sprayers are less comfortable or less ergonomic and found 92.1% who said yes and 7.9% were not. The next question is you agree poison sprayers should be upgraded and 97.4% yes and 2.6 no. besides that the question asked is whether wheel sprayer simplified the spraying process, and the answer is 81.6% yes, 4% no, 4.9% were difficult for grass, orchards and 10.5% were possible.

Next, whether a wheel sprayer is more effective at spraying poisons than normal poison sprayers and the answer is 73.7% is yes 2.2% is no, 21.1% is possible and 3% is the same after that, does a wheeled poison sprayer save time on spraying poison 81.6% is yes, 3% no, 13.2% is possible and 2.2% is looking at the seriousness of spraying poison if you do the time saving speed for a slow waste of time. Lastly, is the filling-wheeled poison sprayer suitable for easier spraying? the answer is 65.8% were very suitable, 15.8% were suitable and 18.4% were probably suitable

4.2.4 COMPARATIVE STUDY

Based on the results of comparison study that can be made is wheel sprayer is very helpful for people. Respondents prefer to wheel sprayer than normal poison sprayer based on pie chart because it facilitates work and lightens the load. the advantage of wheel sprayer is that the time of spraying poison is shorter, spraying is more effective and more ergonomic. Disadvantages is lack of wheel, sprayer is quite high cost, not suitable for use in cramped gardens.

4.2.5 CONSIDERATION

Based on graph wheel sprayer is able to be a machine that is very valuable to the community because wheel sprayer according to aspect required for farmers. Besides wheel sprayer can be commercialized to the market and will be an excellent product.

4.3 RESULT

The Wheel Sprayer is an upgraded pesticides that use more than one nozzle to spray and added the wheel with more ergonomic.

i) Halfway Result Project



Figure 4.1: Halfway project

ii) Final Result Project



Figure 4.2: Final Result of Wheel Sprayer

4.3.1 PRODUCT TESTING

This project must be put to the test in terms of:

- The effectiveness on all people includes young and old people
- Within 2 nozzle spray level
- Scale garden and farm area in range of 800m²
- The component's quality
- The component's lifespan

4.3.2 VALUE OF SUSTAINABILITY

- Cost saving in agriculture cost
- Time saving
- Safety in operation

4.3.3 POTENTIAL MARKETING

- Industries that related to farm and garden with large area for spray pesticides.

4.4 DISCUSSION

Throughout the project's execution, several adjustments and tests are carried out to ensure that the specified objectives, scope, and restrictions are met. One of the studies was to see how long it took to spray pesticide in a garden. It also has the ability to increase spraying efficiency because it includes many nozzles throughout the spraying process. A wheel sprayer test was also performed to check that the sprayer was working properly. We will have met our objectives when all of the testing on the wheel sprayer has been performed satisfactorily and has exceeded our expectations.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

The decision is made for this chapter based on all of the findings received from the experiments completed, and the discussion is about the research's objectives as well as recommendations for the study. In addition, this experiment's conclusions have been reached.

5.2 CONCLUSION

In conclusion, WHEEL SPRAYER design was successful to achieve objective. With this idea and innovation, it can help people especially farmers to spray their farm and gardens because it is more ergonomic to use and handle. Plus, with this new sprayer, it will help farmers to reduce their time and increase effectiveness in spraying process because it got a nozzle on right and left side of the sprayer, so that when the spraying process is running, both side of nozzle will spray plants near them. This innovation will give many benefits to people who use it. Hoping that this innovation will contribute a good results and productivities in agriculture sector.

5.3 RECOMMENDATION

After completing this study, consumers will be more satisfied because they do not need to carry and lift their sprayer wherever they want to spray their plants in farm or garden. Additionally, that those interested in furthering and refining this study are welcome. Can cooperate in improving this project as the use of farming industries is indispensable and encouraging. The most recommendation improvement for the future we have is by adding 1 more wheel, it aims to add more stability when spraying pesticides and herbicides. Besides, we will add another 1 more nozzle to further expand the pesticide and herbicides spray area so that the pesticide spraying work will runs faster and more efficiently. We sincerely hope that this project can increase profit within the country and can exported out of the country and set an example for other countries.

5.4 PROJECT LIMITATION

- With proper maintenance, it might endure a long period.
- Do not be exposed to rainwater or the other to avoid rusting and damage.
- Always check tyre air pressure before start spraying.
- Do not fill the pesticides tank with water over the limitation.

5.5 SUMMARY

Wheel sprayer is very helpful for farmers to farm and cultivate as it can ease the burden for gardening. besides the more ergonomic wheel sprayer which facilitates their work to be more effective. respondents preferred wheel sprayer compared to normal poison sprayers

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i. GANTT CHART PROJECT 1

Week	status	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16
Introduction and planning gantt chart	p																
	c																
Component survey	p																
	c																
Component selection	p																
	c																
Fabrication process	p																
	c																
Testing	p																
	c																
Modification/improvement	p																
	c																
Writing report	p																
	c																
Preparing for banner and presentation skill	p																
	c																
Final project presentation	p																
	c																
Correction and submission report	p																
	c																

TABLE 1.1

GANTT CHART PROJECT 2

Week activities/project	status	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
Briefing project 2	p														
	c														
Component survey	p														
	c														
Component selection	p														
	c														
Fabrication process	p														
	c														
Testing	p														
	c														
Modification/improvement	p														
	c														
Writing report	p														
	c														
Preparing for video and presentation	p														
	c														
Final project presentation	p														
	c														
Correction and submission all task	p														
	c														

TABLE 1.2

ii. PROJECT BUDGET

NO.	MATERIAL	PRICE PER UNIT (RM)	QUANTITY	TOTAL (RM)
1.	Tire	RM 40.00	1	RM 40.00
2.	Knapsack sprayer	RM 48.00	1	RM 48.00
3.	Nozzle	RM 4.00	2	RM 8.00
4.	Stainless steel shaft (10mm)	RM 16.00	1 feet	RM 16.00
6.	Ball bearing (10mm/6300)	RM 6.00	2	RM 12.00
7.	Pillow block bearing 17mm	Rm 9.00	1	Rm 9.00
8.	Set of Sprocket	RM 25.00	1	RM 25.00
9.	T connector	RM 5.00	1	RM 5.00
10.	Mild steel (1x1)	RM 1.90	20 feet	RM 38.00
ESTIMATION COST:				RM 201

TABLE 1.3: PROJECT BUDGET

iii. TOOLS AND EQUIPMENT



Figure 6.1: wheel sprayer tools and equipment

iv. INVENTOR SKETCHING AND DRAWING

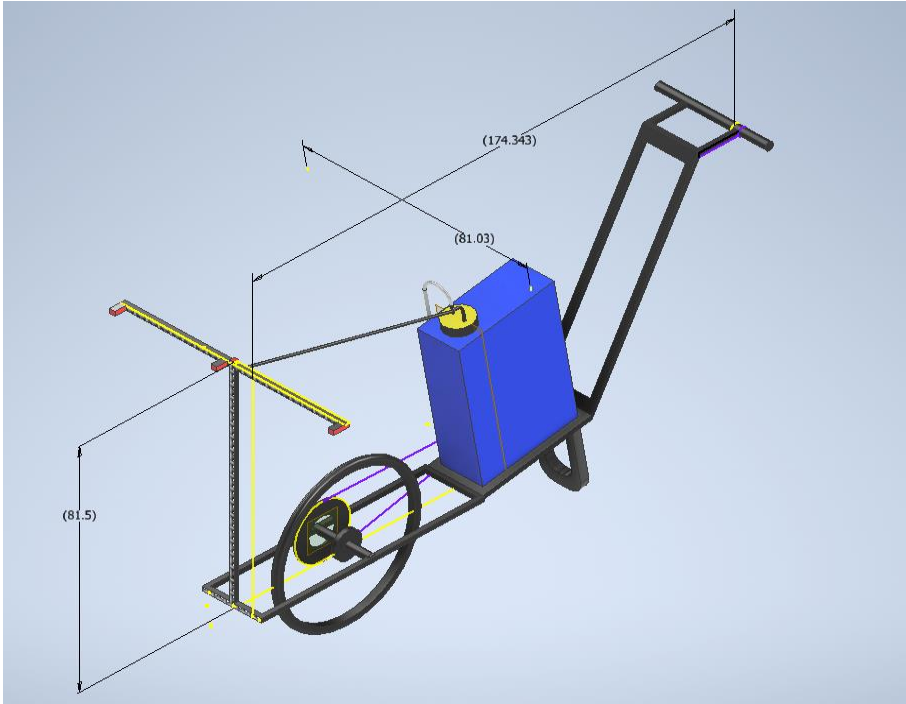


Figure 6.2: inventor drawing

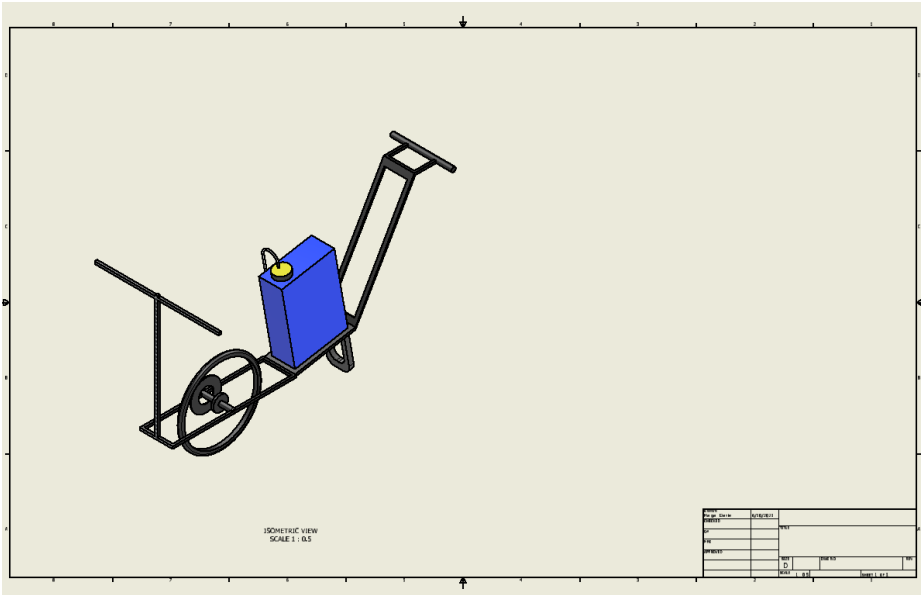


Figure 6.3: inventor sketching