



**FINAL YEAR PROJECT REPORT
A & S PESTICIDE SPRAYER**

MUHAMMAD AFIQ ATHIR BIN MOHD IBRAHIM 08DKM17F1176

SARIYAN BIN MAT SHAH ROM 08DKM17F1167

**DIPLOMA IN MECHANICAL ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING**

JUN 2019

DECLARATION OF OWNERSHIP

I hereby declare that the work presented in this report has been written entirely by myself except for quotations and summaries where stated otherwise by reference and acknowledgement. This report also has not been submitted previously in whole or in part for any other diploma in Politeknik or any other universities.

Name of candidate : Muhammad Afiq Athir Bin Mohd Ibrahim
Candidate's student ID : 08DKM17F1176
Programme : Diploma in mechanical engineering (PURE)
Department : Mechanical engineering
Project title : A&S PESTICIDE SPRAYER

JUN 2019

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MUHAMMAD AFIQ ATHIR

BIN MOHD IBRAHIM

991102-14-6263

08DKM17F1176

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Name of candidate : Sariyan bin Mat Shah Rom
Candidate's student ID : 08DKM17F1167
Programme : Diploma in mechanical engineering (PURE)
Department : Mechanical engineering
Project title : A & S PESTICIDE SPRAYER

JUN 2019

.....
SARIYAN BIN MAT SHAH ROM

990607-10-8663

08DKM17F1167

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ABSTRACT

The main purpose of producing this product is to enable farmers and gardeners to make the process of spraying pesticides and herbicides to their gardens becomes more effective. It helps the gardeners work because they no longer need to carry the tank on their back that can cause their back strain and hurt. This product only has to be push to forward just like how the trolley function and then it will generate mechanically pump by the set of power transmission part by using shaft, bearings and set of sprockets. Energy to pump the tank pump can be reduced. Next, it also comes with a pair of nozzles on the wing. With nozzles on the wing, it can speed up the spraying process as it can spray left and right side at the same time. In conclusion, this product can help gardeners in terms of comfort during spraying, reducing energy to pump tanks, and effectively utilizing spraying time.

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CHAPTER 1

INTRODUCTION

1.1 Research background

Sprayer is well known by all people in nowadays. There is various type of sprayer that have been invented until 2019 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 farming industries to spray pesticide, herbicide, or to watering their plants in farms and gardens.

A&S PESTICIDE SPRAYER is basically designed for spraying pesticide, herbicide and water in vegetable gardens. Usually, gardeners will do the water spraying process every day while pesticide and herbicide spraying process at least once a week. Gardeners need to spray their gardens with pesticide and herbicide to ensure that there are no bushes grow and prevent the gardens from bugs, caterpillar and others pests. Normally, gardeners will use the 16 litres manual Knapsack sprayer to spray their gardens, these may take a long time to finish spraying their gardens. Plus, this manual Knapsack sprayer is provided with only one nozzle.

1.2 Problem statement

Existed pesticide sprayer is heavy and hard to carry. Next, the sprayer that nowadays farmer use to spray their farm take so much time for them to finish spraying. After that, existed poison sprayer is less efficient because only provided with one host and one nozzle to spray. Farmers need to directed the nozzle straight forward to the plant. Then, farmers need to bend them back a little bit when they want to start spraying their farm. They need to bend a little bit because want to carry up the sprayer that is heavy that can cause strain to their back. In addition, only can load with not large amount of water, pesticide, herbicide.

1.3 Objectives

1. To give farmers more ergonomic working environment while spraying because they don't need to lift or carry the poison tank but only push and pull the A&S PESTICIDE SPRAYER.
2. To add more efficiency to spraying because contains more than one nozzle. When do the spraying process, both wings of host will flow the liquids to the plans.
3. To provide a comfortable spraying action because farmers just need to pull and push the A&S PESTICIDE SPRAYER based on their comfort level and don't need to bend their back.

1.4 Scope of research

1.4.1. Can be use in vegetable gardens.

1.4.2. Can be use in fruit gardens.

1.4.3. Tanks can be fill either with water for watering plants or poison for poisoning plants.

1.5 Significant of research

There were many types of sprayer that have been invented since 1947, by Ray Hagie, founder of Hagie Manufacturing. Automatic sprayer and motor sprayer are commonly used by big farming industries to perform a lot of spraying activities in their farms. Different with small industries or vegetable gardens, they commonly used the manual sprayer which is manual Knap sack sprayer. Through this research, to transform a manual knapsack sprayer into a mechanically sprayer that will contribute more comfy and faster working time to all gardeners that work in the small industries. Last but not least, this study also allows other researchers to perform further studies which focusing more to help gardeners in Malaysia and other country to performs their best in spraying activities in gardens.

CHAPTER 2

LITERATURE REVIEW

**PREPARED BY: MUHAMMAD AFIQ ATHIR BIN MOHD IBRAHIM
(08DKM17F1176)**

2.1 Plastic knapsack sprayer

16 litre knapsack sprayer are conventional and most popular equipment used worldwide. They are ideal for spraying insecticides, pesticides, fungicides, herbicides etc. in field areas to protect the crop from pest attack. This sprayer has multiple applications and are widely used in agriculture, horticulture, sericulture, plantations, forestry, gardens etc.



Figure 2.1: Plastic knapsack sprayer

ADVANTAGES	DISADVANTAGES
Can be fit up to 20 litres of water/poison	Very heavy to lift and carry
Convenient maintenance and low price of accessories	Repair rate is high too much trouble
Low price	Low efficiency

2.2 Ogawa / Shizuka sprayer

Shizuka sprayer can be fill with 20 Litres amount of liquid. Also function like manual knapsack sprayer but comes with an engine to generate more power.



Figure 2.2: Ogawa / Shizuka sprayer

ADVANTAGES	DISADVANTAGES
High efficiency because have a motor	This sprayer is heavy to carry
No need to generate a pressure by hand	Need petrol to generate pump

2.3 Typical hand sprayer

Typical hand sprayer can be fill with at least one gallon of liquid. Usually use for small scale of garden or farm or for spraying flower at house.



Figure 2.3: Typical garden sprayer

ADVANTAGES	DISADVANTAGES
Nozzles may be inadvertently moved to provide a different stream or spray	Not suitable for applying most commercial pesticides
Can produce a pressure to poison/water	Heavy to lift and carry
Low price of accessories	Low efficiency

2.4 Knapsack sprayer (hand operate)



Figure 2.4: Knapsack sprayer (hand operate)

This sprayer is suitable for applying chemical to several field crops. The operator carries the sprayer on their back and it has a tank capacity of 10-16 litres. The hydraulic pump fitted inside the tank is used to operate the pump, agitator, filter, delivery hose, and nozzle. When the pump is operated, fluid flows through the suction hole and delivery hose to the nozzle.

2.5 Knapsack motorized



Figure 2.5: Knapsack motorized

It is simplest engine driven sprayer used in agriculture. It is carried on the back of operator. It is used for spraying to all type crops most popularly to paddy, groundnut, cotton and vegetable. When engine is started, the blower generates a high velocity air to which the chemical. The chemical will through the hose and nozzle. This knapsack can fit 20L to 25L and very hard to carry. To run an engine it requires patrols to operate it.

2.6 Power operated duster



Figure 2.6: Power operated duster

Power operated duster mainly consists of a power driven fan, a hopper and a delivery spout. The fan creates strong air flow which causes the dust to blow off from the hopper to a considerable distance vertically or horizontally. Direction of dust is regulated by a movable suitably fitted the unit. This type is used for large area like the paddy.

2.7 Pressure water



Figure 2.7: Pressure water

It is a heavy and effective sprayer and requires an engine to operate the power sprayer. It consists of a triplex pump with stainless steel piston with oil bath lubrication. It can develop 250 to 350 pounds and can deliver the solution up to 15m. The pressure needs to use a long hose to do the spraying and cost for this sprayer is very expensive.

2.8 Hand compression sprayer



Figure 2.8: Hand compression sprayer

It is suitable for applying chemicals for home gardens, small field and not suitable for large farms .It consists of a container of 8 litres capacity a built in air pump, pressure gauge , nozzle and flow cut off lever.

CHAPTER 3

RESEACRH METHODOLOGY

**PREPARED BY: MUHAMMAD AFIQ ATHIR BIN MOHD IBRAHIM
(08DKM17F1176)**

3.1 Introduction

This product can widely use in many gardens and vegetable farms. But their users' targets have been reduced to a smaller scale to get the best results while spraying. It can be use in big industries, but bigger industries must provide more pressure on spraying because the size of field is wide and usually used a machine to make spraying sessions faster. So, the target of users is to a smaller industries and small gardens. Why choose smaller industries because usually gardeners will use the manual knapsack sprayer that is heavy and need to carry on their back to do spraying session, but with this product they only need to push to forward and backward only. Plus, this product can spray both side of boundary so that the time taken is lesser than normal knapsack sprayer took.

3.2 Research design

After a few weeks discuss about the design, finally the best design has been made. This design has been made to provide ergonomic spraying sessions for gardeners to make sure they do not have to carry the heavy tank 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 product 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.

3.3 Material selection

3.3.1 Mild steel

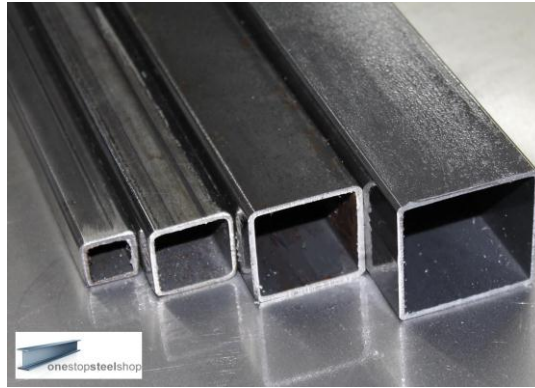


Figure 3.3.1: 1x1 hollow mild steel

- Used to make body parts. This material was chosen because it is more resistance to corrosion. Allows products of mild steel to be basically formed close to the end of the product's design.

3.3.2 Rubber



Figure 3.3.2: Bicycle tyre

- Used to make a tyre for the product. Resilience, also known as rebound, is the ability of rubber to return to its original size and shape following a temporary deformation. Rubber also not easily corroded when contact to water. Is this case, rubber is good material to make the product tyre and host.

3.3.3 Polymer



Figure 3.3.3: Plastic tank

- Used to make the product tank. Polymer is typically low densities, whereas their mechanical characteristic is generally dissimilar to metallic and ceramic materials and they are not as stiff nor as strong as these other material types

3.4 Fabrication

In this project, a lot of fabrication work need to be applied to make sure the project done well and satisfying. The main adhesive agent that have 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.



Figure 3.4: MIG welding on mild steel

3.5 Power transmission part

Mechanically power transmission was applied to the A & S pesticide 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 A & S pesticide sprayer is push forward or backward, this transmission part will make the tank mechanically pump.



Figure 3.5.1: Pillow block bearing (size 6300)



Figure 3.5.2: Stainless steel shaft (size 10mm)



Figure 3.5.3: Set of sprockets

PREPARED BY: SARIYAN BIN MAT SHAH ROM

3.6 Material selection

Steel hollow sections are commonly used in welded frames, columns and as beams providing various benefits to a range of construction and mechanical applications. A& S pesticide sprayer we use mid steel (SHS) steel hollow section for body frame. This kind of steel has good reliability. Low carbon steel with low carbon content has medium hardness and poor workability. It is because the body will should bear the load on the tank when it is added to the chemical. For the wings, we choose aluminium because its lightweight and not easily corrosive. These wings are used to hold hoses and nozzles to make sure the sprayer can spray more efficiently.

3.7 Accessories

After a few weeks discuss about the nozzles, finally the best nozzle has been found. This nozzle has been made to provide ergonomic spraying sessions for gardeners to make sure the spray more efficiency. The nozzle efficiency can be defined as the ratio between the energy available at the nozzle inlet. 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 low pressure it causes the chemical to exit the nozzle quickly.



Figure 3.7: Accessories(nozzle)

3.8 Appropriate tyre

Tire selection is very important because of the ergonomic for the user. These tires are used to move the sprayer more easily and also help with the transmission part. For A&S project we used 16inc tires as they were not too big and not too small and provide user comfort.

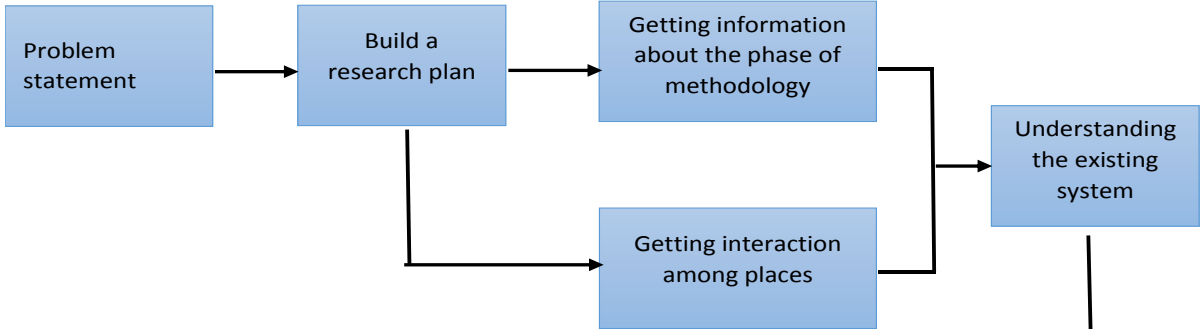


Figure 3.8: Bicycle tyre

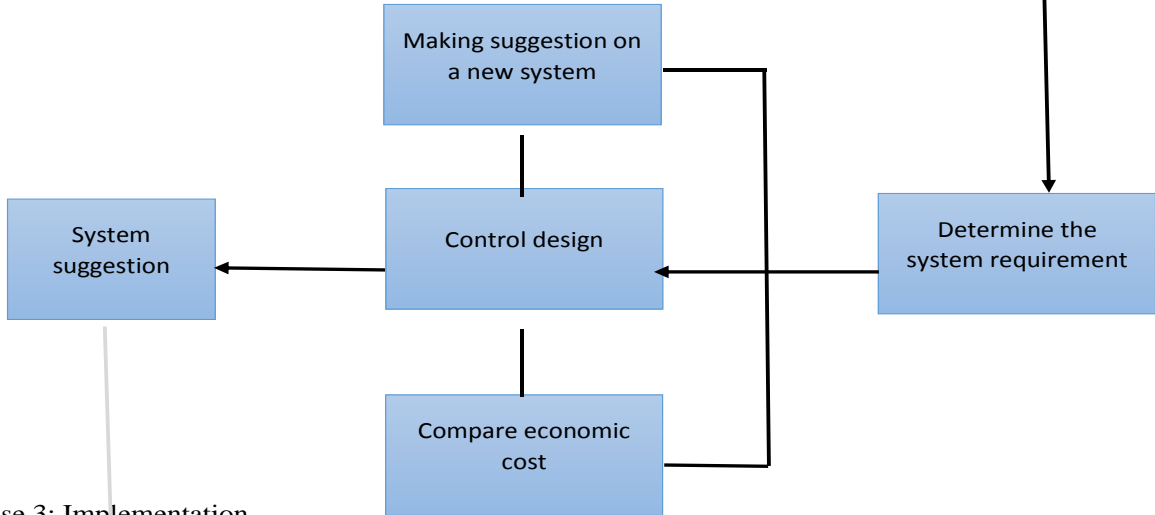
PREPARED BY: BOTH

3.6 Method step

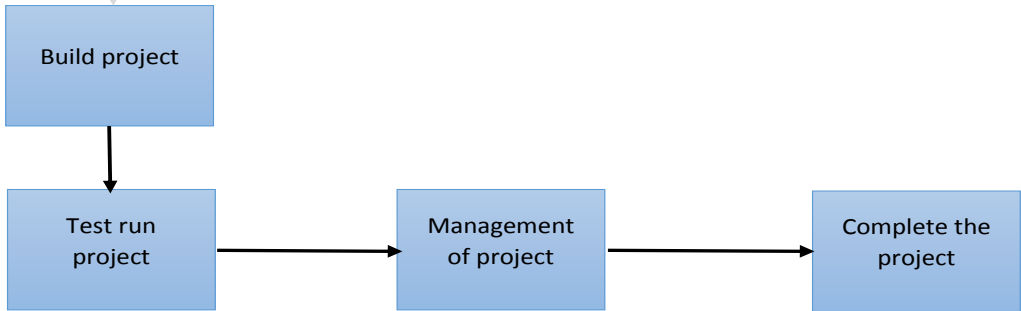
Phase 1: Data Analysis



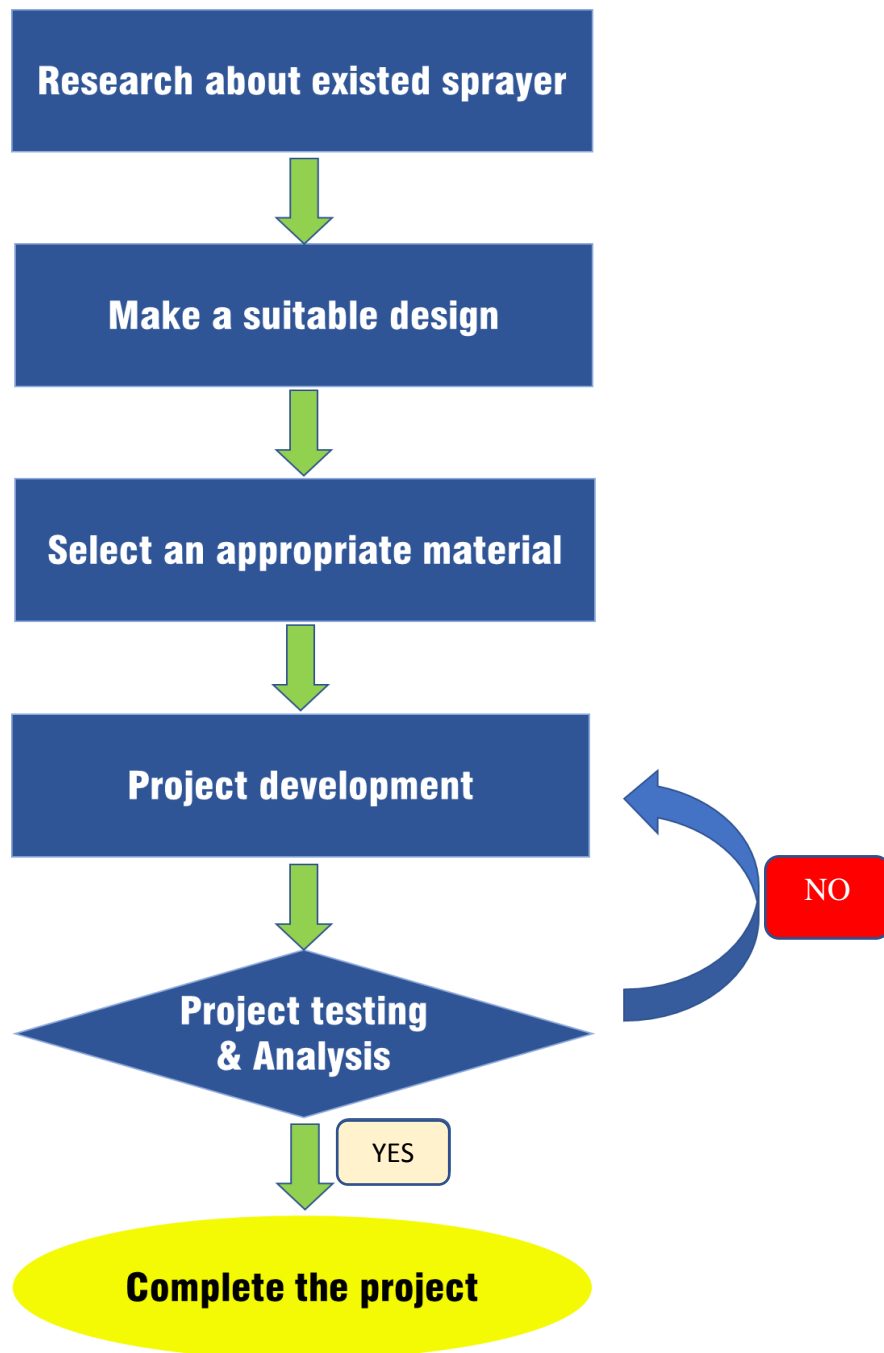
Phase 2: System Design



Phase 3: Implementation



3.7 Method process



3.8 Analysis data of responses from respondents

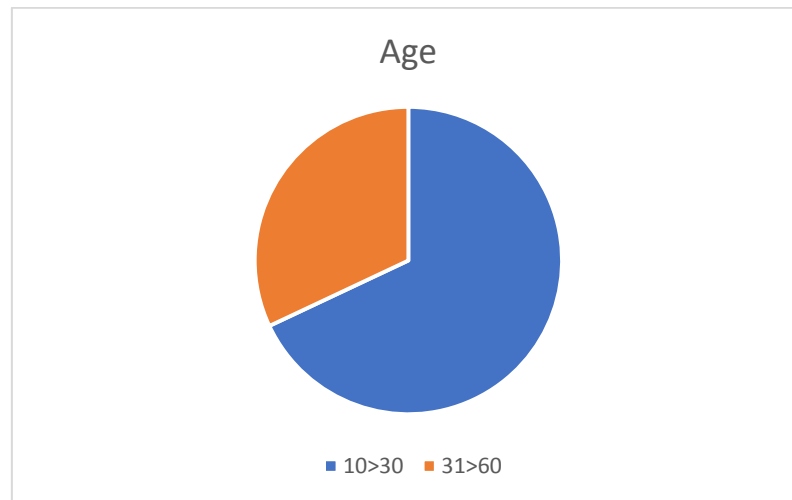


Table 3.8.1: Section A, Question 1

From this questionnaire, question have been answered by most of young and youth people and farmers. The scale for this question is 10-30 (17) and 31-60 (8).

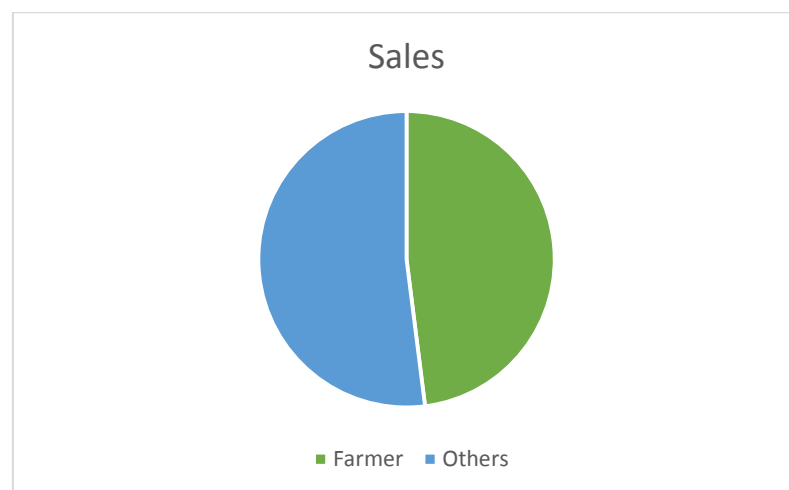


Table 3.8.2: Section A, Question 2

From this questionnaire, the value of farmer and others that have answered this question is quite balanced which is farmer (12) and others (13).

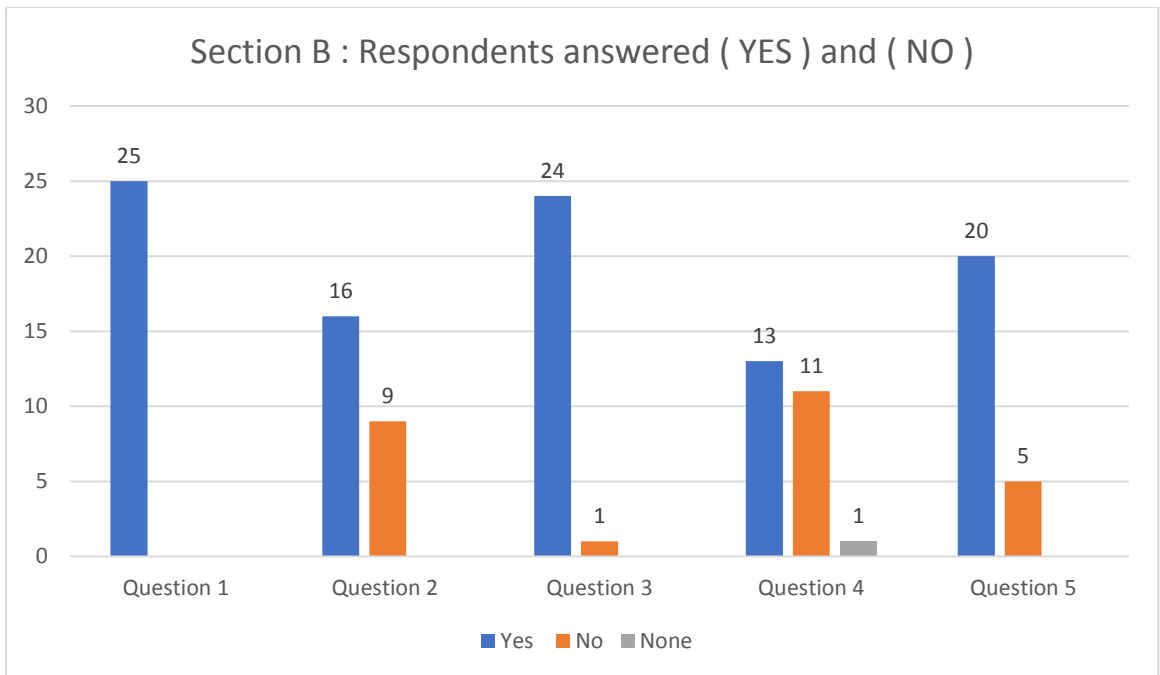


Table 3.8.3: Section B, Respondents answered YES or NO

Based on the question on section B, there are 25 persons have answered all the questions. Some of them have answered YES and some of them have answered NO because of their own opinion. We found that many of the respondents pick YES for all the questions.

3.9 Analysis conclusion for respondents

Based on the questionnaire, there are some of the respondents give us a suggestions and ideas to improve our product. The common suggestions are, they want our product to be capable to use in all type of farm and garden and make a better handling method.

CHAPTER 4

RESULTS

**PREPARED BY: MUHAMMAD AFIQ ATHIR BIN MOHD IBRAHIM
(08DKM17F1176)**

4.1 Time taken to empty the tank fill with liquid

The **A&S PESTICIDE SPRAYER** have been tested on a field because could get a chance to run it on a gardens or farms. The test was held on Bandar Tasik Puteri, Rawang. Several tests were done to get the actual time different between manual knapsack sprayer and **A&S PESTICIDE SRAYER**. There are huge different in time taken after the test. Manual knapsack sprayer took very much time to empty the tank compared to **A&S PESTICIDE SPRAYER**. The distance that used is 168 meters.

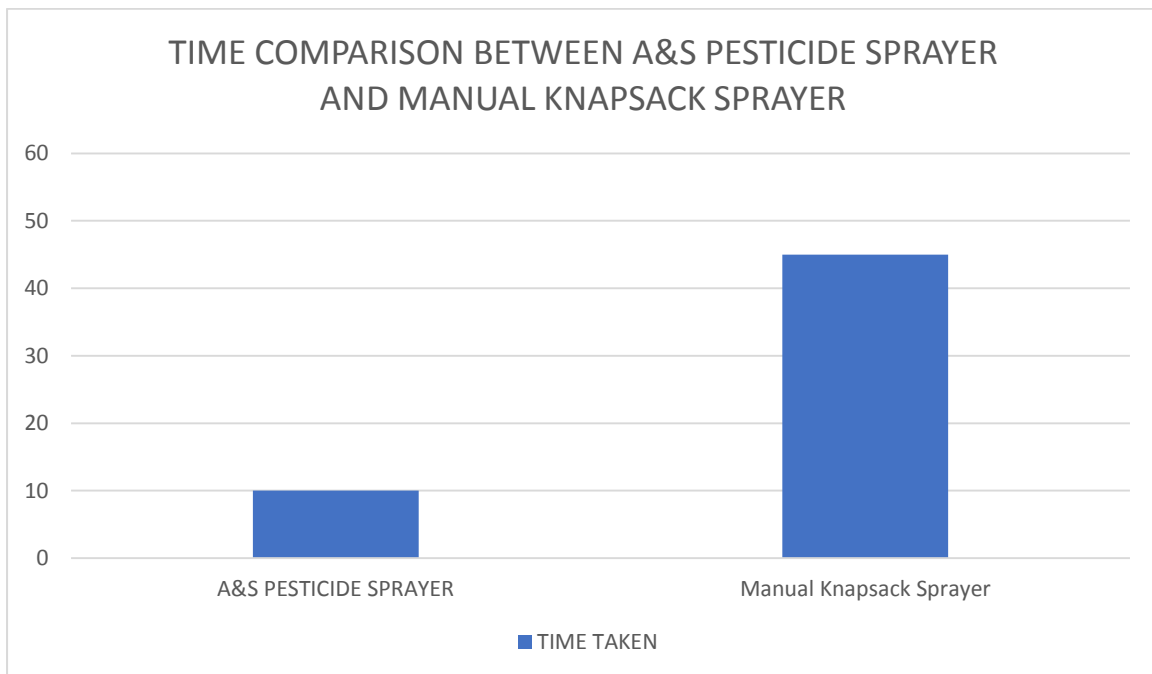


Table 4.1: Time comparison between product

4.2 Gear ratio analysis

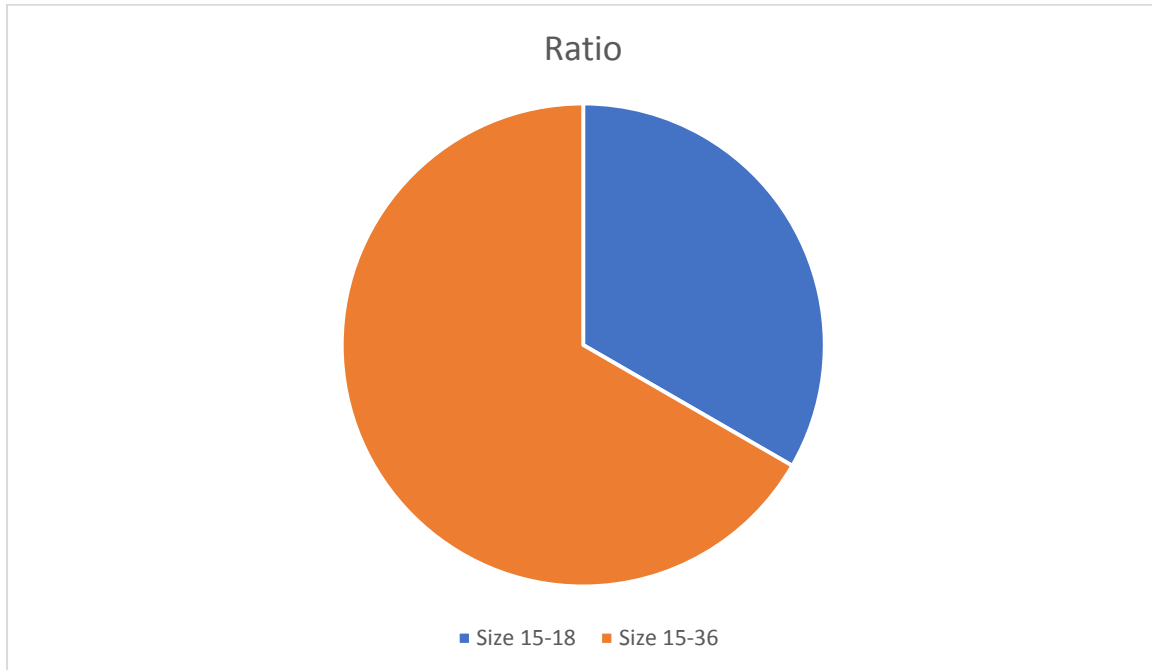


Table 4.2: Gear ratio reading between size 15-18 and size 15-36

This product come with pair of sprockets on the driving part which is size 18 and 36. For the driven part, the size of sprocket is 15. How to know the size of the sprocket is by calculating the numbers of tooth that have from the gear. On the first attempt of test run, the driving gear size of 36 was used. The gear ratio that size 15-36 generated is 2.4 which is bigger than size 15-18 generated which is 1.2. This study shows that the bigger the driving gear use, the bigger gear ratio generated. If the gear ratio is increase, so the pressure that have in the pump will also will be greater. As the conclusion, if the spraying process is using 15-18 size sprockets farmers can just use the nozzle and host that have come with **A&S PESTICIDE SPRAYER**. But if farmers want to use the 15-36 size, they have to change to bigger host or just add more nozzles because the pressure that generate by this size of sprockets is greater than size 15-18.

CHAPTER 5

DISCUSSION AND CONCLUSION

**PREPARED BY: MUHAMMAD AFIQ ATHIR BIN MOHD IBRAHIM
(08DKM17F1176)**

5.1 Discussion

This study was focusing for gardeners and farmers to spraying liquid like pesticide, herbicide, and water to their plant. There are so many ways to how they spray their plant but the most common is using manual plastic knapsack sprayer. After finished product testing, we found that our objective on invent this product have been achieved. Firstly, we have reduced the time taken to spray the herbicide by almost three times faster than the manual knapsack sprayer. Next, we also achieved to add more efficiency to spraying with our pair of nozzles on the wing side. It is more efficient because when the product is moving forward it will generate the pressure to the pump and the herbicide will flow to the both side of nozzles and sprinkle to plants. The last objective that we have achieved is farmers can have a comfortable spraying action.

5.2 Conclusion

Water sprayer and poison sprayer is very important in farm or garden and it is very well known by all people especially by farmers. These sprayers are used to spray pesticide or liquid to plants. Without these sprayers it will burden farmers and people to make sure their plants stay fresh because not get a water and stay in protection from bugs and pests because not been spray with pesticide or poison.

With this idea and innovation, it can help people to spray their farms and gardens because it is more ergonomic to use and handle. Plus, with this new sprayer, it can help us to reduce our time to spraying because they got a wing on right and left side of the sprayer so that when we do the spraying, both side of wing will spray plants near them.

This new innovation will give many benefits to people who use it. Hoping that this new innovation will contribute a good results and productivities in farming industries.

5.3 Recommendation

After completing this study, consumers will be more satisfied because they don't 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 that we got is to combine the **A&S pesticide sprayer** with a bicycle so that we don't have to push it. 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.

PREPARED BY: SARIYAN BIN MAT SHAH ROM (08DKM17F1167)

CONCLUSION

The A&S PESTICIDE SPRAYER a proven the time of spraying is faster and it more efficient compare to the normal type hand sprayer. The farmers will be more efficient when to do the work and to produce better crops for sale. After than that, **A&S PESTICIDE SPRAYER** can comfortable spraying action because farmers just need to pull and push based on their comfort level and don't need to bend their back.

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APPENDICES

A. Gantt Chart

WEEK/ PROJECT ACTIVITIES	Sta tus	W1	W2	W3	W4	W5	W6	W7	W8	W9	W 10	W 11	W 12	W 13	W 14	W 15
Remaking the project design	P															
	I															
Recalculate the project cost	P															
	I															
Find and buy project equipment	P															
	I															
Project making process	P															
	I															
Test run	P															
	I															
Presentation	p															
	I															

Note :

P : date planned



I : date implemented



B. Estimation of Cost

NO.	MATERIAL	PRICE PER UNIT (RM)	QUANTITY	TOTAL (RM)
1.	Aluminium	RM 1.80	8 feet	RM 15.00
2.	Tyre	RM 10.00	1	RM 10.00
3.	Knapsack sprayer	RM 50.00	1	RM 50.00
4.	Nozzle	RM 25.00	2	RM 50.00
5.	Stainless steel shaft (10mm)	RM 16.00	1 feet	RM 16.00
6.	Hollow stainless steel (1/1/4 inches)	RM 9.00	1 feet	RM 9.00
7.	Ball bearing (10mm/6300)	RM 6.00	2	RM 12.00
8.	Sprocket	RM 15.00	1	RM 15.00
9.	T connector	RM 10.00	1	RM 10.00
10.	Brass nozzle bib cock (1/4)	RM 7.00	1	RM 7.00
11.	Mild steel (1x1)	RM 20.00	10 feet	RM 200.00
ESTIMATION COST:				RM 394

C. Technical drawing

