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SPRAY CART

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APPRECIATION

We are from DMP5A the name of our project is SPRAY CART. First of all we would like to thanks all the praises to Allah S.W.T. The Greater and the Most Merciful, because without His permission, we cannot finish our project successfully.

On this occasion, we would like to thank the Polytechnic Sultan Salahuddin Abdul Aziz Shah mainly due to the Department of Mechanical Engineering has provided opportunities for students to apply what they have received in semester 4 during their stay in PSA. Besides, we wish to express our gratitude to our supervisor Madam Nazrathulhuda Binti Hashim for all her guidance, invaluable help, encouragement and patience from all aspect until the end of the project. Without her support, we might not be able to complete all the task given smoothly. Her numerous comments, criticisms and suggestion during the preparation of this project are highly appreciated.

In addition, we would also like to express our gratitude to our family, especially our parents for their continuous support. Guidance, encouragement and advice given were very helpful. Without them we might not be able to overcome the problem encountered along the way in our study. Not forgetting, our friends and people who directly or indirectly helped us in order to complete this project successfully. Thank for all of you.

ABSTRACT

This project is the improvised version based on the current spray pump available in the market. The advantages of this Spray Cart is it can be used to pump and spray liquid herbicide, liquid fertilizer, pesticide, and water to the corps while carrying another necessary tool or loads to planting section. Thus, this cart can do multi-work in one condition. The Spray Cart is directed to farmers who conduct farming on peat or flat land as this tool uses tires that move the trolley. This tool is to ease the burden of farmers rather than heavy duty sprayers. This machine is designed to be used in agricultural industry. Poisons and fertilizers are an important ingredient in farming that is always used to keep plants healthy and fresh. To produce an excellent and successful projects and can be adopted, the characteristic of the advantages that should exist in every project that will be produced are emphasized. It is important to reassure consumers that produced this project once captured the hearts of consumers. Among the advantages of the "Spray Cart'' are, can be operated easily and safely. The machine does not require high skill to operate. Then, consumer didn't need to shoulder the spraying tank. The spraying work easier because it does not require a lot of energy. It only require energy to push the cart and being help by the usage of engine to move. Besides, the machine does not need much maintenance if damaged. The research methodology is used and guided by the flow chart in the process of planning, production, design and testing of projects. The result by following the correct steps and procedures of the project was successfully implemented.

CHAPTER 1

RESEARCH IMPLEMENTATION

1.1 INTRODUCTION

This project is the improvised version based on the current spray pump available in the market. The advantages of this Spray Cart is it can be used to pump and spray herbicide, liquid fertilizer, pesticide, and water to the corps while carrying another necessary tool or loads to planting section. Thus, this cart can do multi-work in one condition.

The Spray Cart is directed to farmers who conduct farming on peat or flat land as this tool uses tires that move the trolley. This tool is to ease the burden of farmers rather than heavy duty sprayers. This machine is designed to be used in agricultural industry. Poisons and fertilizers are an important ingredient in farming that is always used to keep plants healthy and fresh.

1.2 OBJECTIVES

1. To design a spray cart which will use to spray at a large area of land in less time.

2. To fabricate a spray cart which will be able to compete with previous scenario in terms of modifying the design and way of usage.

3. To test product reliability to identify whether it is safety to the operator and also to other workers, thus reducing the labor wages.

1.3 SCOPE

1. Able to use for spraying pesticide, fertilizer or water in maximum of 30 Liter.

2. Able to spray within 0.5 meter to the crops.

3. Able to use in vegetable garden and some of the fruits garden.

CHAPTER 2

PROBLEM STATEMENT

2.1 PROBLEM STATEMENT

In large scale farming the conventional methods of spraying pesticides, insecticide, etc. are inconvenient as they require more time. The farms require a number of workers to complete the task in time. Conventional methods are inefficient as controlled spraying is not carried out. To increase the output and profit we need to overcome the drawbacks, difficulties of conventional methods by synchronizing farming with technology.

2.2 THEORY RELATED

To produce an excellent and successful projects and can be adopted, the characteristic of the advantages that should exist in every project that will be produced are emphasized. It is important to reassure consumers that produced this project once captured the hearts of consumers. Among the advantages of the "Spray Cart'' are,

I. Can be operated easily and safely.
II. The machine does not require high skill to operate.
III. Didn't need to shoulder the spraying tank.
IV. The spraying work easier because it does not require a lot of energy. It only require energy to push the cart and being help by the usage of engine to move.
V. The machine does not need much maintenance if damaged.

2.3 PROJECT SPECIFICATION

- Weight : 40 kg
- Project size : 121 cm x 56 cm
- Height : 56 cm
- Suitable for : Agricultural sector
- Advantages from the existing sprayer: Able to carry more quantity of liquid.
- Capacity : 30 liter

CHAPTER 3

LITERATURE REVIEW

3.1 INRODUCTION

Many national agricultural research programme are moving toward the adoption of on-farm research techniques. This implies location specific research for representative farmers. Among the challenges that scientists face in this type of research are the identification of priority themes for investigation, the selection of representative sites for on-farm experimentation and most important the definition of the clientele for whom the recommendations are to be developed. The concept of the "recommendation domain" is a powerful tool for resolving these problems and for organizing an efficient on-farm research program.

Spray Cart are indispensable agricultural tools. Understanding how to use them is essential for the successful application of agricultural chemicals, especially selective post emergence herbicides. Herbicide efficiency and crop tolerance depend upon inherent species sensitivity to an herbicide and the size of the weed or crop at application. With many new herbicides, the rate difference between effective weed control and crop tolerance is small. In order to successfully use herbicides, their application must be accurate and uniform. Nozzles, spray tips, multiple nozzle booms, pressure regulation and sprayer calibration are the essential components of the spray-application technology.

3.2 CHANGES BY YEAR

2005. Vineyard evaluation of a recycling tunnel sprayer.

An air-assisted sprayer and a tunnel sprayer with a recycling system were used to compare distribution quality and losses to the soil. The trials were completed in a vineyard at two growth stages. The results show that losses to the ground with the tunnel sprayer were less than 5 percent of the sprayed liquid at both growth stages – much lower than with the conventional fan sprayer. Leaf retention of spray was about 87 percent of that sprayed. Efficacy over the season was not significantly different between the two sprayers. The results establish that the tunnel sprayer equipped with an air circulation system is more efficient and has less drift than the conventional air-blast sprayer.

2005. A system to assess the mass balance of spray applied to tree crops.

Initial work with an adjustable metal frame and grid system to facilitate sampling of spray losses during applications to trees or vines was reported in this paper. The system was designed to develop an alternative to the proposed International Standards Organization (ISO) methodology for classifying orchard/vineyard sprayers according to drift risk. Another goal was to facilitate the study of spray mass balance discharged to target plants, ground, and atmosphere. A follow up to assess progress on this work is warranted.

2005. A windows version of DRIFTSIM for estimating drift distances of droplets.

A Windows version of a computer simulation tool to determine the relative effects of various factors on spray drift was released by the USDA group at Wooster, Ohio. This version of DRIFTSIM was developed to rapidly estimate the mean drift distances of water droplets discharged from sprayers. A flow-simulation program of drift distances up to 200 m at temperatures ranging from 50°F to 86°F, release heights of 0 to 6.5 ft., initial droplet velocities of 0 to 154 ft. /sec, relative humidity of 0 to 100 percent, wind speed of 0 to 32.8 ft. /sec, and droplet sizes of 10 to 2,000 microns were part of the calculation. Included with the drift distances are measurements of Dv0.1, Dv0.5, and Dv0.9 droplet size distributions. The results of the findings from using DRIFTSIM were verified using a single-droplet generator and the wind tunnel.

2006. Effect of application variables on spray deposition, coverage, and ground losses in nursery tree applications.

An experiment with multiple treatments was conducted to compare an experimental cross-flow fan sprayer and a conventional axial-fan orchard sprayer while treating several rows of four-year-old multistem trees. Variations in spray deposits and coverage across multiple rows were generally less with the cross-flow sprayer. However, the axial-flow sprayer produced the highest deposits in the first row nearest the sprayer. Although reducing fan speed improved nearest row coverage, decreasing the volume of spray did not affect the coverage in that same row. The fan orientation on the tower/cross-flow sprayer did not affect canopy deposits but did minimize drift. The findings in this study also suggest that applicators can use different spray volumes and speed settings to improve efficiency with orchard spraying.

2006. Development and validation of a new deflector system to improve pesticide application in New York and Pennsylvania grape production.

Testing of a new air deflector on the Kink elder sprayer was undertaken by the research team from Cornell University. This sprayer is notorious for high wind speeds and airs hear nozzles that create large amounts of drift, resulting in poor coverage. In vineyard trials, the deflector provided for horizontal flow, which increased canopy deposition (25 percent) and reduced drift.

2006. Pollution reduction from a spray recovery sprayer.

A spray recovery system designed for apple orchards was adapted for use in vineyards to evaluate its ability to reduce ground contamination and airborne drift. A conventional air-blast sprayer set for vineyard spraying and a recovery sprayer were compared. Airborne drift was reduced by a factor of 3 and ground deposits by a factor of 4 at the wind speeds evaluated when using the recovery sprayer. The results showed that the recovery sprayer was an effective way to reduce ground losses, airborne drift and buffer zone widths.

2006. Foliar deposition and off-target loss with different spray techniques in nursery applications.

A conventional air-blast sprayer was used to evaluate spray deposits in crabapple trees and on the ground when using conventional hollow-cone nozzles, air-induction nozzles and conventional hollow-cone nozzles with a drift-retardant material. Airborne and ground deposits were also investigated. A wind-tunnel evaluation was conducted to compare the treatments without air assist for both downwind and airborne deposits. Droplet size distributions were also measured. No significant differences for tree coverage or ground deposits were found in the field study among the three treatments. Even at a reduced application volume of 700 L/ha (half of normal) the tree canopies received more spray than needed. A large portion of the spray was deposited on the ground. Drift was reduced with both the air-induction nozzle and the hollow cone with drift retardant in the wind tunnel, but the difference was not significant in the field study. This finding would not support using air-induction nozzles or drift-retardant material to reduce off-target drift or ground accumulation. The findings in this study would support lower application volumes to reduce pesticide waste. Another conclusion was that it is not necessary to place a large-capacity nozzle at the top of the air-blast sprayer, especially in orchards with shorter canopies.

2006. Quantifying the amount of aerial spray in the air over time for vector control operations.

The purpose of this work was to develop a technique to measure aerosol mass remaining in the air after spraying. Remote light detection and ranging (lidar) measurements of airborne spray plumes were evaluated in combination with drop size distributions and spray rates to estimate the amount of material remaining in the air and drifting in real time. Lidar is an optical remote-sensing technology that can measure properties of a target by illuminating it with light, often using pulses from a laser. It was observed that fine spray droplets (37.3 microns) in the air decreased rapidly for one to two minutes, then remained nearly constant and drifted with the air currents. From related studies, it is argued that analysis of lidar images of spray plumes is an accurate and efficient way to estimate turbulence values for spray transport models.

2007. Recycling tunnel sprayer for pesticide dose adjustment to the crop environment.

A recycling tunnel sprayer was used in vineyard field trials to determine the influence of leaf density and spray flow rate on plant and ground pesticide deposits. As reported in previous studies by this research team, spray losses to the ground were minimal: less than 2 percent of that sprayed in all comparisons of flow rate and vine growth stage. When operating beneath the dripping limit, canopy density and flow rate did not affect losses. The researchers state that with this system, it would be very easy to calculate the amount of material retained. This would allow for a highly precise distribution of the required dose during a single spraying operation at a specific growth stage.

2007. Coverage and drift produced by air induction and conventional hydraulic nozzles used for orchard applications.

This study compared conventional hollow-core nozzles (D3-25 and D4-25) to a drift reducing venture nozzle, Turboprop XL (Greenleaf). A conventional axial-flow sprayer was used to make applications to the outside row of a semi-dwarf apple tree block. The Turboprop had the lowest downwind drift. There were relatively few differences in canopy spray deposits among all nozzle treatments, though the Turboprop XL typically had reduced under leaf coverage.

2007. Inspection of sprayers in use: A European sustainable strategy to reduce pesticide use in fruit crops.

This paper discussed compulsory inspection of sprayers as a means to achieve better control of the application of plant-protection products. Results from a survey and discussions with several European members with training experience suggest that such a system would benefit the pesticide application process.

2007. Spray characteristics and drift reduction potential with air induction and conventional flat-fan nozzles.

Laboratory tests were completed to evaluate spray drift potential, spray coverage, droplet size, and spray pattern width of various air-induction and conventional flat-fan nozzles with similar orifice sizes. Droplet sizes were measured using laser imaging, spray coverage was determined using water-sensitive paper during boom applications, and ground and airborne spray deposits were measured in a wind tunnel. Sealing air intake holes on air-induction nozzles was also evaluated to learn of any effects on air induction characteristics. In this study, it was reported that the air-induction nozzles had 2.10 to 2.75 time's larger exit orifice areas, even at an equivalent nominal flow rate, than conventional flat-fan nozzles. When comparisons were made with equal-sized orifice areas and equal liquid flow, no significant differences were found in droplet size, spray pattern width, spray coverage, ground spray deposit, or airborne drift between conventional, regularly operating air-induction, and plugged air-induction nozzles. The researchers concluded that desirable spray characteristics of air-induction nozzles could be achieved using conventional nozzles with the equivalent orifice size operated at a reduced pressure.

2007. The influence of operator controlled variables on spray drift from field sprayers.

Field studies were completed to measure drift from horizontal boom sprayers, looking at different drift-reducing spray application techniques. A reference sprayer flat-fan nozzle was compared to low-drift and air-inclusion nozzle designs at varying orifice sizes, spray pressures, driving speed, and spray boom heights. Downwind horizontal drift collectors were placed according to the ISO 22866 sampling technique. Reported findings show that lower speeds, reduced boom height, larger nozzle orifice sizes, and lower spray pressures generally reduced drift. Among nozzle types studied, the air-inclusion designs were most likely to reduce drift followed by the low-drift and the standard flat-fan nozzle types. Drift amounts were closely linked to the droplet size characteristics of the sprays.

2007. Predicting drift from field spraying by means of a 3D computational fluid dynamics model.

A computational fluid dynamics model in 3D for investigating and understanding drift from field sprayers was developed. The 3D approach permitted an understanding of the 2013 Wolfe – Drift Reducing Strategies and Practices for Ground Applications influence of deviation in wind direction by better analyzing the wake behind a windscreen and the effects of changing nozzle orientation. Field experiments based on the international standard ISO 22866 were used to validate the model's accuracy. Experiments were conducted using a 27-m boom sprayer with 54 nozzles operating at 2.22 m/sec. The wind was perpendicular to the spray tract, allowing the model to predict drift differences resulting from various boom heights, wind velocities, wind deviation from the perpendicular, and the injection velocity of the nozzles. Taking into account these factors, boom movements had the greatest impact on the variations in drift values. This impact was followed by variations in wind velocity and nozzle injection velocities. Wind deviation from the perpendicular actually reduced the amount of drift. Small variations in driving speed had little impact on drift values.

2007. A test bench for the classification of boom sprayers according to drift risk.

This group set out to find an alternative sprayer classification procedure that did not require evaluating the drift risk of sprayers operating in stable wind conditions during field experiments. A test bench was developed to measure drift potential generated by boom sprayers. Comparisons between the bench test system and ISO methodology were made using a conventional boom sprayer equipped with traditional and air induction flat-fan nozzles. Treatments were done at 50, 80, and 100 cm. The results showed that the test bench method had a higher repeatability than the field test.

2007. Atmospheric loss of pesticides above an artificial vineyard during air assisted spraying.

This research assessed drift while making air-assisted sprays in an artificial vineyard. Three experiments were performed to evaluate method, quantify upward movement of sprayed droplets, and investigate the influence of climatic variables on drift. Fine and very fine droplet sprays (Brighton Crop Protection Conference; BCPC) were used. Very fine sprays contributed more drift at 2.5 m above the ground (9.0 to 10.7 percent) than fine sprays (5.6 to 7.3 percent). During stable air conditions, the drift was traced along the mean wind direction over the crop. In unstable air conditions, the drift plume was larger and moved to higher levels above the crop. From this study, a statistical model (based on simple multiple regression, including droplet characteristics and climatic variables) was developed to estimate spray loss just above the crop. This method was considered suitable to quantify spray drift and to study the influence of several variables on the amount of pesticide released into the atmosphere with air-assisted sprayers.

2007. AGDISP sensitivity to crop canopy characterization.

This aerial-based evaluation of model systems was undertaken to help model users understand the effects various inputs have on system outcomes. The main objectives were to quantify (1) the effects of different crop canopy characteristics (height and canopy closure) on spray deposition and downwind movement, and (2) how the results compared to spray movement and deposition using AGDISP. Multiple trials were conducted in cotton fields at various canopy heights and growth stages. It was reported that the model actually over predicted the deposition close to the canopy when compared to field measurements. However, at higher canopy heights the model and field measurements were more closely matched. Though this is an aerial study, applicators are cautioned that the model use for applications with ground boom sprayers close to the canopy may not as accurately predict deposition, especially if the canopy is more than 80 percent closed.

2008. Field testing of a prototype recycling sprayer in a vineyard: Spray distribution and loss.

A prototype recycling sprayer was tested in a vineyard to measure spray distribution and off-target movement. A design incorporating wrap-around booms with nozzles mounted in air spouts was used in the field study. The sprayer also had a centrifugal fan to provide converging air through ducts to help transport the pesticide to the vine canopy. Vertical and horizontal air curtains were added to the rear and lower edges of the tunnel to aid in the process. The recycling device saved 32 percent of the active ingredient.

2008. A history of air-blast sprayer development and future prospects.

A historical review of air-blast sprayers was provided in this article. Sprayer designs have changed dramatically over the last several years, mainly in response to the changing size of orchard trees. It is easier to produce more uniform coverage with less drift when spraying small trees. Designs that incorporate towers, directed jets of air, and tunnels can greatly reduce airborne drift and give more uniform coverage. Applicators can better match the sprayer parameters of airspeed and direction, application volume, and droplet spectra to tree size, shape, and density.

2008. Less spray and lower chemical rates for vineyards.

A surrounding sprayer was built and evaluated to achieve more efficient applications to vineyards and orchards, thus reducing drift and runoff. The objective of the field trials was to determine if smaller amounts of spray solution with smaller droplets could impact drift and runoff. The surrounding sprayer and a conventional fan sprayer were compared, using nozzles selected to generate medium- and fine-droplet spectra. The surrounding sprayer working pressure was at half the pressure of the conventional system (6, 12 bar). Water-sensitive paper was placed in the tree canopy to measure differences at three height levels. Downwind drift was collected outside the vineyard. Sufficient coverage was measured on the collectors, with the surrounding sprayer showing better foliar coverage. Less drift was found while using the fine-sized nozzles compared to medium-sized nozzles.

2008. Adjusting air blast sprayer airflow based on tree foliage density.

This paper reports on an electromechanical system to adjust the air output from an air blast sprayer. The system used a moving air-deflector plate actuated by the sensor that determined the foliage density. Two trials were completed to evaluate this system. The first evaluated the role of the deflector plate position in modifying the air flow/penetration across trees with different foliage densities. The second measured the movement of spray droplets with varying deflector plate positions. Differences in air penetration across various tree canopy densities were found. There was also an effect on the spatial movement of droplets. The results indicated that a change in air volume could help reduce drift in orchard applications.

2008. Nozzle classification for drift reduction in orchard spraying:

The development of a nozzle classification system to identify the drift-reduction potential of spray nozzles used in fruit crop spraying was undertaken based on drop size measurements. Two nozzle types, Albuz TVI 80025 and Lechler ID 9001, formed the endpoints for the classification system. These nozzles were used to rank the volume fraction of droplets smaller than 100 microns as a drift-potential predictor. Nozzles were identified at 50, 75, 90, and 95 percent drift reduction. These nozzles were the TeeJet DG 8002, Albuz AVI 80015, Lechler ID 9001, and Albuz TVI 80025.

2008. The classification of the drift risk of sprays produced by spinning discs based on wind tunnel measurements.

This study assessed the drift potential of spinning discs using a wind tunnel as the measuring tool. Drift profiles from standard flat-fan nozzles were compared to the spinning discs. With the flat fan as the standard and using similar droplet sizes, it was reported that the spinning discs drifted much more than the flat fans. The greatest differences were measured at higher wind speeds and smaller droplet sizes. A classification system for spinning discs was proposed from this data.

2008. Estimated nationwide effects of pesticide spray drift on terrestrial habitats in the Netherlands.

This paper reports on an evaluation in the Netherlands using field trials to estimate the effects of drift on different species groups at various distances from treated plots. Drift measurements were taken using standard agricultural practices to help model the deposition outside the treated area. It was determined after reviewing periods ranging from 1998 to 2010 that changing application practices during those years have reduced drift amounts. The use of narrow, unsprayed buffer zones was considered a major factor in reducing drift. It was also reported that extending the width of the buffer area would have an even larger impact on reducing the amount of deposition outside the treated area.

2008. Role of hedgerows in intercepting spray drift: Evaluation and modeling of the effects.

This study evaluated the use of hedgerows as a way to reduce drift from air-assisted sprayers into surrounding, untreated areas. This Italian study considered three hedgerow scenarios – zero, single, and double hedgerow – with the sprayers working parallel and perpendicular to the hedgerow, releasing spray at 1 to 2 m. The hedgerows 7 to 8 m high proved effective in reducing drift from 82 to 97 percent. The presence of a double hedgerow did not change the level of drift reduction.

2008. Measures to reduce pesticide spray drift in a small aquatic ecosystem in vineyard estate.

A study was conducted to evaluate the effect of buffer zones and tree row buffers on reducing pesticide drift into bodies of water while spraying vineyards. It was determined in the study that spray drift occurred over a distance of 24 m and that the use of tree rows in front of a body of water downwind from the application greatly reduced spray drift. It was also reported that when the data in this experiment was compared to the Drift Calculator procedure (model), the model failed when the procedure was used for short distances.

2008. Low level atmospheric temperature inversions and atmospheric stability:

This study examined inversion periods for strength, time of occurrence, and duration. During the monitoring period, stable and very stable atmospheric conditions (which are responsible for most drift) mostly occurred between 6:00 p.m. and 6:00 a.m. About half of the monitored inversions occurred after 4:00 p.m. unstable conditions tended to dominate between 6:00 a.m. and 6:00 p.m. Thus, applicators should take extreme caution when spraying in the very early morning (before 6:00 a.m.) and in the evenings, particularly when wind speeds are below 2 m/sec.

2008. Influence of micrometeorological factors on pesticide loss to the air during vine spraying:

Data analysis with statistical and fuzzy models. Measuring spray drift losses over vine crop applications made with air-assisted spray systems were evaluated using linear multiple regression and fuzzy logic inference models. Fine and very fine sprays were tested, with the significant variables for multiple regressions being wind speed, air temperature, and wet bulb depression. For the very fine sprays, atmospheric stability was also significant. Spray losses were predicted using fuzzy inference systems with high determination coefficients. In summary, both analysis tools can be combined with mathematical modeling to evaluate air pollution and spray drift from field tests.

2008. Field experiment on spray drift: Deposition and airborne drift during applications to a winter wheat crop.

This group performed field experiments to evaluate techniques to measure spray deposition and airborne drift during conventional boom sprayer applications to winter wheat. Various horizontal collectors and positions were compared along with both passive and active air-sampling techniques to measure airborne deposits. The experimental findings showed little variation in sampling technique. When compared to estimates of spray deposits using the IMAG Drift Calculator, the findings agreed only for areas located 0.5 to 4.5 m from the last nozzle. There was a four-fold overestimation of the drift at 2 to 3 m. Thus, it was concluded that the calculator had a high level of uncertainty for deposition at close distances.

2008. Influence of spray additives on droplet evaporation and residual patterns on wax and wax-free surfaces.

Comparisons of evaporation times and the wetted area of single droplets were measured under different relative humidity conditions in a controlled laboratory setting. The spray mixtures used to form the droplets included different combinations of water, a polymer drift retardant, a surfactant, and two insecticides. The evaporation was investigated on the surface of crabapple leaf surfaces using hydrophilic and hydrophobic glass slides. Adding surfactants into the spray mixtures greatly increased the droplet wetted area and reduced the evaporation time. Adding the drift-retardant material into the spray mixture slightly increased evaporation time and decreased the droplet coverage area. Increasing the relative humidity also increased the evaporation time but had little effect on the coverage area. It was also determined that both the evaporation time and coverage area increased as the droplet size increased.

2008. An assessment of agricultural producers' attitudes and practices concerning pesticide spray drift: Implications for Extension education.

This journal article summarizes findings of a survey of agricultural producers concerning their practices and attitudes regarding pesticide spray drift. Results indicate that the growers' approaches in managing drift are diverse and complex. Growers tend to use multiple strategies to reduce drift and are flexible in their attempts to do so. Since farm profitability is a major concern, programs and regulations designed to reduce drift should emphasize cost-effective compliance.

2008. Selecting drift-reducing nozzles.

This Extension publication is a detailed discussion of the various nozzle types available to apply crop protection products. It includes excellent images and descriptions of the basic nozzle types available both to reduce drift and to maintain excellent pest control. A discussion of the basic pesticide application issues is also highlighted. A main caution expressed is that though drift is a major concern, it is also prudent to choose nozzles that will control the target pest. A key point is that one nozzle type may not be suitable for all pesticide applications.

2009. Deposition of spray drift behind border structures.

This study evaluated the effectiveness of windbreaks as a border structure to reduce drift. Initial testing was conducted in a wind tunnel using artificial screens and plastic Christmas trees. The screens reduced spray drift in the sheltered region, but significant deposition peaks were found behind the screens. These peaks indicated that though the filters reduced the wind speed and captured deposits, wind currents were still present and accelerated over the top of the screens. In field scenarios where natural windbreaks were equal to or taller than the spray nozzle release point, less drift was measured. There was more measured deposition at short distances in the natural settings compared to the artificial. However, the peaks found in the artificial settings did not occur in the natural settings.

2010. Spray model to predict deposition in air-carrier sprayer applications.

A model was developed to predict on-target deposition of spray material from air-carrier sprayers accounting for evaporation, drift, and ground deposition. The model simulates the mass dispersion of the spray material as the spray plume or cloud passes through several connected compartments in the direction of the application. The tree canopy sub model accounts for foliage distribution, which will represent the canopy resistance to spray transport and deposition. Using spray volume rate, air velocity, sprayer ground speed, target canopy distance, and canopy foliage density as input factors, multiple simulations of the model measured deposition. The results showed that target canopy distance contributed the most to the mean deposition. Spray volume rate and canopy density were also found to significantly contribute. It was concluded that the model can help spray applicators plan spray programs.

2011. An interactive spray drift simulator.

This group is reporting on the development of drift-prediction software used as a management tool to determine the effects of applying pesticides under certain operating conditions. This program links DRIFTSIM (a software program that predicts droplet movement based on size and wind speed) with a global positioning system simulator to obtain a two-dimensional drift prediction for simulated ground-based sprayers. The program was evaluated using a variety of operating conditions to determine the effects on drift deposition levels. The results show the importance of choosing the largest nozzle orifice size, operating under lower wind speeds, and spraying at the lowest possible boom height. Using the model to simulate multiple swath applications showed patterns of increased and reduced application rates due to spray drift.

Changes that we have made in this spray cart is:

- We have prepared a tank that can accommodate 30Litre of substance
- We have prepared a multipurpose spray cart which can store liquid pesticide, liquid fertilizer and water
- We have made some space to place your equipment that related for farming
- Didn't need to shoulder the spraying tank while only need to push it.

First truckload of vineyard sprayers leaves for Cracker Holdings, SA in 1975

Figure 3.2.1

UV-stabilized polyethylene linkage tanks introduced in 1976

Figure 3.2.2

Silvan introduces the Turbo miser Low Volume sprayer to the Australian market in 1983

Figure 3.2.3

Polytuff UV-Stabilized polyethylene tanks are released for all the Silvan trailed sprayers in 1985

Figure 3.2.4

CHAPTER 4

METHODOLOGY

4.1 INTRODUCTION

Organizing is combination of two or more workers together to achieve the objective or goal. Organizing terms can be defined as coordination of organization resource with the effective method to achieve the planning objectives. Organizing is determined the task and role needed for people in a group. Organizing also is one of the management ethics or functions after planning. The function of organization determined that they have relate between thicker and planned with the way using to achieve the planned goals. In a team, we need a systematic and complete successfully.

To ensure the project can be finished in the given time, one planning schedule (Gantt chart) were created and all the members must do their given task depending on the chart. Each group members given their task and they have to completely understand what they have to do, so that the work or task given can be completed efficiently without no error under the given schedule (Gantt chart).

4.2 PROJECT METHODOLOGY AND DEVELOPMENT

To ensure our project run as what we planned, we must use the correct appliance to picture clearer illustration and idea about our project. The appliance that we use while completing this project is given below. These are the equipment's.

1. MIG welder

Figure 4.2.1 MIG welder

Gas metal arc welding (GMAW), sometimes referred to by its sub types metal inert gas (MIG) welding or metal active gas (MAG) welding, is a welding process in which an electric arc forms between a consumable wire electrode and the work piece metal(s), which heats the work piece metal(s), causing them to melt and join.

2. Steel cutting saw

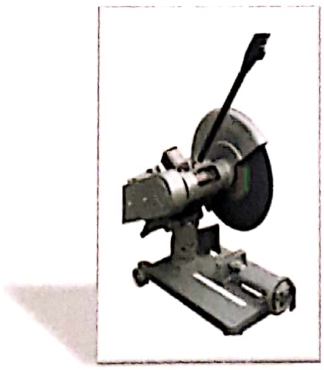


Figure 4.2.2 Steel cutting saw

An abrasive **saw**, also known as a cut-off **saw** or **chop saw**, is a power tool which is typically used to cut hard materials, such as metals, tile, and concrete. The **cutting** action is performed by an abrasive disc, similar to a thin grinding wheel.

3. Glove

Figure 4.2.3 Glove

A glove is a garment covering the whole hand. Gloves have separate sheaths or opening for each finger and the thumb, if there is an opening but no (or a short) covering sheath for each finger they are called fingerless gloves. Fingerless gloves having one large opening rather that individual opening for each fingers are sometimes called as gauntlets. Gloves which cover the entire hand or fist but do not have separate finger openings or sheaths are called mittens. Mittens are warmer than gloves made of same materials because finger maintain their warmth better when they are a contact with each other. Reduced surface area reduced heat loss. Gloves protect and comfort our hands against cold and heat, damage by friction, abrasion or chemicals and disease or in turn to provide a guard for what a bare hand should not touch.

4. Welding helmets

Figure 4.2.4 Welding helmets

Welding helmets are most commonly used with arc welding processes such as shielded metal arc welding, gas tungsten arc welding, and gas metal arc welding. Welding helmets can also prevent retina burns, which can lead to a loss of vision.

5. Welding goggles

Figure 4.2.5 Welding goggles

Welding goggles provide a degree of eye protection while some forms of welding and cutting are being done. They are intended to protect the eyes not only from the heat and optical radiation produced by the welding, such as the intense ultraviolet light produced by an electric arc, but also from sparks or debris.

6. Meter tape

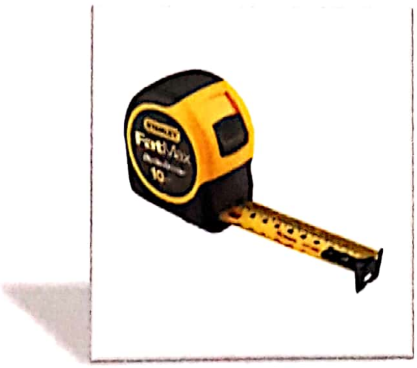


Figure 4.2.6 Meter tape

A tape measure or measuring tape is a flexible ruler and used to measure distance. It consists of a ribbon of cloth, plastic, fiber glass, or metal strip with linear-measurement markings. It is a common measuring tool. Its design allows for a measure of great length to be easily carried in pocket or toolkit and permits one to measure around curves or corners. Today it is ubiquitous, even appearing in miniature form as a keychain fob, or novelty item. Surveyors use tape measures in lengths of over 100m (300+ ft.).

7. Water pump

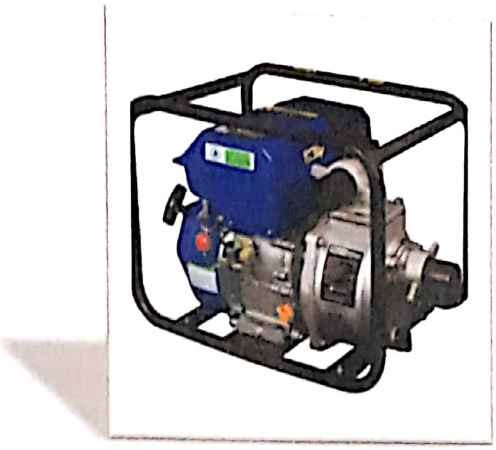


Figure 4.2.7 Water pump

Water pumps are simple devices. They force coolant through the engine block, hoses and radiator to remove the heat the engine produces. It is most commonly driven off the crankshaft pulley or in some cases the pump is gear-driven off the crankshaft. At the jet, the increase in water velocity creates the partial vacuum that draws standing well water into the second pipe and then back into the pump and plumbing system. Deep-well jet pumps use both the suction at the jet to bring water into the system and pressure applied by the impeller to lift the water.

8. **Hollow stainless steel bar**

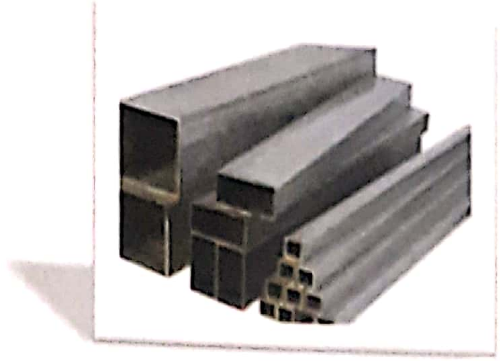


Figure 4.2.8 Hollow stainless steel bar

Rectangular hollow sections or rec tubes are cold formed and welded from either hot rolled, cold rolled, pre-galvanized or stainless steel. In order to form the rectangular steel section the appropriate mother tube, a round steel tube, has to be formed first. From a round tube rolls are used that progressively press the round tube into a rectangular hollow section. This is all done inline. For example: A round tube with an outside diameter of 101.6 is pressed into an 80x80 square tube.

9. **Hand Drill**

Figure 4.2.9 Hand Drill

A drill is a tool fitted with a cutting tool attachment or driving tool attachment, usually a drill bit or driver bit, use for boring holes in various materials or fastening materials together with the use of fasteners.

10. Screw driver

Figure 4.2.10 Screw Driver

A screw driver is a simple tool, manual or powered, for turning (driving or removing) screws. A typical simple screwdriver has a handle and a shaft, and a tip that the user insert into the screw head to turn it. The shaft is usually made of tough steel to resist bending or twisting. Handle are typically wood, metal or plastic and usually hexagonal, square or oval in cross-section to improve grip and prevent the tool from rolling when set down.

11. Grinder Flap Discs

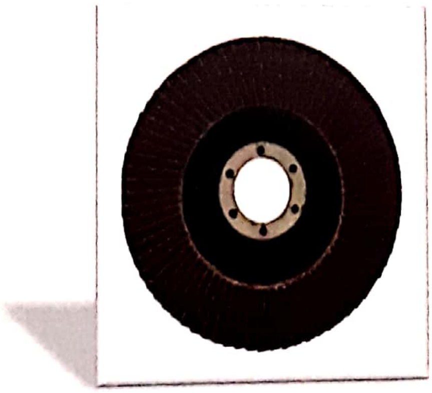


Figure 4.2.11 Grinder Flap Discs

A flap wheel and the related flap disk is an abrasive disk, used for metal finishing. Unlike the simpler flat disks, made from a circular flat sheet of a coated abrasive, a flap wheel is made of multiple overlapping small pieces or 'flaps', bonded to a central hub.

12. Angle grinder

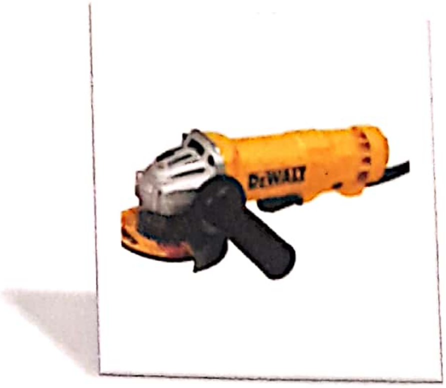
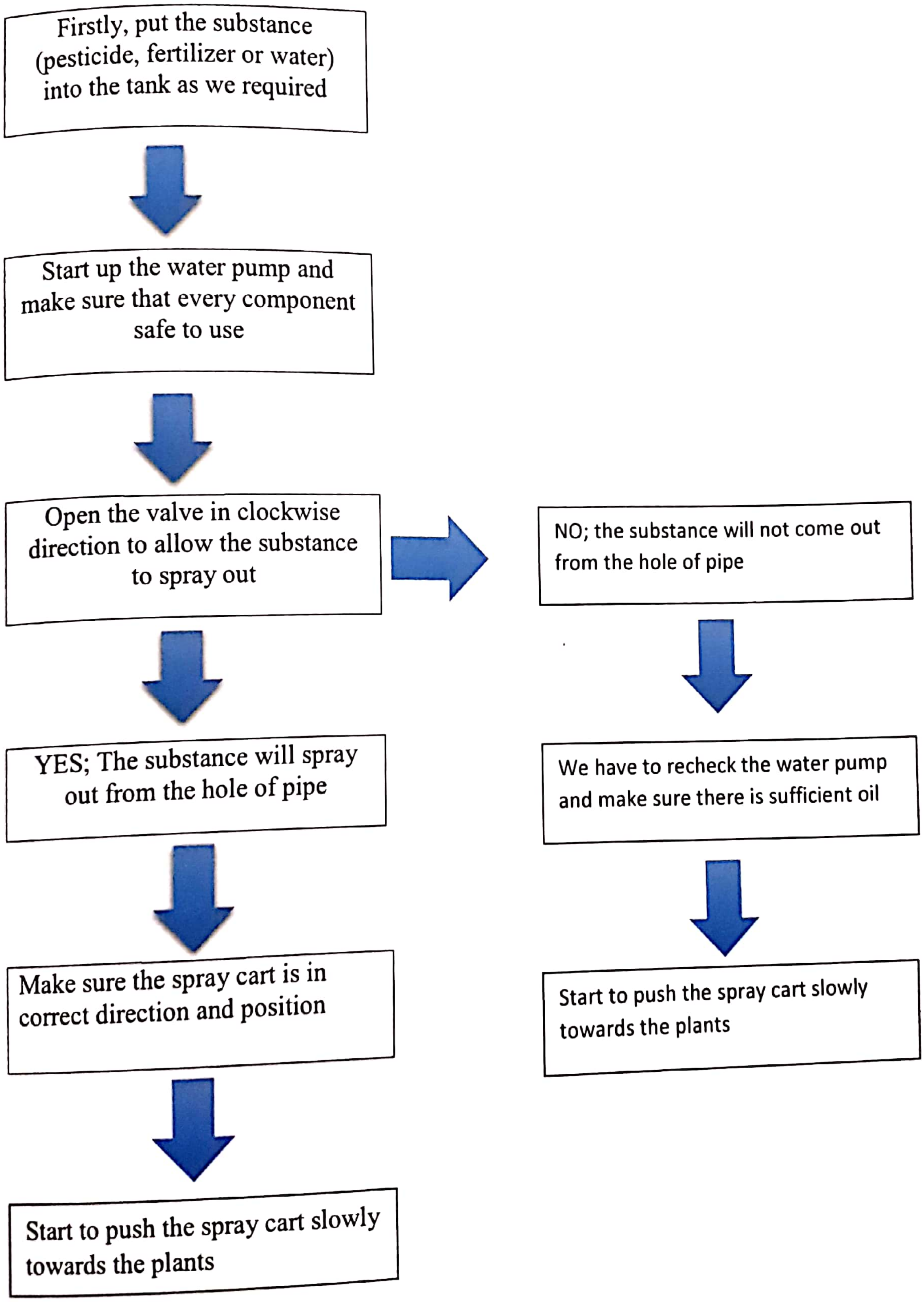


Figure 4.2.12 Angle Grinder

An angle grinder, also known as a side grinder or discs grinder is a handheld power tool use for cutting, grinding and polishing materials.

4.3 FLOW CHART



4.4 PROCESS DESIGN

4.4.1 INTRODUCTION TO PRODUCT DESIGN

The engineering design process is a multi-step process including the research, conceptualization, feasibility, assessment, establishing design requirements, preliminary design, details design, production planning, tools design and finally design whole of project. The section to follow are not necessarily steps in the engineering design process, for some tasks are completed at the same time as other tasks.

4.4.2 DESIGN DETAILS

1. External dimension
2. Maintenance and testability provision
3. Material requirements
4. Reliability requirements
5. External surface treatments
6. Design life
7. External marking
8. Safety of product

a) Factor of design

- Design factor is important aspect in the production of the product.

b) Main function

- Able to do job much easier, faster and simple
- Must be able to ease the user and much better than the current innovation.

c) Equipment

- Consist of mechanical parts and electrical parts.
- Must use the correct equipment to complete the project efficiently.

d) Cost

- Reasonable cost and lower overall project. Including :

1. Life
- From the research has been done, this machine can be used without any problem.

2. Security
- Material used are good and high quality and most importantly is safe.

3. Ergonomics
- Easy to use without the need of maximum energy and skilled worker.

e) Safety

- The material used must be suitable and the most be suitable and the most important thing is it safe to use and not cause harm for both human and earth. It is not harmful because the design is safe and suitable for daily use.

4.3 OTHER DESIGN FACTOR

1. Size
- The component size that used in this project is depend on the project itself. Besides, the size of project is suitable for daily use and convenient.

2. Stability
- Stability is important in this project to make it easier to use and the handle that we attach on the project make it even easy to handle.

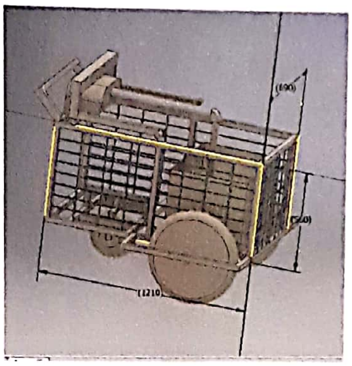
3. Structure
- The structure of our project is strong and safe because we apply the correct tool and material.

4.4 PROJECT DISCUSSION

We make several design of the project. From the design, we make a discussion on which one will be our choice to proceed for our project.

Drawing

DESIGN A



DESIGN B

Figure 4.4.1: Early design

After a discussion, we decided to choose project drawing B because it is better compare to the project drawing A. We choose design B because it is even easier to make and more ergonomics to the users. It also have water pump use to pump liquid to the hose.

4.5 PRODUCT DESIGN

ORTOGRAPHIC VIEW IN 3D

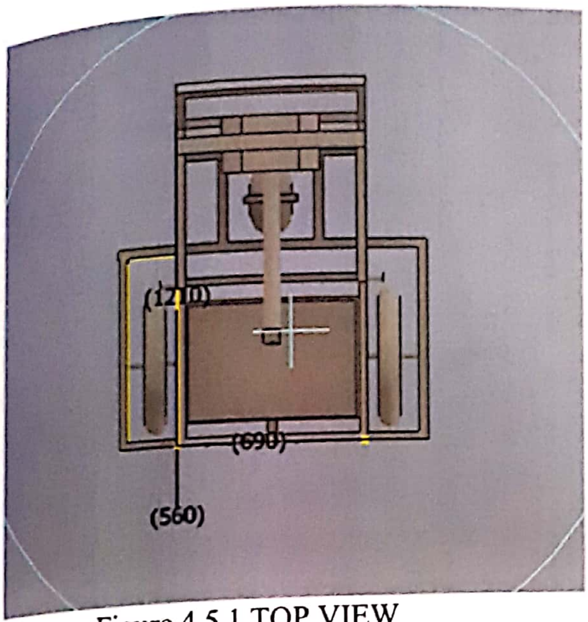


Figure 4.5.1 TOP VIEW

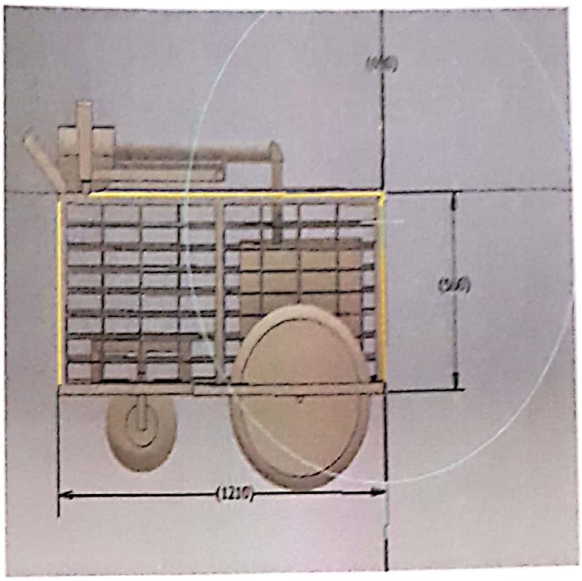


Figure 4.5.2 SIDE VIEW

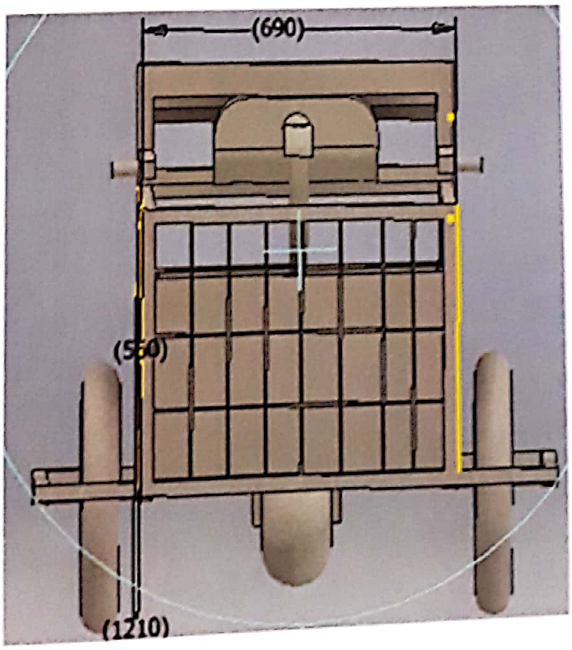


Figure 4.5.3 FRONT VIEW

2D VIEW OF THE PRODUCT

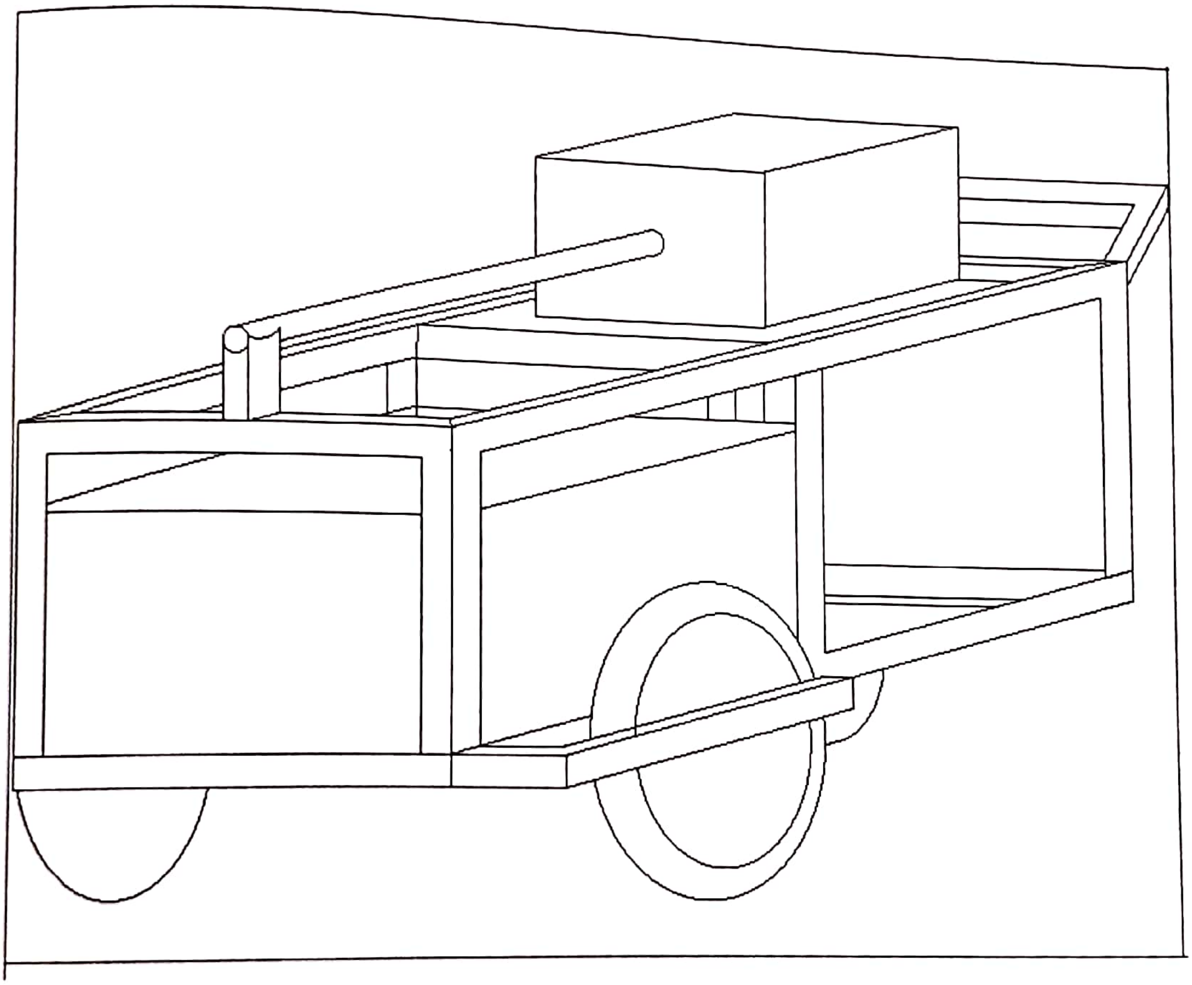


Figure 4.5.4

4.6 COST OF MATERIALS

NO	COMPONENT	SPECIFICATION	QUANTITY	COST/1	COST
1.	Side	Steel grill 80cm x 35cm x 37cm	5	RM 18	RM 90
2.	Cart body	Stainless steel (hollow bar)	2	RM 30	RM 60
3.	Tank	30 liter water tank	1	RM 25	RM 25
5.	Poly pipe	3 m	3	RM 3.50	RM 10.50
6.	Spray Paint	Black color	1	RM 5.60	RM 5.60
7.	Sandpaper	–	3	RM 0.57	RM 1.70
8.	Wheels	Diameter 8 Inch	4	RM 12	RM 48
9.	Cable ties	–	12	RM 0.70	RM 8.40
10.	Water pump	–	1	RM 380	RM 380
11.	PP Equal Bend	25mm x 25mm	4	RM 4.80	RM 19.20
12.	PP Female TEE	25mm x ¾ mm	1	RM 6	RM 6
13.	PP END Cap	25mm	1	RM 2.50	RM 2.50
					TOTAL : RM 657

4.7 WORKING DIAGRAM

The steel were cut into several parts to make the body of the cart.

The steel were attached to each of the cart body by using MIG Welder.

The steel grill were attached to each of the cart body to add some safety to the cart.

The diagram shows one of our teammates welding the cart to add some component for the rear 360 wheel.

The water pump engine was being test to make sure nothing wrong and was ready to be installed to the cart.

After the installation of the water pump, the spraying and piping process begins

After installed the water tank, finally SPRAY CART is ready to be use.

4.8 GANNT CHART

ACTIVITY	WEEKS														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Group Discussion	■														
Search Workshop		■													
Material Analysis			■	■											
Equipment and Material Preparation					■										
Produce Project						■	■	■							
Poster and Slide preparation									■	■					
Analysis											■				
Preparation of Business Canvas												■			
Testing													■	■	
Final Presentation															■

CHAPTER 5

DISCUSSION AND ANALYSIS

5.1 RESEARCH METHOD

Refer to the method or techniques use in performing research information.

- FIELD RESEARCH

MECHANICAL ENGINEERING DEPARTMENT SULTAN SALAHUDDIN ABDUL AZIZ SHAH POLYTECHNIC

QUESTIONNAIRE

Dear respondents,
We are fifth semester student pursuing a Diploma course in Mechanical Engineering at Sultan Salahuddin Abdul Aziz Shah Polytechnic Selangor. We are conducting a survey to complete a PROJECT 2. The purpose of the survey is to find out how farmers spray herbicide, pesticide or fertilizer on their crops.

- It is easy for you to spray your crops using your current method?
- How long did it takes for you to complete spraying herbicide, pesticide or fertilizer for your whole farm in a day?
- How often you spray your crops in a month?

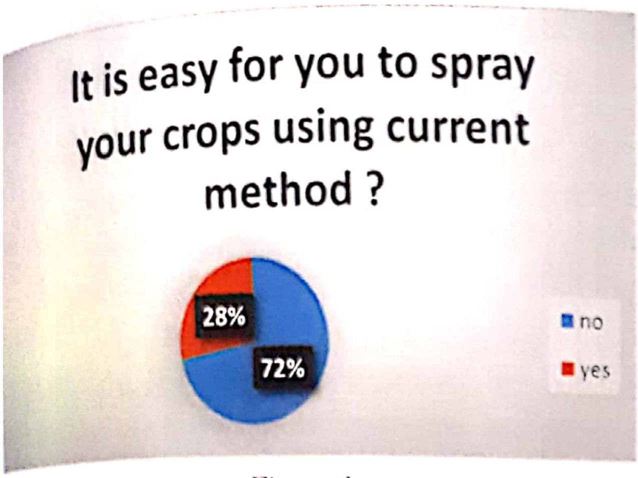


Figure 1

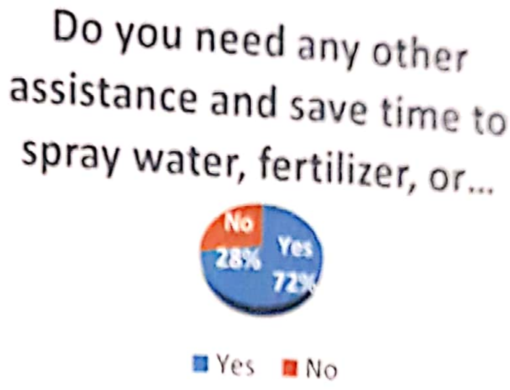


Figure 2

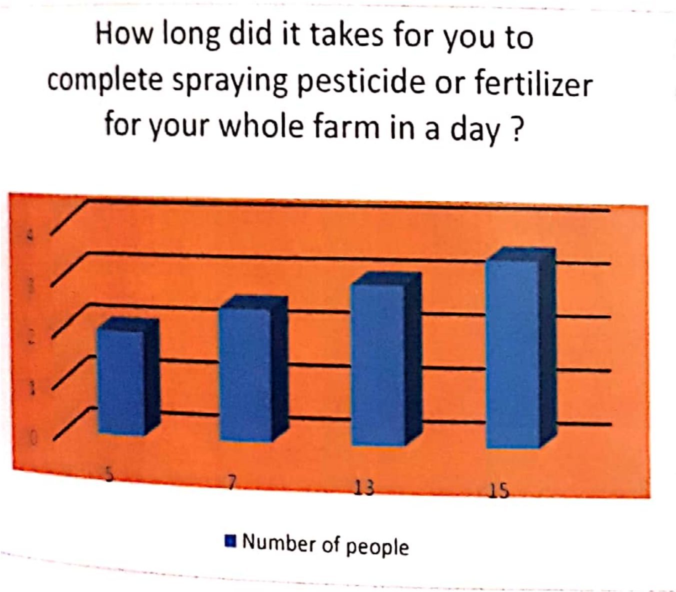


Figure 3

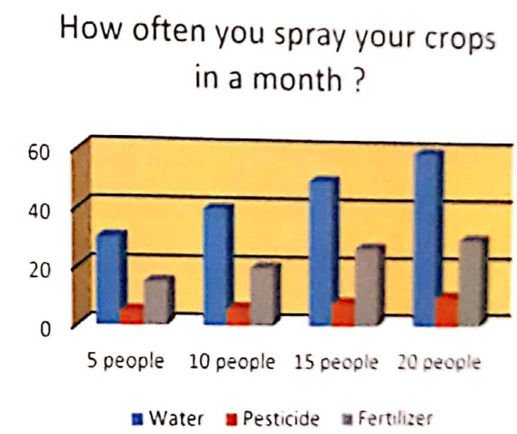


Figure 4

6.0 CONCLUSION AND RECOMMENDATION

During the final year projects, we as a group member has gain experience and knowledge that is useful to accomplished the task given. With the completion of this final year projects, it can generate students thinking skills to be more creative and innovative. This is because "SPRAY CART" is able to be operated manually. The use of human energy can be saved with a simple control method.

This "SPRAY CART" is expected to be used as proof of our passion and knowledge in producing machines in the field of agriculture. Safety function and long-term health is also very focused in our project so as not to endanger and harm consumers.

Based on the objectives that have been submitted previously, the conclusion of this project is a very useful invention. In conclusion, we can know the difference between poison and methods trolley bag inflators. Here it can be concluded that the project has achieved the desired objectives. We hope that if the project is approved, we will be able to produce cart that can be used to spray or water to the plant.

For further improvement of our project which is 'Spray Cart', our group made a several recommendation to even ease the burden of the farmer. First, about the capacity of the project after the load is inserted. Workers can add with bring on extra liquid in the cart. Secondly, the safety or comfort of the 'Spray Cart'. For example, user can use additional cushion to wrap or place at the handle to give more comfort ability while handling it.

7.0 REFERENCES

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