Efficient Comparison of Series and Parallel Pumps to Support Oil Palm Nursery Activities

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Abstract. This research was conducted to obtain a comparison of the efficiency of using a pump concerning the final results, namely in the form of pressure and discharge, so that it can be used for watering oil palm seedlings that are far from water areas and difficult terrain. Based on the results of research that has been carried out, the position of the series pump arrangement can increase water pressure, while the position of the parallel pump arrangement can increase water discharge. In the series pump arrangement, the pressure was 14.22 psi and the discharge was 0.0308 m3/s, while in the parallel pump arrangement the pressure was 9.08 psi and the discharge was 0.0354 m3/s. Installation of series pumps can increase pressure by 56% compared to parallel pump arrangement, while the discharge efficiency is 15% with parallel arrangement.

Keywords: Pump, Series, Parallel.

1. INTRODUCTION

A plantation company is a company in the form of a business entity/legal entity which is engaged in cultivating plantation crops on land it controls, with economic/commercial purposes, and has obtained a business permit from the authorized agency in granting plantation business permits [1].

Soil health is an important aspect of achieving sustainable agriculture or palm oil. Various efforts can be made to increase soil productivity to support plant growth and productivity. One effort that can be made is by using plant growth-promoting bacteria better known as plant growth-promoting bacteria (PGPB) [2].

The growth of oil palm seedlings is influenced by shade and watering frequency. The shades that are often used are paranet and plastic. Paranet can reduce the light intensity required by plants directly, and can also increase humidity. The amount of water needed for oil palm seedlings is very necessary to support growth, so it is necessary to know the duration of shade and the frequency of watering that is effective for the growth and development of oil palm seedlings. [3]

A pump is a machine that is used to move fluid from one place to another, namely from a place with a low surface to a place with a higher surface or to move fluid from low pressure

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to higher pressure by passing through a long and resistant piping system. very large hydraulics [4]. The pump operates by creating a pressure difference between the suction section and the discharge section, by converting mechanical energy from a power source into fluid energy, where this energy is used to flow the fluid and to overcome obstacles along the flow [5].

In general, pumps are used for:
1. Moving fluids from low places to higher places.
2. Increase the pressure of the fluid.
3. Increase the flow speed of the liquid.
4. Moving more fluids over a certain period

The pump receives mechanical power which is generally in the form of rotation produced by a driving motor so that it can move liquid fluid from a low place to a higher place. If the required pump head or capacity cannot be achieved using just one pump, then you can use two or more pumps which can be arranged in series or parallel, therefore special attention is needed to operate the pump by checking the condition and capacity of the pump.[6].

Based on the discussion above, a way is needed to increase the watering of oil palm seedlings so that it can increase the productivity of oil palm seedlings.

2. MATERIAL AND METHOD

Before carrying out the experimental process, you must determine the flow diagram according to the analysis that will be carried out starting from design to conclusion as in the picture below.

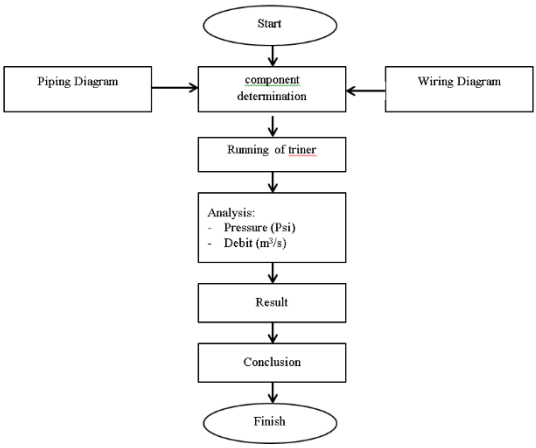

Fig. 1. Flow Chart

In this experimental process, an analysis will be carried out of the results of pump arrangement in series and parallel. The water will be sucked in by two pumps which will be arranged in series and parallel as in the following picture.

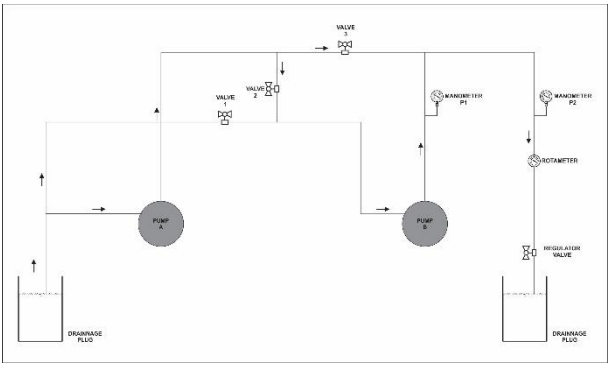

Fig. 2. Piping diagram for series and parallel pump arrangement

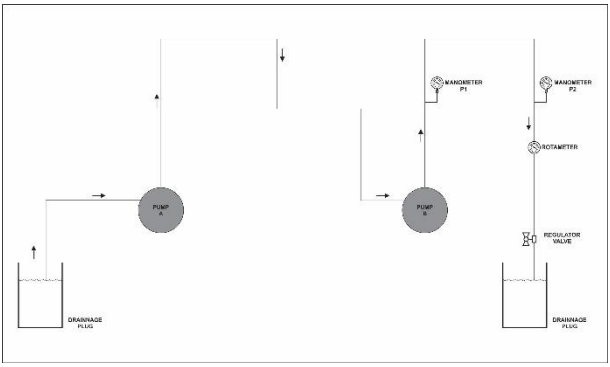

Fig. 3. Piping diagram for series pump arrangement

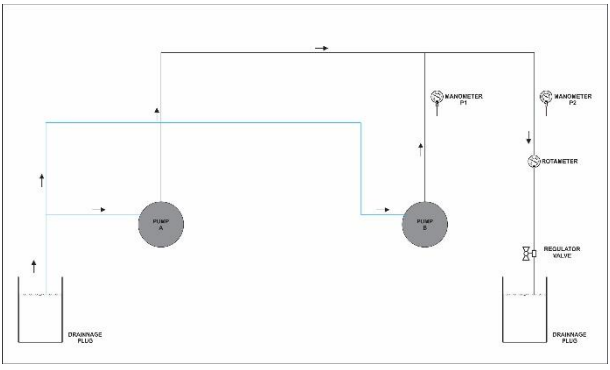

Fig. 4. Piping diagram for parallel pump arrangement

By using a pump arrangement in series and parallel, water comparison results will be obtained both in terms of water flow and pressure. The time used is 20 seconds to obtain results by varying each nozzle on the pipe. This is done to provide the right solution for cultivating oil palm seeds far from water sources and difficult terrain.

3. ANALYSIS

To obtain the flow and pressure results, basically use the following equation:

$$Q=\frac{v}{t} \quad (1)$$

Where:

Q	=	Flow	(m^3/s)
v	=	Volume	(m^3)
t	=	Time	(s)

$$P = \rho . g . H \quad (2)$$

Where:

P	=	Pressure	(Psi)
ρ	=	Water density	(kg/m^3)
g	=	Grafity	(s)
H	=	Head	(m)

4. RESULT AND DISCUSSION

Based on the results of the simulation that has been carried out, the following results are obtained:

Table 1. Pressure and discharge results in series and parallel pump circuits

Valve (%)	Time (second)	Series		Parallel	
		Pressure (Psi)	Debit (m^3/s)	Pressure (Psi)	Debit (m^3/s)
100	20	5,14	0,0353	4,9	0,0471
75	20	6,32	0,0339	5,14	0,0459
50	20	8,44	0,0329	5,84	0,0454
25	20	14,22	0,0308	9,08	0,0354

The table above is the result of data obtained from setting up pumps in series and parallel positions with valve opening variations of 100%, 75%, 50% and 25%. Based on the data obtained, it can be seen that the pressure increases more in the pump position in the series arrangement, while the discharge increases in the parallel pump arrangement.

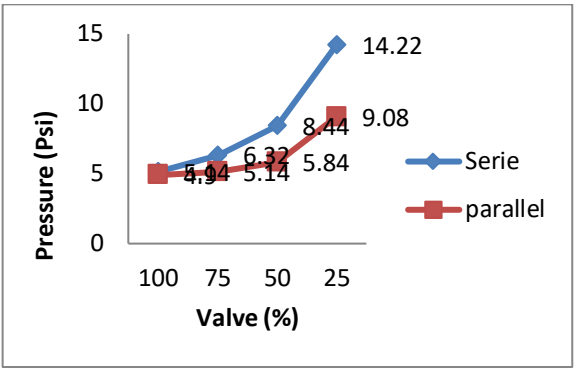

Fig. 5. The result of pump pressure on pump position

Based on the picture, it can be seen that the series pump produces greater pressure, especially at 25% valve opening where the water pressure reaches 14.22 Psi.

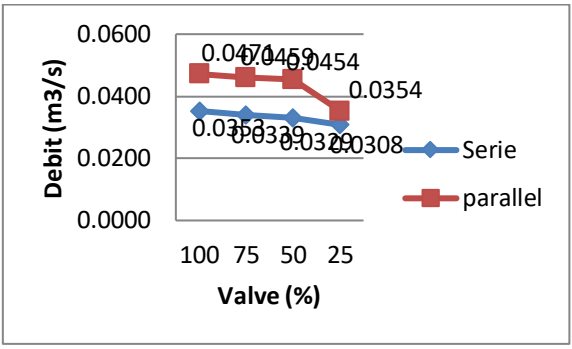

Fig. 6. Results of pump discharge against pump position

Based on the picture, it can be seen that the parallel arrangement pump produces a larger discharge, especially at 100% valve opening where the water discharge reaches 0.0471 m3/s.

5. CONCLUSION

Based on the results of the research that has been carried out, it can be concluded that series pumps will increase water pressure, while parallel pumps will increase water flow. Within 20 seconds the maximum pressure obtained in the series pump arrangement was

14.22 Psi and the maximum discharge obtained in the parallel pump arrangement was 0.0471 m3/s.

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