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Hydrogel Plus as Alternative Technology In Sustainable Oil Palm Agriculture

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ABSTRACT

Palm oil (*Elaeis guineensis* Jacq.) is one of the most important plantation crops in the agricultural sector. However, during the dry season the production of palm oil is decreasing, due to the reduced availability of water especially on peatlands. One way to overcome this problem is by the use of Hydrogel Plus technology (hydrogel base bagasse with the addition of *Pseudomonas fluorescens*). This study aimed to determine the role of Hydrogel Plus (hydrogel with the addition of *Pseudomonas fluorescens*) to the growth and production of oil palm on the peat during the dry season. The method used in this research is the experimental method using Completely Randomized Design. Treatment was done by 4 treatments and each treatment was repeated 5 times, so the experimental unit amounted to 20 units. The treatments include (P1) Control, (P2) hydrogel application (P3) application of *Pseudomonas fluoresces* suspension and (P4) Hydrogel Plus applications. Based on the result of the research, it can be concluded that hydrogel administration with the addition of *Pseudomonas fluorescens* bacteria tends to have a significant effect on leaf diameter, leaf number, and height of plant at each treatment; only at plant height on treatment of *Pseudomonas fluorescens*; and only hydrogel treatment which has no real effect. Utilization of Hydrogel Plus can provide effect to oil palm plant growth and production, to be a specific effort as an alternative technology in sustainable oil palm management in peatlands during dry season.

Keywords: Hydrogel plus, palm, peatland, *Pseudomonas fluorescens*

INTRODUCTION

Palm oil (*Elaeis guineensis Jacq*.) Is one of the most important plantation crops in the agricultural sector. This is because palm oil is able to generate the greatest economic value per hectare compared to other oil or fat producing plants. However, in the dry season, the production of oil palm is decreasing due to the lack of water availability especially in the peatlands (Sunarko 2007). Peatland is a land with water saturated soil, formed from sediments derived from the accumulation of residues of ancient tissue that decay, with a thickness of more than 50 cm (Harni *et al.* 2012). In the rainy season the water content in the peatlands will be fulfilled, while in the dry season peatlands will deficit of water. The water deficit will result in a decrease in palm oil production. To overcome this, it requires specific handling

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and environmentally friendly method with the use of Hydrogel Plus technology (hydrogel base bagasse with the addition of *Pseudomonas fluorescens*). Hydrogel Plus is a hydrogel added with *Pseudomonas fluorescens* which has been proven can absorb and release water depending on external stimuli, such as the pH, humidity, temperature, and environmental stresses around it. In general, hydrogels are able to absorb distilled water up to 500 times the weight of the dry volume (Tung and Lori 1990). The application of hydrogels on farmland has been proven to increase the retention of groundwater because the water wasted outside the root zone is capable of being absorbed by the hydrogel material, and can then be reused up to 95% of the water stored in this material (Jhurry 2008). The content of *Pseudomonas fluorescens* bacteria in hydrogels is also capable of spurring growth and production of oil palm because the bacteria have properties as plant growth promoting rhizobacteria (PGPR) that produce indoleacetic acid (IAA) hormones and produce auxin, gibereline and cytokinin hormones, which will spur and promote growth plants and produce pseudobactins that can increase induced systemic resistance (Susanto 2008). Based on the above background, it is necessary to research about hydrogel plus in sustainable cultivation of oil palm, especially in the peat land during dry season. This research aimed to find out the role of Hydrogel Plus (hydrogel made from sugar cane with *Pseudomonas fluorescens*) to growth and production of oil palm on peatland during dry season.

MATERIALS AND METHODS

The making of Hydrogel Plus was held at the Plant Disease Laboratory of the Faculty of Agriculture, Riau University, Pekanbaru. Application of Hydrogel Plus was carried out at UPT Experimental Garden of Faculty of Agriculture of Riau University, Pekanbaru. This research was conducted for 2 months. This study used Hydrogel Plus (hydrogel with addition *Pseudomonas fluorescens*) in the form of granules that applied directly to oil palm plants for approximately 40 days. The method used in this research is the experimental method using Completely Randomized Design. Treatment was done by 4 treatments and each treatment was repeated 5 times, so the experimental unit amounted to 20 units. The treatments given were P1= Control, P2= Hydrogel application treatment, P3= Treatment of *P. fluorescens* application, P4= Treatment of hydrogel applications with the addition of *P. fluorescens.*

Data obtained from this study was analyzed by statistical analysis of two ways analysis of variance (ANNOVA) with the help of statistical package for social science program (SPSS for Windows Version 16.0). If the results obtained were significantly different, then it was proceed by Duncan test at 5% confidence level to see the influence of each treatment.

RESULTS AND DISCUSSION

Table 1 showed that Hydrogel administration with the addition of *Pseudomonas fluorescens* bacteria tends to have a significant effect on leaf diameter, leaf number, and height of plant at each treatment, and only at plant height on treatment of *Pseudomonas fluorescens,* and hydrogel treatment which has no significant effect. This may be suspected because the application of hydrogels on farms has proven to increase the retention of groundwater because the water wasted outside the root zone is absorbed by the hydrogel material and can then be reused up to 95% of the water stored in this material (Jhurry 1997). In addition, hydrogel applications are also able to increase soil moisture, lower water stress, which then improve the performance of plant growth. The addition of bacteria *Pseudomonas fluorescens* to hydrogels is also very beneficial because *P. fluorescens* has properties as bacteria that increase plant growth. This bacteria has properties as plant growth promoting rhizobacteria

Table 1 Result of height plant, leaf number, and leaf diameter

Treatment	Height Plant	Leaf Number	Leaf Diameter
P1	32.39[b]	4.60[b]	1.76[c]
P2	35.20[ab]	4.60[b]	1.84[bc]
P3	36.10[ab]	5.00[b]	2.03[b]
P4	40.00[a]	6.60[a]	2.10[a]

(PGPR) because it produces indolacetic acid (IAA). *P. Fluorescens* also produces auxin, gibberellin, and cytokinin hormones which will stimulate and increase plant growth and produce pseudobactins that can increase induced systemic resistance (Susanto 2008).

These bacteria also produce large amounts of phytohormones especially IAA to stimulate growth and stem lengthening in plants (Rao 1994). *P. flourescens* living in plant roots can act as microorganisms of phosphate solvents, bind to nitrogen and produce plant growth regulators for plants so that with these capabilities *P. flourescens* can be utilized as biological fertilizers that can provide nutrients for plant growth (Ardiana 2012). The use of hydrogel main ingredients will provide a positive advantage in the cultivation of oil palm plants because it is able to store water 200 times its weight so it is suitable to be applied in peatland that experienced drought during the dry season. Hydrogels made with the addition of *P. fluorescens* bacteria will be active after application in the field.

CONCLUSION

Administration of hydrogel with the addition of *Pseudomonas fluorescens* bacteria tends to have a significant effect on leaf diameter, leaf number and plant height at each treatment, and only at plant height in treatment of *P. fluorescens* and hydrogel treatment alone which has no significant effect. From the results of the study, it can be concluded that Hydrogel Plus (hydrogel with the addition of *P. fluorescens*) have a potency and important role in increasing the growth and production of oil palm in the peat season during the dry season.

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