



The Influence of Microbia Time and Types of PGPR on Growth of Soybean Plant (*Glycine Max Meril*) on Vegetative Phase

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Abstract:

This research was conducted in the Experimental Garden of the Faculty of Agriculture, Jabal Ghafur Glee Gapui University, Pidie Regency, which took place from September 16 to November 15, 2017. This study used a Completely Randomized Design (CRD) of 2 x 3 with 3 replications. The time factor for administration consists of 2 levels : W1 (Pagi), W2 (Sore). Plant Growth Promoting Rhizobacteria (PGPR) type factors consist of three levels: P1 (Rhizobium), P2 (Mikoriza), P3 (Mikoriza + Rhizobium). Parameters observed in soybean plant components include: plant height at ages 15, 30 and 45 HST, root fresh weight, root dry weight, number of nodulations. The difference in the time of administration of PGPR has a very significant effect on root dry weight, but it does not significantly affect the height of plants aged 15, 30 and 45 HST, root fresh weight, root length and number of root nodules, the best treatment was encountered at the time of administration of PGPR W2 (Afternoon). Different types of PGPR have very significant effect on root length and number of nodulations, but no significant effect on plant height aged 15, 30 and 45 HST, root fresh weight and root dry weight. The best treatment was found in the treatment P1 (Rhizobium). There was no interaction between the time of administration of the PGPR and the type of PGPR against all observed parameters.

Keywords:

microbia time; types of pgpr; soybean plant; vegetative phase

I. Introduction

One type of food crops that can be developed in dry land is soybean (*Glycine max Meril*), it's just that the limitation factor of soil fertility is an obstacle that needs attention in its management. Some conventional agricultural practices with high inputs on dry land cannot be maintained, this reality requires a solution to overcome these problems so that soybean crop production can be increased, on the other hand its sustainability is guaranteed in the long term (Atman, 2006). Drought stress is a major environmental factor affecting leaf growth, roots, stomata content, photosynthesis and accumulation of dry matter (Zang, 2007). One of the most important structures connecting plants with the environment is stomata with guard cells found in leaf epidermis, and plays a role in tolerance to environmental changes (Schroeder et al, 2001). Furthermore Maghsoudi, (2008) added that drought stress is very influential on the characteristics of plant photosynthesis, this event results in photosynthesis and leaf chlorophyll content being reduced (Feng et al., 2013). The manifestation of plant responses to drought is a complex physics-chemical process and affects the formation of many large and small biological molecules such as nucleic acids, proteins, fats, hormones, free radical ions and minerals (Ingram and Bartels, 2006).

Water stress affects every phase of plant development, however damage caused by stress is more pronounced when it occurs in important growth phases such as germination,

shoot and root growth, flowering and seed formation (Rauf, 2008).

This problem can actually be overcome by utilizing microbial-based biotechnology taken from sources of biological wealth (Hanafiah et al, 2007). The microbial technology, known as biological fertilizer, is an active biological product consisting of soil-fertilizing microbes to improve fertilizer efficiency, fertility and soil health (Sarwati and Sumarno, 2008). The reasons for health and nature conservation make organic agriculture as an alternative to modern agriculture, which in essence is to manipulate biological bodies in order to play a more effective role in increasing agricultural production. In general, soybeans are planted in rice fields and dry fields, lack of water can inhibit plant growth and reduce yield. The application of mycorrhizae in plants is an effort to overcome stunted growth due to drought stress.

Biotechnology is also a solution to the need for procurement of fertilizers in a cheap and environmentally friendly way, where one of them is by the use of biofertilizers. The content of biological fertilizer is a microorganism that has a positive role for plants, a group of microorganisms that are often used are microbes that tether N from the air, microbes that dissolve nutrients (especially P and K), microbes that stimulate plant growth (Isroi, 2008).

Microbes from the group of bacteria used as biofertilizers are referred to as rhizobacteria that promote plant growth or are popularly called plant growth promoting rhizobacteria (PGPR), are groups of beneficial bacteria that aggressively "occupy" (colonize) rhizosphere (thin soil between 1-2 mm around the rooting zone). PGPR activities provide benefits for plant growth, both directly and indirectly. The direct effect of PGPR is based on its ability to provide and mobilize or facilitate the absorption of various nutrients in the soil as well as to synthesize and change the concentration of various growth promoting phytohormones, while the indirect effect is related to PGPR's ability to suppress pathogenic activity by producing various compounds or metabolites such as antibiotics and siderophore (antibiotics and siderophore) Kloepper et al., 2001).

PGPR lives in rhizospheric areas and plays an important role in plant growth, due to its ability to form colonies around roots quickly (Hasanuddin, 2003). Its functions include helping supply nutrients for plants, facilitating nutrient absorption for plants, helping decomposition of organic matter, providing a better rhizosphere environment, so that in the end it will support growth and increase crop production (Issroi, 2008). Efforts that can be made to overcome this problem are the use of mycorrhizal fungi. Mahbub (2009) states that this fungus is able to dissolve P which is difficult to dissolve by producing phosphatase enzymes and chelating compounds Al. Mycorrhizal fungi can also increase P uptake due to the presence of external hyphae that have a wide range that can accelerate the availability of P so that it will be able to increase P uptake of plants.

To get optimal growth and yield of soybean, PGPR is also greatly influenced by the right application time and according to dosage and environmental environmental factors. This is consistent with what was stated by Kelik (2010) that fertilization with the right dose and time will provide optimal results on plants, if the influence of other factors such as temperature, light, etc. are also in optimal conditions.

Based on the description above, it can be seen that the use of soil microorganisms / microbes in increasing nutrient availability is important to study, so it is necessary to conduct research on the use of plant growth enhancing bacteria to increase mycorrhizal infections, nodulation and growth of soybean plants in dry land.

II. Research Methods

The research was carried out in the experimental garden of the Faculty of Agriculture, Jabal Ghafur Sigli University, from September 16 to November 15, 2017. The materials used in this study were: as a growing media consisting of certified Anjasmoro soybean seeds, PGPR (Mycorrhiza and Rhizobium) pesticides Nara. The equipment used in this study includes polybags, hoes, sieves, rakes, scales, counters and writing instruments, other equipment that supports this research.

III. Discussion

The results of the variety analysis showed that, when giving PGPR statistically did not significantly affect the age of 15, 30 and 45 HST. But visually there are differences, especially at the age of observation at 45 days. The average height of soybean plants aged 15, 30 and 45 HST due to the time of PGPR administration can be seen in Table 2.

Table 1. Average Height of Soybean Plant Age 15, 30 and 45 HST Due to Time of Giving PGPR

Time of Giving PGPR	Plant height (cm)		
	15 HST	30 HST	45 HST
W ₁	14,74	46,09	79,50
W ₂	15,04	49,83	86,56

From Table 2 it can be seen that, the average height of soybean plants due to differences in the time of PGPR administration at all age observations was found in the W2 treatment (the time of afternoon administration) which is 15.04; 49.83 and 86.56 cm. While the lower average plants were found in W1 treatment (the time of morning administration), which was 14.74; 46.09 and 79.50 cm.

Although PGPR is given according to the needs of plants (the right application time and according to dosage), but to get optimal growth and yield is also greatly influenced by environmental factors. Consumption of plant nitrogen from nitrogen fixation occurs not at the beginning of the vegetative phase and at the end of the reproductive period, but occurs after the formation of nodules that occur due to rhizosphere colonization and rhizobia infection in the legume root (Beck et al., 2001).

IV. Conclusion

When giving PGPR has a very significant effect on root dry weight, but it does not significantly affect plant height aged 15 30 and 45 HST, root fresh weight, root length and number of root nodules.). PGPR type has a very significant effect on root length and number of nodulations, but does not significantly affect plant height aged 15, 30 and 45 HST, fresh weight and root dry weight, the best treatment is found in treatment P1 (Rhizobium). There is no real interaction between the time of the administration of PGPR and the type of PGPR against all observed parameters.

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