

## **Abundance and Potential Test of Rhizobium Isolated from Peatland for Increasing the Growth of *Acacia crassicarpa* at PT. Mayangkara Tanaman Industri**

By:  
Ummi Rosyidah

### **ABSTRACT**

Indonesia has of 13.43 million hectares of peatland, some of which have been utilized as plantation land in form of Industrial Plantation Forests. Peatlands have characteristics waterlogged landscape, anaerobic condition, a low pH, and limited nutrient availability, necessitating distinctive management approaches. To ensure optimal condition for plant growth, it is necessary to implement management strategy. Nitrogen is a limited nutrient for plants mostly obtained by fixation from the atmosphere through soil microorganisms, one of which is rhizobium. Isolation of rhizobium from peatlands is needed to reduce habitat selection so that they can be developed into biofertilizers to improve plant growth. This study aims to evaluate the population and obtain selected rhizobium bacteria to be developed as biofertilizers, and to determine their response to plant growth in the nursery.

Plantation of *A. crassicarpa* stands ranging from 1-4 age classes with a spacing of 3x2.5 meters were used in this study. For each age class, three replication of 20x20 m sample plots were established to obtain data on growth, environmental conditions, soil samples, and root nodules. Isolation was conducted from root nodules using the discontinuous streak method with pH medium treatment, while the abundance was analysed by employing the microdroplet method. The isolates obtained were characterized and tested for nodule formation for 2 months to obtain selected isolates. Six selected isolates were propagated using yeast extract-mannitol liquid media and formulated into a biofertilizer. The biofertilizer were then inoculated employing 3 shade treatments (P1, P2, and P3) with 60 replications was carried out for 3 months. The assessed parameters were the percentage of germination, percentage of survival, height, biomass, and weight of nodules.

The findings revealed that the height of *A. crassicarpa* aged 1, 2, 3, and 4 years were 4.2, 7.6, 12.7, and 12.2 m, respectively, while their corresponding diameters were 3.6, 8.3, 10.5, and 13 cm. The cultivated land has a groundwater level of 25-45 cm, a soil moisture content of 347%-580% and a bulk density of 0.064-0.101 gr/cm<sup>3</sup>. The abundance of rhizobium in peatlands ranged from 10<sup>4</sup> to 10<sup>7</sup> cfu/g soil. A total of 73 rhizobium isolates were obtained, comprising 24 isolates (KU 1), 24 isolates (KU 2), 18 isolates (KU 3), and 6 isolates (KU 4). The six selected isolates, namely isolate A (1-1-2 (5)), B (1-2-2 (5)), D (1-3-1 (5)), E (1-3-2B (5)), C (1-2-2B (6)), and F (2-1-1B (6)), demonstrated the ability to form nodules in 39-44 days after inoculation, with 6 to 11 nodules. The inoculation of isolate A, B, D, and E resulted in fairly good response in terms of plant growth, encompassing seedling height, above-ground and below-ground biomass, as well as the number of root nodules.

Key words: rhizobium, peatland, *A. crassicarpa*, nurser

## **Kelimpahan dan Uji Kemampuan Rhizobium dari Lahan Gambut untuk Peningkatan Pertumbuhan *Acacia crassiparva* di PT. Mayangkara Tanaman Industri**

oleh:  
Ummi Rosyidah

### **INTISARI**

Indonesia memiliki lahan gambut seluas 13,43 juta ha yang sebagian telah dimanfaatkan sebagai lahan pertanian dalam bentuk Hutan Tanaman Industri. Lahan gambut memiliki karakteristik berupa lahan tergenang, anaerob, pH serta unsur hara rendah, sehingga membutuhkan pengelolaan khusus. Upaya pengelolaan ini perlu dilakukan untuk memberikan kondisi optimal bagi pertumbuhan tanaman. Nitrogen merupakan unsur hara yang terbatas bagi tanaman yang sebagian besar diperoleh melalui simbiosis dengan mikroorganisme tanah salah satunya rhizobium. Isolasi bakteri rhizobium dari lahan gambut diperlukan agar lebih sesuai dikembangkan menjadi biofertilizer bagi tanaman di lahan gambut. Penelitian ini dilakukan untuk mengevaluasi populasi dan mendapatkan isolat bakteri rhizobium terpilih yang akan dikembangkan sebagai pupuk hayati, serta mengetahui pengaruhnya terhadap pertumbuhan tanaman di persemaian.

Penelitian ini menggunakan plot pertanian tegakan *A. crassiparva* KU 1 sampai KU 4 dengan jarak tanam 3x2,5 m. Pada setiap KU dibuat PU 20x20 m sebanyak 3 ulangan untuk pengambilan data pertumbuhan, lingkungan, sampel tanah dan bintil akar. Isolasi dilakukan dari bintil akar dengan metode gores dengan perlakuan pH media, sedangkan uji kelimpahan dengan metode taburan. Isolat yang diperoleh dikarakterisasi dan diuji kemampuan pembentukan bintil selama 2 bulan untuk mendapatkan isolat terpilih. Enam isolat terpilih diperbanyak menggunakan media cair *Yeast Extract Mannitol* dan diformulasi untuk menjadi biofertilizer. Inokulasi biofertilizer pada semai menggunakan 3 perlakuan naungan (P1, P2, dan P3) dengan 60 ulangan dilakukan selama 3 bulan. Parameter yang diamati meliputi persen berkecambah, persen hidup, tinggi, dan biomassa semai, serta berat bintil.

Hasil penelitian menunjukkan bahwa tinggi *A. crassiparva* umur 1, 2, 3, dan 4 tahun berturut-turut adalah 4,2; 7,6; 12,7; dan 12,2 m, dengan diameter 3,6; 8,3; 10,5 dan 13 cm. Lahan pertanian memiliki TMAT dari 25-45 cm, kadar air tanah 347% -580 % dan berat volume 0,064-0,101 gr/cm<sup>3</sup>. Kelimpahan populasi bakteri rhizobium di lahan gambut berkisar 10<sup>4</sup>-10<sup>7</sup> cfu/g tanah. Isolat bakteri rhizobium yang diperoleh sebanyak 73 isolat terdiri dari KU 1 (24 isolat), KU 2 (25 isolat), KU3 (18 isolat), dan KU 4 (6 isolat). Enam isolat terpilih yaitu isolat A (1-1-2 (5)), B (1-2-2 (5)), D (1-3-1 (5)), E (1-3-2B (5)), C (1-2-2B (6)), dan F (2-1-1B (6)) memiliki kemampuan pembentukan bintil 39-44 hari dengan jumlah bintil 6-11 buah. Inokulasi isolat A, B, D dan E memberikan respon cukup baik terhadap aspek pertumbuhan tanaman yaitu tinggi semai, biomassa atas dan akar, serta jumlah bintil akar.

Kata kunci : rhizobium, gambut, *A. crassiparva*, persemaian