

INTISARI

Penambangan batu kapur untuk bahan baku semen dengan metode penambangan terbuka meninggalkan lahan berupa lapisan batu kapur yang miskin hara, tanpa bahan organik, dengan populasi mikroba tanah sangat rendah, dan pH yang tinggi. Kondisi lahan seperti itu sangat tidak mendukung kolonisasi dan pertumbuhan vegetasi suksesi awal sehingga pemulihan fungsi lahan melalui suksesi alami akan berlangsung sangat lambat. Campur tangan manusia melalui kegiatan reklamasi diperlukan untuk mengakselerasi suksesi awal. Pembangunan pertanaman awal yang diinokulasi Fungi Mikoriza Arbuskula (FMA) merupakan intervensi dalam reklamasi yang diharapkan memberikan efek katalitik terhadap pengembalian komponen-komponen dan proses suksesionalnya. Penelitian bertujuan untuk mengidentifikasi efek katalitik pertanaman awal dan FMA terhadap proses suksesi alami di lahan bekas tambang kapur melalui 1) evaluasi terhadap kolonisasi tumbuhan alami, 2) analisis terhadap perbaikan tapak, dan 3) evaluasi terhadap perkembangan jenis-jenis sere lanjut. Penelitian dilakukan pada 4 tipe areal di lahan bekas tambang kapur yaitu: A0 (areal kondisi alami areal bekas tambang yang dibiarkan tanpa upaya reklamasi), A1 (areal yang direvegetasi dengan *cover crop*), A2 (areal yang direvegetasi dengan *cover crop* dan dilanjutkan dengan pertanaman sere berikutnya yang tidak diinokulasi FMA), dan A3 (areal yang direvegetasi dengan *cover crop* dan dilanjutkan dengan pertanaman sere berikutnya yang diinokulasi FMA). Kemunculan jenis-jenis tumbuhan alami diukur menggunakan kerapatan individu, keanekaragaman, dan kekayaan jenis melalui sampling vegetasi dengan metode plot kuadrat secara sistematis berdasarkan tipe habitusnya. Kondisi tapak diukur berdasarkan sifat biologi, kimia dan fisik tanah. Perkembangan sere diukur dengan pengamatan pertumbuhan jenis-jenis sere lanjut yang ditanam pada areal-areal tersebut dan pengamatan secara terkendali di rumah kaca. Hasil penelitian menunjukkan pertanaman awal dan inokulasi FMA terbukti mempercepat kemunculan jenis-jenis alami melalui peningkatan kerapatan individu, keanekaragaman jenis dan kekayaan jenis pada semua tipe habitus. Perbaikan tapak yang lebih cepat terjadi pada areal pertanaman bermikoriza, yang ditunjukkan dengan peningkatan sifat biologi, kimia dan fisik tanahnya. Lebih cepatnya pertumbuhan tinggi dan diameter, biomassa daun dan kadar P daun tanaman sere lanjut (*Alstonia scholaris* dan *Tectona grandis*) yang ditanam di areal pertanaman bermikoriza menunjukkan tapak yang tercipta mampu memfasilitasi pergantian sere berikutnya. Selain itu, peran FMA dalam mempercepat perkembangan sere lanjut dapat ditingkatkan oleh adanya akumulasi bahan organik dan fiksasi N. Secara keseluruhan, hasil penelitian disertasi ini menjelaskan bahwa fasilitasi tapak tidak hanya mendukung perkembangan komunitas biotik selanjutnya, tetapi juga mempercepat kehadiran semua jenis sere secara lebih awal dan pergantian sere, sehingga akselerasi suksesi alami di lahan bekas tambang kapur dapat terjadi.

Kata kunci: suksesi alami, fungi mikoriza, tambang kapur, tapak aman, efek katalitik

ABSTRACT

Limestone mining for the production of cement with an open-pit mining method leaves the land with rock layers of nutrient-poor limestone, no organic matter, and high pH soil with very low microbial population. Such conditions of lands do not support the colonization and growth of early vegetation succession so the restoration of land functions through natural succession will occur very slowly. Human intervention through reclamation activities is necessary to accelerate the early succession. However, the reclamation that has so far been undertaken has not entirely led to a significant acceleration. The establishment of initial planting inoculated by Arbuscular Mycorrhizal Fungi (AMF) is an intervention expected to provide catalytic effects on restoration of the succession components and processes. The study aims to identify the catalytic effects of initial planting and AMF on natural succession process in ex-mining land of limestone by analyzing and evaluating their roles on 1) the colonization of natural vegetation, 2) site improvement, and 3) the development of later seres. This study was conducted in four types of area in ex-mining land of limestone, namely: A0 (ex-mining area naturally left without any reclamation attempts), A1 (area in which revegetation was conducted with cover crop), A2 (area in which revegetation was carried out with cover crop and followed by later sere species without AMF inoculation), and A3 (area in which revegetation was carried out with cover crop and followed by later sere species with AMF inoculation). The emergence of natural vegetation was measured using individual density, species diversity, and species richness through vegetation sampling with a systematic square plot method based on the type of habitus. The site improvement was measured by biological, chemical and physical properties of soil. The development of later sere was measured by observing the growth of later sere species planted in the areas as well as by observing their growth in a controlled experiment in greenhouse. The results showed that the initial planting and AMF inoculation are proven to accelerate the emergence of natural vegetation by increasing individual density, species diversity and species richness at all types of habitus. The site improvement occurs faster in mycorrhizal-inoculated planting area, indicated by the improved biological, chemical and physical properties of soil. The more rapid growth in height and diameter, leaf biomass and P content of later sere (*Alstonia scholaris* and *Tectona grandis*) planted in mycorrhizal-inoculated planting areas shows that the sites created are capable of facilitating the shift to the later sere. Additionally, the FMA's role in boosting the development of later sere can be enhanced by organic matter accumulation and N fixation. Overall, the results of this research describe that the facilitating of site not only promote the development of biotic communities, but also accelerate an earlier emergence of all types of sere and shift of sere, thus making it possible for the acceleration of natural succession in ex-mining land of limestone to occur.

Keywords: natural succession, mycorrhizal fungi, limestone quarry, safe sites, catalytic effect