

学位論文の要旨

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学位論文題目	Biodiversity conservation and clove oil productivity of mixed-culture systems in Indonesia (インドネシアの混合栽培システムにおける生物多様性保全機能とクローブオイル生産性)

【論文の要旨】 (和文の場合1,200字程度、英文の場合800語程度)

Clove (*Syzygium aromaticum* L.) is an important cash-crop tree species in Indonesia as the producer of the essential oil represented by eugenol. Clove trees have been currently cultivated mostly in standard monoculture and partly in a traditional mixed-culture system as a kind of agroforestry with various trees and/or crops growing in a same site. Recently, agricultural production systems, including that for clove production, requires to play a role of conserving biodiversity as well as production efficiency for their sustainability. The present study aimed to develop the sustainable and efficient systems for clove and clove oil production from the following three aspects; 1) clove production systems desirable for biodiversity conservation with a special reference to the possible advantage of mixed-culture systems for conserving plant species diversity, 2) appropriate physical environments (light and water regimes) for clove seedlings required for successful establishment of mixed-culture systems, and 3) the optimal site conditions that assure the high eugenol yield for long-term production.

Firstly, I investigated the plant species occurrence in a typical mixed-culture (MI) stand, and compared it with that in a clove monoculture (MN) stand in East Java, Indonesia, in order to examine the advantage of MI in conserving plant species diversity. The occurrence of vascular plants in the understory were surveyed in the plots established for both MI and MN with the microsite conditions. MI and MN included 40 and 17 species, respectively, indicating far greater species richness in MI with a diverse life form composition and large numbers of woodland and/or native species. The α - and the β -diversities were higher in MI than MN. These results suggested that the superiority of MI for conserving plant species diversity compared to MN. Comparisons of microsite conditions revealed that the human disturbances to the soil surface associated with frequent clove litter collection from the whole stand reduced the plant species richness by inhibiting plant establishment and cancelling the positive effects of the variability in physical environment in MN. I concluded that the higher species richness of MI was due to alleviating the effects of litter-collection disturbances, which facilitated the effects of the heterogeneous physical environment within the stand.

Secondly, I explored the growth responses of clove seedling to light and soil water regimes by a field experiment with shading and irrigation treatments to clarify their growth traits at the early stage of plantation establishment. Eighteen-month-old clove seedlings were subjected to twelve treatments, that is, 3 shading treatments (0%, 60% and 80% shading) x 4 watering treatments (1.0, 0.75, 0.5 and 0.25 liter/m²/day), for ca. 6 months. Increment ratio of seedling height (*IH*), number of newly created buds (*NB*) during the experimental period and dry mass per plant at the end of the experiment (leaves: *LM*, stem and branch: *SM*, root: *RM* and total plant: *TM*) were compared among the treatments. The results revealed that the growth of clove seedlings was generally more susceptible to water stress than to low light availability in particular for *IH*, *NB* and *LM*. From these results, I concluded that dense planting of clove seedling with other competitive crops should be avoided to insure the fast growth of clove seedlings at the establishment stage.

Third, I examined the influences of the same treatments in the second study on eugenol productivity to provide the basic information for the suitable site conditions for long-term essential oil production. The total leaf mass per tree (*LM*), eugenol content per unit leaf mass (*EL*) and the eugenol yield per tree (*EY*) were measured and compared between treatments of this study. The soil moisture deficit and the low light availability had negative and positive effects on the eugenol yield per tree, respectively. These results suggested that the relatively dryer site condition where moderate water stress is likely to occur is more suitable for planting clove trees from the aspect of the for long-term high productivity of eugenol, and that the high tree density which may results in a severe competition and a heavy mutual shading among clove trees should be avoided for maintaining high productivity for a long term

These findings are thought to be useful in developing appropriate mixed-culture systems that can balance biodiversity conservation with clove oil productivity.

- (注1) 論文博士の場合は、「専攻、入学年度」の欄には審査を受ける専攻のみを記入し、入学年度の記入は不要とする。
- (注2) フォントは和文の場合、10.5ポイントの明朝系、英文の場合12ポイントのtimes系とする。
- (注3) 学位論文題目が外国語の場合は日本語を併記すること。
- (注4) 和文又は英文とする。