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檳榔園水文特性及其對環境的影響

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摘　　要　過去數十年間檳榔栽植面積在臺灣迅速增加，對低海拔坡地環境與生態造成相當的衝擊，並廣泛受到重視。本文根據林試所蓮華池研究中心滲漏計及鄰近檳榔園試區試驗結果，以及參考其他研究報告，陳述檳榔性狀，並探討檳榔園的水文特性及山坡地改植檳榔後對土壤水水化學成分、微氣候等環境因子的影響。檳榔植株爲單幹型，通直不分歧，6-9 枚具蠟質羽狀複葉，聚生於幹頂，樹型固定而少有變化。截留容量約 1.5 mm， 較其他林型遠爲低；穿落雨佔降雨量的比率高出林冠空隙比率甚多，幹流量比率則可高達 85%。根系爲放射型不定走向鬚根，數量眾多且大多密佈於離樹幹基部約 1 m 範圍內。入滲速率約 0.22 cm/min，高於大多數降雨之強度，致雨水多能進入地表；惟進入土層內的水分多沿腐敗根係所產生的水流路徑以次地表逕流方式迅速流至下坡處，造成流量歷線呈驟起驟落狀，保存於土壤層的水分反而相對降低。在土壤水分充足時檳榔試區因蒸發散而消耗的水分估計約在 6.5 mm/day，較杉木及草生地試區爲高；惟在乾旱情況下，檳榔的蒸發散損失與杉木林及草生地間之差異即不顯著。另一方面，同一土壤深度下，檳榔試區地表月平均溫度較天然闊葉林高出 1.3-3.6℃，幾乎與草生地或空曠地相差無幾。而地表 5 cm 處的土壤平均溫度及林內最高溫度檳榔園高出闊葉林分別達 2.3 ℃ 及 1.8 ℃，且具統計上的顯著差異，說明坡地改植檳榔後將會影響微氣候。因此檳榔園之有機質會因溫度增高而加速分解，導致次地表逕流取樣水中 Ca^{2+}，Mg^{2+}，N^{+}，SO_4^{2-}，HCO_3^{-}等土壤營養基含量較高。

關鍵詞：檳榔、滲漏計、蒸發散量、微氣候。

Hydrological Characteristics of Betel Nut Plantations and the Impacts of Forested Lands Conversion to Betel Nut Plantation on Environmental Factors

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ABSTRACT　In the past two to four decades financial incentives for land owners have been favorable for the cultivation of betel nut plantations on slope lands. Consequently, low- to mid-elevation forested slope lands have been cleared and cultivated on a large scale. The impacts of slope land betel nut plantations on soil and

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water conservation are serious enough to have attracted much concern of government and many environmental groups. This paper investigated and analyzed the characteristics of betel nut and the hydrologic factors of mature betel nut plantations. Further, we looked at the impacts of conversion forested land to betel nut plantation on soil and water conservation and analyzed the microclimate and chemical properties of soil moisture by using a lysimeter and nearby ploys in the Lienhuachih branch of the Taiwan Forestry Research Institute. Betel nut has a single stem with no divergence and 6 to 9 coriaceous pinnate leaflets at the top. A tall and single-layer canopy produces a much higher percentage of throughfall to the ground than what crevice areas in a whole canopy allow. The interception capacity was estimated to be about 1.5 mm, which is relatively low compared with that of other forest stands. In addition, stemflow can be observed with a small amount of rainfall. A maximum proportion of 85% of total rainfall was recorded as the stemflow. A large number of fine roots that are mostly concentrated within 1 m from the base of the stem create an excellent pipe flow system once they decay. This extensive small channel system not only resulted in infiltration rates after 90 min of as high as 0.22 cm/min on the betel nut plot, but also caused the peak of the storm hydrograph to occur immediately after the rainfall peak. The estimated evapotranspiration losses from betel nut plots were about 6.5 mm/day under wet soil conditions. The average monthly temperature of the topsoil of the betel nut plot was 1.3-3.6℃ higher than that of China fir and natural hardwood plots and nearby natural hardwood forests. In addition, the maximum under canopy daily air temperatures and ground temperatures for betel nut plantations are higher than those of hardwood forest by 1.8℃ and 2.3℃, respectively. This indicates that the microclimate can be affected following the conversion of an area from hardwood forest to betel nut plantation. It also indicated that rates of decomposition of organic matters will be higher than that of forested lands. The higher Ca^{2+}, Mg^{2+}, N^{+}, SO_4^{2-}, and HCO_3^{-} concentrations in water samples from the betel nut plot indirectly support this viewpoint.

Key Words: betel nut, lysimeter, evapotranspiration, microclimate.