Title : Physiological analyses of the citrus-rice intercropping system developed from the ancestral surjan technique: valorizing the indigenous knowledge of the tidal swampland cultivation

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Abstract

The surjan is a technique developed in Kalimantan and adopted by tidal swampland's farmers to primarily establish their second crop. The beauty of this technique is to meet three main objectives: prevent the second crop rooting system from being saturated by water, avoid the pyrite oxydation that may affect root functioning, and reduce the risk of failure of the main crop, rice, due to any fluctuation of the soil water availability. The surjan technique is established by digging and assembling the soil in order to make levees for planting the citrus and keep it away from likely submerged soil. In case the digging has to be wider, establishment of the surjan is done gradually for few years. Some advantages of this cropping system are to (i) introduce more biodiversity and so increase the number of ecosystem services provided, (ii) improve the sustainability of soil fertility by diversifying the spatial and temporal nutrients needs, by increasing the organic matter deposition and the micro fauna activity, and by limiting nutrient losses through leaching, (iii) reduce the negative impacts of pests and weeds. Another advantage is to diversify the food production, in this case rice and citrus having adaptive ability and high potential in tidal swampland areas. This system has been adopted by many local farmers, in particular at Barito Kuala and Banjar districts which are known as the production center of citrus in South Kalimantan. The gain in Revenue Cost ratio (R/C) for rice is 1.84 and 3.40 for superior and local variety, respectively, and that for citrus is 8.67, highlighting the high efficiency of surjan system. The present case study, recently implemented in the field, considers the surjan-based agroforestry system of rice and citrus as the valorization of an indigenous knowledge of local farmers and an adaptive intercropping system to anticipate climate change. Indeed, compared to a rice monocrop, this system reduces the consumption of water and fertilizers, as being more efficient in using resources. It is confirmed by the higher yield of rice surjan-based (3.5 t ha-1) compared to that of a rice monocrop (2.7 t ha-1). Taking into account its powerfulness and sustainability, this agroforestry system is worth including an ecophysiological component in order to design better adapted rice varieties, particularly addressing tolerance to shading, access to soil organic matter, and phenologybased resources needs in agreement with the citrus production cycle.

Key words: Surjan, agro-ecology, citrus-rice intercropping, climate change