

Potentials of Integrating Spice Crops With Forestry in the Pacific Islands¹

John K. Gnanaratnam²

Abstract: The forest is an integral part of the island ecosystem, and any indiscriminate destruction is bound to cause a shift in the climatic conditions, increased soil erosion, and other effects. The conservation of existing forestry is of great importance. Future patterns of agricultural development in the Pacific Islands should aim to integrate with the forest cover rather than eliminate it. Climatically, Pohnpei is regarded as one of the best sites in the world for the cultivation of a range of high value spice crops. One spice crop that will thrive well in the existing forests above 1500 m is cardamom (*Elletaria cardamomum*), a potential crop for the Pacific. Initially, it will be necessary to carry out research relating to 1) adaptability at different elevations, 2) introduction of high yielding varieties, 3) resistance to pests and diseases, and 4) soils and shade management. Research is also necessary to identify suitable processing techniques for the spice crops currently cultivated on Pohnpei, including black pepper (*Piper nigrum*) and cloves (*Eugenia carophyllus*).

Forests are the wealth of any nation, and they play a major role in maintaining the balance of nature. In the past, forests were maintained for the purposes of supporting wildlife and providing timber for construction and fuelwood. These can be referred to as tangible or monetary benefits. Non-tangible benefits accruing from forests include 1) recharge of soil moisture, 2) reduction of solar radiation, 3) increase of soil organic matter content, 4) recycling of leached out bases (especially Ca and Mg), 5) maintenance of desirable agro-climatic conditions, and 6) lessening of cyclonic effects.

In recent years, indiscriminate felling of forests has been occurring faster than afforestation/reforestation, particularly in the tropics. Of all the damages caused by deforestation, the most serious appears to be the increase of the "greenhouse effect." Despite warnings by meteorologists, deforestation continues, apparently without concern of a worldwide change in climatic conditions. Trees act as a vast storehouse of excess carbon dioxide. In the absence of forests, carbon dioxide remains in the atmosphere, forming a blanket over the surface of the earth. The sun rays penetrate this cover but back radiation is prevented. This has led to a rise in the temperature of the earth. The World Meteorological Organization (WMO) has warned that a further rise in the temperature of about 1.5°C will melt the ice in the polar regions leading to a rise in sea level. A rise in ocean levels can inundate low-lying islands.

Thus the need is to conserve our forests rather than to eliminate them. Furthermore, the terrain on Pohnpei does not lend itself to deforestation for commercial agriculture ventures. Consequently, any agricultural development should be integrated with the existing forestry. Mixing crops with forestry for commercial purposes is of a recent origin, although some combi-

nation of shade trees with plantation crops and illegal cultivation of some crops in the forest to avoid detection took place earlier. In 1930, the British Government of India allowed landless villagers to cultivate food crops on Crown Land along with newly established forest plantations (the Taungya System). Even today, this type of communal forestry can be seen in and around Delhi.

Cardamom: Mixed Cropping with Forestry

The microclimate produced under forest cover can be harnessed to grow several crops, depending on crop compatibility, intensity of shade, soil fertility, and elevation. The cultivation of cardamom (*Elletaria cardamomum*), a high value spice crop, under forests has proven to be a most successful combination. This form of mixed cropping is widely practiced in countries like India (70 percent of the world production), Sri Lanka, Guatemala, Vietnam, Laos, and more recently, Papua New Guinea. Cardamom is valued for its essential oil, in high demand in the middle east countries. Saudi Arabia alone consumes nearly 200 tons/year, where it is used to prepare a ceremonial drink known as ghawa, or Arab coffee. Cardamom also has a variety of uses as confectioneries, pastries, baked foods, curry powder, ham and sausage additives, toothpaste, and drugs.

Cardamom is a shade and moisture-loving herbaceous shrub. The optimum parameters for successful cultivation are:

- Fertile soil;
- Annual rainfall of 100-200 inches without extended dry periods;
- Average humidity of 70-80 percent
- Average temperature of 65-80°F.

In forest/cardamom combination, cardamom constitutes the major component, the forest trees providing 1) filtered light, 2) recycling of bases like Ca and Mg (self-liming), and 3) rich organic matter encouraging microbial activity.

Cardamom is generally established under forestry in shallow pits 2 ft x 2 ft x 1 ft at a spacing of 6 ft to 8 ft, depending on variety. Cardamom is not a soil exhausting crop, and substantial amounts of nutrients are returned to the soil at the time of thrashing (cutting of spent leaves, empty tillers, and broken stems). Mulching around clumps to prevent clump walking and earthing up to cover exposed roots are vital operations carried out annually. Application of dolomite lime once in 3 years helps to maintain satisfactory pH levels, as forest soils are often acidic. Annual fertilizer application is carried out in two applications at the rate of 30 kg N, 60 kg P₂O, and 30 kg potash per hectare.

In the cultivation of cardamom under forest cover, a certain amount of shade regulation is necessary. Some trees shed their leaves and thereby afford natural shade regulation. Sometimes large gaps occur due to the death of a tree or windblow, thus

¹ An abbreviated version of this paper was presented at the Workshop on Research Methodologies and Applications for Pacific Island Agroforestry, July 16-20, 1990, Kolonia, Pohnpei, Federated States of Micronesia.

² Spice Consultant, Pohnpei Division of Agriculture, Kolonia, Pohnpei, Federated States of Micronesia 96941.

exposing cardamom to direct sunlight, which reduces yield. Thus it is important to maintain a forest stand of mixed ages to fill in these types of gaps.

Other Spices

The other spice crops in order of possible economic importance for Pohnpei are cloves, nutmeg, and vanilla, all of which have been found to grow extremely well under local conditions. Secondary forest areas are ideal for the cultivation of cloves and nutmeg at a spacing of 20-24 ft apart. Upland forests areas

provide the ideal climatic conditions for the cultivation of vanilla. Earlier introductions to Pohnpei have not done well due to low elevation. Before large-scale cultivation is undertaken, sustained research efforts are necessary in the following areas: 1) assessment of market potential, 2) adaptability of crops at different elevation levels, 3) introduction of high yielding varieties, 4) introduction of disease-resistant strains, 5) field trials, and 6) post-harvest technology.

Introduction and cultivation of spice crops should be undertaken as a project so as to exploit available market potential and to make Pohnpei a true "spice island."