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The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

REPORT TO MR. WARD M. CANADAY

January, 1952

Some time ago it was proposed that I give you my reactions, in the form of a report, to your projects for developing the horticultural and agricultural potential of St. Croix, particularly in terms of your land holdings there and after a visit to the Virgin Islands in October, 1951. Unfortunately, it was impossible for me to go to St. Croix but I hope to be able to do so in the near future.

At my suggestion and with your assistance my colleague, Mr. Paul C. Hutchison, Botanist in the University of California Botanical Garden (Berkeley), took my place and spent the period October 28 to November 10 principally on St. Croix but also on St. Thomas and at Mayaguez, Puerto Rico. He accumulated as many data as time permitted on the following topics which appeared to him directly or indirectly germain to the preparation of the report referred to above: geographic and climatic conditions; character and distribution of the native and introduced vegetation; past and present utilization of the terrain appropriate for agriculture; labor and management; inter-island economic and political problems. Obviously, each of these topics deserves far more extensive consideration than Mr. Hutchison had time or opportunity to give. However, he was able to obtain a sufficient background concerning those specifically related to matters horticultural and agricultural so that certain observations and recommendations can be made.

Geography and Climate

The Virgin Islands are situated some 60 miles WSW of Puerto Rico, the main islands being St. Thomas, St. Croix and St. John. St. Croix is called the dry island. Its maximum elevation is some 1100 feet on your estate and the low range of mountains is parallel to the trade winds,

hence comparatively small rainfall of 30 to 70 inches results. The ridge runs east-west along the northern edge of the island and heaviest rainfall is in this area. The eastern tip of the island is a desert; the southern plateau, the primary agricultural area, is quite dry for 8 months of the year. As there are no year-round streams, there is little irrigation. Extensive well drilling is probably not feasible under present conditions as not enough water would be available for intensive irrigation purposes.

Rainfall data (monthly averages) available from the Annual Report of the Agricultural Station on St. Croix are misleading in two respects: first, no mention is made of the fact that practically an entire month's rain may fall in 24 hours; second, that rainfall in different sections of the island may be very different seasonally and annually. Months indicated in the St. Croix report as heavy rainfall periods may in some years be totally dry. Therefore, to depend solely or largely upon natural precipitation for truck crop production would be hazardous. Humidity and temperature seem fairly constant in any given area on the island.

There are two cities, Christiansted on the NE shore and Fredericksted on the W shore. The population is ca. 7000 or 8000 negroes, ca. 5000 Puerto Ricans and several hundred white continentals.

Character and Distribution of Native and Introduced Vegetation

The island may be roughly divided into five zones on the basis of the nature of terrain and of the plants occurring: arid low hills, saline flatlands, cultivated southern plateau, brushland and forest.

1. The arid low hills occupy the easternmost end of the island and are a low rainfall and relatively lower humidity area dominated by a scrub Acacia and species of cacti (Opuntia, Melocactus, Cephalocereus). There is evidence of a slight seasonal rainfall in dried remains of annual plants. This area might be made useful for grazing if cacti (particularly

Opuntia) were eliminated to some extent and if good perennial grasses tolerant of arid conditions were introduced.

2. Saline flatlands occupy a small area in the southwestern corner of the island near the airport. This is evidently nonarable land, but supports a growth of perennial grasses and small trees -- probably could also be made suitable for grazing.

3. Arable southern plateau is the relatively level cultivated land primarily devoted to the cultivation of sugar cane. It is encroached upon and divided in some areas by brushland hills, some of which have been cleared and have proven arable.

4. Brushland on the south-facing slopes of the mountain range which runs east-west along the north side of the island is at present primarily devoted to grazing. On these southern slopes wherever precipitation is somewhat higher the brushland rapidly converts into the

5. Northwestern and north central Forest, which on the north-facing slopes of the range is quite precipitous and on the south-facing slopes in less precipitous areas has been cleared to some extent for orchards, truck crops or grazing. The north slopes have rich top soil; terracing would make crop or fruit production practical. Some attempts at plantings of hardwood trees have been made here. On the gentler slopes palms, mango, avocado, fiber plants and other commercial fruits could be produced if roads could be built and maintained.

Past and Present Utilization of Terrain Appropriate for Agriculture

St. Croix has two main sources of income -- cane sugar and cattle. Between 4000 and 5000 acres are intensively cultivated. Originally the island was divided into about 25 estates and some 25000 slaves worked them. The earliest colonists were English, Irish and Scotch, later the Danes. Of these, descendants of all nationalities except the Irish still own land on the islands. In 1917 the islands were sold to the United

States and have been administered by them since. The Canaday estate (some 4500 acres) comprises what was formerly several separate estates. The Armstrong holdings on St. Croix are of about the same size and are devoted primarily to grazing lands for cattle. There are several 1000 to 2000 acre estates and the remainder are smaller. The holdings of the Virgin Island Corporation comprise about 6000 acres, primarily in cane. The island supports some 6000 head of cattle.

CANE: The average yearly production is about 15 tons per acre and at least 25 tons per acre is necessary to break even on the cane crop. There are one or two small estates on the island which average about 50 tons per acre in areas of intense rainfall. In Puerto Rico, where rainfall averages approximately 60 inches and up, cane production is about 40 to 60 tons per acre; in Cuba, rainfall of 80 or more inches, 60 to 80 tons per acre; in Hawaii, rainfall 100 or more inches, tonnage 80 to 100 per acre. From standpoint of competition St. Croix cannot maintain cane as a primary crop and make it pay using methods of production and administration now in force.

It is said that $250,000 annually is lost on the cane crop and that the primary reason for continuing to grow cane is that the United States has a $4,000,000 investment in a processing plant controlled by the Virgin Island Corporation.

Although no data were gathered on rum production, McFarland's data on federal income from tax on rum ($6,000,000 yearly) indicate that it is an important factor in the economy of the island.

TRUCK CROPS: Vegetables which have been grown successfully on St. Croix are: ochra, lettuce (leaf types), onions, garlic, carrots, radishes, turnips, peppers, egg plant, string beans, peas, sweet potatoes, yams, cabbage. In years of good rainfall tomatoes have been grown commercially but disease resistant varieties should be introduced or developed and better inspection and shipping procedures instituted. The Black Rock

sweet potato (developed on the island) is superior in flavor to most varieties grown in the United States and might become a profitable crop for export.

FRUITS: The citrus fruits (lime, orange, sour orange, grapefruit, lemon, citron) have been grown on St. Croix with varying success in different parts of the island depending on local climate and the varieties involved. Inadequate control of scale insects was evident on all trees seen and unless remedied will make ineffective efforts to develop these fruits as a profitable export crop. Avocado grows well but improved varieties should be introduced and a winter-producing avocado is needed. At the USDA station at Mayaguez, Puerto Rico, bud-wood of a winter avocado can be obtained. Pineapple as grown by Mr. Kai Laweitz is superior to the Hawaiian pineapple, the latter being produced primarily for canning rather than fresh-fruit consumption. It is possible that this crop can pay large dividends if exported fresh or frozen to the New York markets. Banana, custard apple, sugar apple, guavas, breadfruits, coconuts, sour sap, guava berry all produce well on the island; most of these fruits are consumed only locally and competition in their commercial production would be offered by the cheaper produce of the British West Indies. Chirimoya apparently is not grown but would probably do well. (For mango and papaya cf. following recommendations.)

RECOMMENDATIONS: In addition to the incidental suggestions concerning improvement of existing agricultural products of St. Croix the following specific recommendations can tentatively be made. They obviously involve the gradual reduction in the areas devoted to cane in favor of other crops.

FRUITS: It is particularly recommended that mango and papaya production be attempted. Mango would adapt itself well to the hilly shrubland and forest areas of the island. Mr. Kai Laweitz has already imported a [illegible] varieties for test on St. Croix and his results

are primising. Export of the fresh fruit offers some problems due to fruit-fly occurrence on St. Croix and United States restrictions on fruits on which this insect lives. However, some strains of mango appear to be resistant to this pest and they could be grown for export and improved by breeding. Processed and frozen fruit of mango and papaya (which grows equally well) find a ready market in both Puerto Rico and the United States (ref. Mr. Eric Laweitz). Mr. Kai Laweitz already has certain improved strains of papaya producing well. The relative marketing potential of the small vs. the large fruited varieties of mango and papaya should be carefully investigated. It is to be noted that superior flavor in some tropical fruits may not necessarily pay ready dividends in the markets.

FIBERS. Potentially, fibers could be an important agricultural product, at present almost entirely unexploited, if it were possible to compete successfully with fiber production on the British islands. One ready market would be St. Thomas which annually imports $10,000 of fiber for local handicrafts. Sisal has been grown successfully but in limited quantities on St. Croix and St. Thomas. Most fiber-producing species should be equally successful. Asclepias carassavica which grows wild on St. Croix has in some parts of the world proved to be a commercial source of fiber. The United States Navy has experimented with the floss on the seeds of this plant and found it superior to Kapok as a filler for jackets, life-belts, etc.

MEDICINAL PLANTS. The economic potentialities of certain of the native medicinal plants are considerable. The proposal (cf. section on Canaday Tropical Gardens) to develop and maintain a collection of such plants is made in anticipation of possible development of some of the indigenous plants for commercial use. The Jumbo Pepperbush (Ravenia levis) used as a cure for dysentery and the Congo Root, used for causing abortion and/or sterility and as a heart stimulant, are examples of native plants

with possible importance to the drug industry. Congo Root has characteristics which indicate it may be useful as an insecticide.

The larger pharmaceutical companies in the United States have developed high yielding strains of many standard drug-producing plants and an attempt should be made to introduce certain of them in St. Croix for testing under the subtropical conditions which prevail. Digitalis, for example, might prove a valuable crop on the island. It will, of course, not be possible to do any fundamental research on the chemical output of drug plants on the island; however, a program of cooperation with the drug trade in the United States might prove mutually profitable. It is assumed that St. Croix offers growing conditions which do not prevail in any section of the United States and that therefore some medicinal plants would do well in cultivation there which at pesent cannot be grown commercially in the United States. A drug firm importing dried plants from which to extract a chemical would profit by obtaining them from St. Croix free from federal trade restrictions.

The island would also support a crop of many of the trees from which essential oils are extracted, such as the Bay tree for bay oil and bay rum. A number of these oil-producing trees are rare and their products bring high prices.

FORAGE PLANTS. One of the Agricultural problems of St. Croix is the low protein content of existing forage plants. This problem is discussed here under three headings: the species which should be replaced or eliminated; those which are on St. Croix and the use of which should be extended; those which should be introduced.

(1) To be eliminated or replaced: "Barbados Sour Grass" ("Hurricane Grass"), Andropogon pertusus - a low protein food. Its prominence on the island is evidence of poor range management because its natural competitors on the island would largely eliminate it if the land were not

over-grazed. Replace with Antigua hay grass (which see under "introductions"). "Guinea Grass" - Panicum maximum Jacq. The form on St. Croix is low in protein and high in hydrocarbons. There is a dwarf form of this species on Guadalupe which should be introduced to replace the large form since the former is a better protein food.

(2)To be extended: The following grasses grow wild on St. Croix (one on St. Thomas) but not in sufficient quantity and all are good protein foods. "Pengola"- Digitaria decumbens L.; "St. Augustine Grass" - Stenotaphrum secundatum (Walt.) Kuntze; "Pos liane" - Clitoria Ternatea L.; "Pois rouge " - Macroptilium lathyroides (L.) Urban; "Pois sucrier" - Rhynchosia minima (L.) DC.; "Pois hallie" - Rhynchosia phaseoloides (Sw.) DC.; "Trefle jaune" - Stylosanthes hamata (L.) Taubert; "Pois enivrant" - Terammus labialis (L.f.) Spreng.; "Sudan Sweet Grass" - Sorghum vulgare (L.) Pers. var. sudanense (Piper) Hitchc.

(3) To be introduced: "Antigua hay grass" - Andropogon caricosus L. var. nodosus (Willm.) Stehle; "Guinea grass" - Panicum maximum Jacq. (the dwarf form); "Herbes elephant" - Pennisetum purpureum Schum. var. Florida and var. Uganda; Pennisetum 29.722 x Millet; Pennisetum Hybrid 207 Dwarf (de Floride); "Pois velu" - Calopogonium muconoides Desv.; "Kudzu" - Pureria phaseoloides (Rosb.) Benth. - there is a strain tolerant of aridity which may grow well on St. Croix; "Pois de Bengale" - Stizolobium aterrimum Piper and Tracy.

Of the above plants the following, in addition to being valuable as forage crops, have been used for erosion control: Calopogonium muconoides Desv., Clitoria Ternatea L., Macroptilium lathyroides (L.) Urban, Pureria phaseoloides (Rosb.) Benth., Rhynchosia minima (L.) DC., Stizolobium aterrimum Piper and Tracy, Stylosanthes hamata (L.) Taubert, Terammus labialis (L.f.) Spreng.

Mr. Hutchison believes that all or the majority of the species mentioned above can be obtained from Dr. H. Stehle, Director, Agricul-

CANADAY TROPICAL GARDENS

Your proposal to establish a unique collection of ornamental plants drawn from the tropical and subtropical regions of the world which would become a major tourist attraction and an integral part of a hotel development on your St. Croix estate, is entirely feasible. On the assumption that the hotel development would be located on high ground above the bay on the north shore the following suggestions for establishment of the Tropical Gardens are made.

The canyon which runs up the north slopes of the hills behind the bay is one of the most ideal areas on the island for developing an intensive planting of tropical species, ideal by virtue of rich and apparently deep top soil as well as protection from prevailing winds. The garden should surround the hotel, extend to the beach and up the hill and over the crest to the present garden area. By carefully selecting plants for the various ecologic conditions involved the plantations proposed would after a number of years require a minimum of maintenance. About the hotel and in the glade at the bottom of the canyon near the bay an intensive planting should be made - this would become the "show area" containing many rare and exotic plants in lush surroundings. A few of the possible developments in this area could be:

(1) Orchids. Several species of orchids are native on St. Croix and grow luxuriantly in wild areas. Ornamental species are represented on various estates by Cattleya, Oncidium and other highly ornamental and commercially valuable genera but for the most part by poor or common varieties. These have adapted themselves and seem to grow well. By instituting an overhead spraying system and a program of importing desirable and showy orchids in quantity a remarkable display could be maintained in the "show area" near the hotel with year-round bloom, the plants being grown primarily on the trees.

(2) Tree ferns. Special attention might be given to forming a large and representative collection of these most spectacular plants which should grow luxuriantly in the canyon area.

(3) Bougainvillea. Three common forms are grown on the island, a purple, a white and an orange-red one. In north Africa a nurseryman has been breeding this genus for new varieties; these could be introduced and planted in sunny areas to give mass color effects. Some of them would no doubt be of sufficient value to introduce to California and Florida horticulture. With a large collection available breeding for new and improved forms could be attempted.

(4) Plantings in quantity of "tropical effect" plants such as mango, papaya, palms, bamboo, banana, etc., could be employed as background. They would supply fresh fruit for the hotel and would include new or improved varieties being tested for quality. For example, new or improved varieties of mango could be blended into the landscaping scheme and, if successful, bud-wood could be taken from them for establishing groves elsewhere on the estate.

(5) Medicinal plants native to St. Croix and introduced could be grown as a unit in the tropical gardens area; properly labelled such a collection would be of interest to the tourist. In addition it could serve as a "trial ground" for the species concerned.

(6) Another possible development would be the planting of the margins of the roads leading to the hotel and Tropical Gardens. The overall plan for such plantings should consider the effect upon the visitor as he drives to the hotel. As the car rounds the turn where one first sees the houses and existing garden area, an avenue of palms could lead to the hotel. At this turn one should command a view up the hill of exotic trees and vines growing comparatively wild. In this relatively sunny and drier area Bougainvillea and Croton and many flowering trees and shrubs could be planted; such plantings being made solely for an overall

massive color effect as the visitor drives by. Once established the proposed roadside plantings would require a minimum of maintenance.

As indicated in the above suggestions for the development of the Tropical Gardens, not only would the ornamental potential be great but, in addition, many species of potential or known commercial value could be "test grown" and at the same time contribute to the ornamental objective.

Nursery. To develop the Canaday Tropical Gardens a relatively small but well-equipped and staffed plant nursery would be indispensible. In it introductions of ornamental and agricultural importance from other tropical and subtropical regions would be given an initial test for tolerance of St. Croix conditions and potential commercial value. Selected species would be propagated for planting in the Tropical Gardens or in parts of the estate devoted to agriculture. Stocks would be maintained for sale to St. Croix residents and for inter-island sale. Sale of flowers to hotels and visitors from the nursery might be considerable, expecially during the tourist season. To superintend the nursery and the planting and maintenance of the Tropical Gardens it would be essential to hire a skilled horticulturist with some botanical training and some experience in plant improvement.

The species initially to be introduced could be obtained from Botanical Gardens and horticultural establishments. As soon as the Tropical Gardens on St. Croix have become established and known for the superior quality of the plant material being grown, additional introductions could be obtained on an exchange basis with similar institutions throughout the world.

T.H.Goodspeed (signed)
P.C.Hutchison