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Agricultural notes on the Southern Marshall Islands, 1952

by

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AGRICULTURAL NOTES ON THE SOUTHERN MARSHALL ISLANDS, 1952[1]

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On Arno Atoll several instances of low productivity of coconuts were observed. The Marshallese recognize at least two types of "poor coconuts:" "laora" and "mellal." Both conditions appear to be related to local soil conditions, although many Arno people attribute "mellal" to the presence of demons. Lajibili, former magistrate of Arno, called the writer's attention to a malady affecting breadfruits. Since there appears to be no native name for this condition, the term "brown rot" is suggested. On the southern field trip of September 18-27 the occurrences of "laora" and brown rot of breadfruit were investigated. In addition, notes were made on all local agricultural problems which appeared sufficiently important to warrant attention.

Laora in its most extreme form is characterized by:

1. Yellowing and scorching of the leaves of the coconuts. The tips of the leaves and leaflets are most severely scorched. Areas adjacent to the midribs are usually green.

2. The leaflets of the coconuts are sometimes twisted and more or less knotted together.

3. Dead leaves tend to hang on the tree, giving it the appearance of a Washington palm.

4. The trunks are sometimes blackened.

5. Density of stocking is low — about 40 trees per acre in the worst affected areas of Arno. This is about 1/3 the stocking of the more productive groves.

6. Dead trees are conspicuous. About 35 trees per acre are dead in the worst affected areas of Arno.

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[1] The information recorded in the notes presented here was gathered during the brief visits to the several atolls mentioned during the official field trip of September 18-27 to the southern Marshall Islands. It was written up for the use of the District Administrator and his staff and was mimeographed for very restricted distribution to staff members. Since there appears to be no probability that the information will be worked up into any further publication, and since there are original observations, not available elsewhere, Dr. Hatheway has consented to the reproduction of his memorandum to the District Administrator for the users of the Atoll Research Bulletin. It has here been reproduced in exactly its original form, without further editing except change of title. — Editor's note.

7. The older trees are mostly barren of fruit, although they produce inflorescences. Apparently the fruits abort at an early stage of development.

8. The younger trees bear fairly well; the water is exceptionally sweet.

9. In the worst affected areas of Arno the ground cover consists of

a) Clumps of Fimbristylis cymosa ("Relijman"), covering the ground between which is a leathery black blue-green alga (unidentified as yet) resembling a crustose lichen.

b) Tacca leontopetaloides ("Mokmok" or "Arrowroot") is common. Its leaves are yellow except along the veins and are characterized by circular brown spots 1/8 to 1/4 inch in diameter.

10. Abandoned coconut groves are invaded by the following species of plants in roughly the order listed:

a) Wedelia biflora ("Marjej")

b) Premna obtusifolia ("Kar")

c) Artocarpus altilis ("Breadfruit:" variety "Bukaral" most common, spreading by root suckers; variety "Mijwan" invades by seed)

d) Pipturus argenteus ("Arme")

e) Morinda citrifolia ("Nen")

f) Guettarda speciosa ("Wutilomar")

g) Allophyllus timorensis ("Kitak")

h) Pandanus tectorius ("Erdwan")

11. "Laora" is restricted to the centers of the wider islands. Most of this land was formerly in breadfruit forest, scattered throughout which were pits in which the Micronesian taro (Cyrtosperma chamissonis or "yaraj") was grown. Since the advent of copra culture much of this land has been given over to the growing of coconuts.

Laora is here tentatively attributed to a deficiency of available phosphorus, although the opinion of many of the more sophisticated Marshallese that it is due to a lack of salt (sodium chloride) should not be dismissed without further investigation. Phosphorus deficiency is suggested by:

1. The analyses of Dr. E. L. Stone (Atoll Research Bulletin Nos. 5-6, November 15, 1951), who found only 10 pounds of available phosphorus per acre in a sample of soil from an area of poor coconuts on Arno Island.

This is less than 10 percent of that available in productive groves.

2. Field evidence from Ebon Atoll, where there are local phosphate deposits in the interior of Ebon Island. The coconuts on the soils on or immediately adjacent to the phosphate deposits are vigorous and bearing heavily, whereas "laora" is restricted to the non-phosphatic areas of the same island.

3. The oily nuts of the coconut contain relatively large amounts of phosphorus, as do most seeds. The abortion of the fruits at an early stage suggests a deficiency of an essential element. The sweetness of the nuts that are formed may indicate that the sugars are not transformed into proteins. Phosphorus is an essential constituent of nucleoproteins, which tend to occur in high concentrations in seeds.

4. "Laora" is restricted to certain local areas, on which other species of plants totally unrelated to the coconut -- e. g., Tacca -- show similar symptoms. This makes it extremely unlikely that "laora" is to be attributed to the presence of insects, nematodes, pathogenic fungi, bacteria, viruses, or other pests.

"Mellal" is easily distinguished from "laora". The symptoms are:

1. General yellowing of the leaves of the coconut. New leaves tend to remain yellow for long periods of time.

2. The coconut trees appear stunted and probably die early. Trees in "laora" areas are often very tall.

3. Dead leaves do not fall readily.

4. The trees bear only a few nuts.

5. Ground cover is invariably depauperate. It consists chiefly of an open stand of bunchy Lepturus repens ("ujoij" a grass). The parasitic vine, Cassytha filiformis ("kanong") is usually abundant. Intsia bijuga ("kubuk") grows as a straggling shrub, although on better sites it becomes a tree often common.

6. The soil is a nearly unaltered gray sand containing very little organic matter. The soil of "laora" areas, on the other hand, is a black loamy sand containing as much as 30 percent organic matter.

"Mellal" was observed on several islands of Arno Atoll, usually at or near lagoon or ocean shores. Stone's analysis of a "mellal" soil suggests a nitrogen deficiency, although excessive salinity is possible in some cases. It is extremely likely that many instances of "mellal" can be traced to ancient typhoons. In the course of these large quantities of sand and rock fragments were thrown up on the land, or the topsoil was washed away. The resulting soils are immature and contain little organic matter or

available nitrogen. It is suggested that the planting of native leguminous ground-cover plants be encouraged. These would tend to build up the nitrogen and organic matter content of the soil. The plants best suited for this purpose are the creeping vines Vigna marina ("markine-jojo") and Canavalia spp. ("marlap").

"Mellal" is a common but very local condition. The affected areas are usually less than 5 acres in extent. Since it appears that intensive research into this problem by agriculturists of the Trust Territory would not yield returns commensurate with the time and money invested, no attempt was made to study the distribution of "mellal" in the southern Marshalls. "Laora," on the other hand, is a problem of major importance. Over 200 acres on Arno Island alone are in poor coconuts or secondary forest. About 60 tons of copra per year could be harvested from this area if the condition were corrected. This would increase the cash income of the atoll by about 10 percent. Moreover, the presence of a considerable source of phosphate rock at Ebon Atoll suggests that if "laora" is correctly attributed to a lack of available phosphorus, the condition might be quickly and inexpensively remedied. This would also, of course, provide income to the owners of the Ebon phosphate. The distribution of "laora" in the southern Marshalls is:

Atoll	Islands	Remarks
Arno	Arno	Very severe
	Ine	Slight
Majuro	Majuro*	Not seen
Ebon	Ebon	Severe
Namrik	not present	
Kili	not present	
Jaluit	Jaluit*	Not seen
	Pingelap*	Not seen
Mille	Mille*	Not seen

* Not visited by Field Trip ship, but reported by native informants.

Brown Rot of Breadfruit

The writer has observed this condition only on the variety "Bitaktak," although Johnny Silk, the school principal of Ebon Atoll, stated that he had seen it on "Bukaral". "Bitaktak" is the preferred variety of breadfruit, at least in the Southern Marshalls.

Symptoms are:

1. Lumpy or knobby appearance of the fruit, similar to that of the seeded variety "Mijwan." Normal "Bitaktak" is much more nearly a perfect ellipsoid.

2. Abnormally small size of the fruit.

3. Discoloration of the rind. Brown, roughly circular spots an inch or more in diameter appear on the surface of the fruit. This discoloration may extend to the core, but more commonly the portion of the fruit immediately beneath the brown rind is ripe, although the rest of the fruit remains unripe. That is, the flesh beneath the brown spot is yellow, soft, and has a fruity odor, instead of being white, firm, and nearly odorless (Bitaktak is normally picked green). In severe cases very small fruits may ripen and rot completely without falling from the tree.

Some informants stated that this condition was merely one of normal ripening, and that it occurred chiefly at the end of the bearing season, presumably on fruits which the owner had neglected to pick. Others said that they had noticed it only very recently. There was some disagreement as to the year in which the condition was first observed. The writer collected specimens of diseased fruits (pickled in 70 percent alcohol) and associated insects (copra bugs and fruit-fly larvae), and took color photographs of healthy and "diseased" fruits. Although the condition may not be abnormal or pathological in any sense, it merits further study by agriculturists of the Trust Territory. The distribution of brown rot of breadfruit in the southern Marshalls is:

Atoll	First Observed	Remarks
Arno	c. 1935; spread from Arno Island	Severe
Majuro	c. 1936	Not seen
Ebon	c. 1945	Severe
Namrik	Apparently not present	
Kili	Apparently not present	
Jaluit	c. 1949	Severe
Mille	"Always present"	Severe
Aur	Present; informant; Johnny Silk	
Caroline Islands		
Moen (Truk)	Present; informant: Johnny Silk	
Mortlok	" " " "	
Losap	" " " "	

The Phosphatic Rock at Ebon

Near the lagoon shore of Ebon Island four groups of piles of phosphatic limestone and soil were observed. Two groups of piles consist of chunks of phosphatic rock about 0.2 cubic feet in size. The piles are 125 to 150 feet long, 25 to 30 feet wide, and 3 to 5 feet high. Total volume of these piles is estimated at 64,000 cubic feet. Two other groups of piles consist of loose phosphatic sand and loam. The piles are roughly triangular in shape, and their total volume is about 25,000 cubic feet. The total volume of phosphatic rock and soil in the piles is thus approximately 89,000 cubic feet.

Assuming a density of about 1.7, the weight of the phosphatic rock and soil in the Ebon piles is about 5,000 tons.

According to local informants this phosphate was dug in the interior of Ebon Island by Ebon people under the direction of the Japanese and stored in specially constrected warehouses near the lagoon awaiting shipment. Several shiploads were sent to Japan, but American bombers prevented the loading of the remaining phosphate by destroying the warehouses and the miniature railway which facilitated loading. The phosphate workers were paid wages by the Japanese, but the owners of the land from which the rock was removed were not compensated, the phosphate being regarded by the Japanese as Ebon's contribution to the Imperial war effort.

The phosphate diggings in the interior of Ebon were visited. Although probably more than 50,000 tons of phosphatic rock and soil were removed, considerable amounts still remain -- perhaps 50 to 100 thousand tons.

Considerable deposits of phosphatic limestone were also observed at Takleb Island, on Arno Atoll. According to Felix, the magistrate of Arno, whose family holds land rights on Takleb, pineapples, tomatoes, bananas, and papayas formerly grew well there. Several members of the Trust Territory staff at Majuro have expressed desires to grow these plants. If phosphatic soil were transported from Ebon to Majuro, perhaps these and other desirable crops could be grown in places sufficiently protected from salt spray. A more significant use of the Ebon phosphate would be the possible alleviation of "laora" on several atolls of the southern Marshalls.

The Mille Mekinono

A "Mekinono" (a variety of breadfruit with deeply incised leaves) was observed at Mille, which, according to the local school teacher, bears the year around. Since all varieties of breadfruit in the Marshalls -- including Mekinono -- are usually strictly seasonal in their fruiting habits, this tree may prove to be extremely valuable. The variety is propagated vegetatively by root suckers, so that all its offspring should have identical fruiting characteristics. It is suggested that suckers be purchased from the owner and grown at Majuro. Grafts on small stocks of other varieties might be attempted. A special search should be made for non-seasonal varieties of breadfruit and pandanus and for plants of those or any other species the fruiting times of which do not coincide with the majority of varieties. These should be collected and studied in a central experimental garden. It is possible that eventually exchanges might be effected between the Marshalls and other Pacific Islands. The Marquesas, for example, are rich in cultivated varieties of breadfruit the fruiting seasons of which may possibly be different from those of the Marshallese varieties. Similarly, the Gilbert Islands possess many horticultural varieties of pandanus not found in the Marshalls.

The Mille Mekinono stands in front of the council house on Ngalu Island. It is said to belong to Laibon.

Notes on Insect Pests

A coconut tree infested with insects on Mille was pointed out to the writer. Larvae and adults of the insect were collected.1/ The damage did not appear to be severe.

At Jaluit "white grubs" were reported on the leaves of the breadfruit.

The agricultural situation at Kili

The Bikini people now living at Kili Island have for at least the last two years relied heavily on imported foods. During the brief stop at Kili an attempt was made to assay the agricultural situation. The following food plants were observed:

1. Coconut. Although the growth and productivity of the trees appears excellent, copra production is not high (c. 60 tons/year). Most groves are very poorly maintained. Apparently little attempt has been made to cut back the brush, a common practice elsewhere in the southern Marshalls. In some places the undergrowth of "Arme" (Pipturus argenteus) and "Kangal" (Pisonia grandis) is so thick that collection of fallen coconuts must be nearly impossible.

Pandanus. The Bikini people relied heavily on Pandanus on their home atoll.. They have only 4 or 5 cultivated varieties at Kili, whereas at Bikini they probably had 20 or 30. The trees are by no means abundant at Kili, and there apparently is not enough of the thatching variety ("Benuk") to provide roofing material.

Yaraj (Micronesian taro -- Cyrtosperma chamissonis). In the interior of Kili Island stands a fresh-water swamp at least 20 acres in extent. This is eminently suitable for the cultivation of yaraj. Although a few yaraj patches were noted in the swamp, they appeared to be neglected, and over 95 percent of the swamp was overgrown with weeds, especially Jussiaea suffruticosa and Ipomoea tuba. Over 1000 pieces of yaraj were collected at Ebon and presented as a gift to the people of Kili.

Kutak (Hawaiian taro - Colocasia esculenta). A few neglected plants of two varieties were observed in the interior swamp. At the council meeting the people requested instruction in the cultivation of this important food plant.

Sweet Potato (Ipomoea batatas). Several patches were observed. The plants appeared healthy and well cared for. Instructions for cultivation were requested.

Breadfruit. Varieties Bitaktak and Bukaral present. There is ample potential breadfruit land. Some young trees have been set out, but many more could be planted.

1/ Brontispa chalybeipennis Zacher, according to Dr. J. L. Gressitt. Distribution: Ponape, Kusaie, Marshalls.

Wōt in Kabiling (Xanthosoma sp. or "yautia"). This is a taro-like plant cultivated in upland well-drained soils. Several patches were observed. The plants appeared to be well tended and are thriving.

Mokmok (Tacca leontopetaloides; "arrowroot"). Only one plant observed. This is an important food plant elsewhere in the Marshalls. It requires no care, and more should be introduced.

Bananas (Musa spp.). Bananas are planted in and around the village. A good deal of potentially valuable banana land is not being utilized.

Banke (Cucurbita pepo -- pumpkin). Several plants observed.

Kurak (Inocarpus fagiferus -- Tahitian chestnut). One mature tree.

Kotel (Terminalia catappa -- Indian almond). One immature tree.

At the council meeting a request for turkeys was made. Turkeys were formerly common in the northern Marshalls, but were confiscated by the Japanese during the war. Whether they would be successful in the wetter southern Marshalls is a matter of conjecture. Ducks and chickens are thriving at Kili; the former take full advantage of the central swamp. It is suggested that domestic geese be introduced to Kili instead of turkeys, Geese are large, hardy, fast-growing birds, and are able successfully to forage at large with virtually no supplementary feeding.

The general impression is inescapable that the resources of Kili are not being effectively utilized. The interior fresh-water swamp could easily produce yaraj sufficient to feed twice the present population. The coconut groves are sadly neglected. Banana production could be trebled in a few years with very little effort. It is my impression that the Kili people regard their present home as strictly a temporary one and are unwilling to invest labor on crops that they may never harvest. Indeed, the feeling may exist that if the resources of Kili were effectively utilized, the American authorities might decide that the situation was satisfactory. That is to say, by making a satisfactory adjustment to Kili the Bikini people might irrevocably prejudice their chances of returning to Bikini. Certainly the attitude that Kili is considered unsatisfactory was made very clear at the council meeting. The problems of Kili, however, are not basically agricultural.

Rats

On Jilang, Kejbwe, and Enidrik Islands of Arno Atoll rats damage a considerable proportion of the coconuts, by eating through the sides of the green nuts and extracting the milk and soft meat. These rats are said to be small and grey.

On the Possible Use of Dynamite

At Jaluit and Mille several small bomb craters were observed. In most cases the ground water was exposed in the pits. This suggested that taro pits might be conveniently excavated by the judicious use of small explosive charges. The method would be especially applicable on Mille Island, Mille Atoll, where the Japanese constructed their major airstrip in the southern Marshalls. It is impracticable for the Marshallese to attempt to dig taro pits through the cement runways of this strip, but the work could possibly be done cheaply and effectively with explosives, under the supervision of a competent civil engineer.

At Namrik and Kili copra loading operations are at best inefficient and at times actually dangerous. At Namrik copra is loaded from the shore into flat-bottomed boats, which are dragged across the ocean reef flat to a relatively high Lithothamnion ridge. The latter is exposed at low tide. At this point the heavy bags are transferred to Mokil boats, which are parked on the Lithothamnion ridge. The Mokil boats, are then towed or rowed to the field-trip ship. A channel blasted in the ocean reef flat from the Lithothamnion ridge to the shore would enable the Mokil boats to dock at the beach and be loaded directly.

General Remarks

At Council Meetings the Marshallese were especially eager to discuss agricultural problems. It is obvious that the Marshallese themselves have neither the training nor the economic means to investigate the causes and treatments of "laora", brown rot of breadfruit, and similar problems. Some technical assistance is necessary. Indeed, a program which had as its purpose the study of agricultural problems would seem to be one of the most concrete ways of "helping the Marshallese to help themselves." Such a program would involve at least the following provisions:

1. Periodic inspection and inquiry into local problems. This was attempted on the present field trip.

2. Detailed investigation of major problems. Field observations and analyses of soil suggest that phosphorus deficiency may be the cause of "laora," but experimentation in the field is necessary to test this hypothesis. Such experimentation could be conveniently accomplished on Arno Island, but it might require the continued presence of the investigator for several weeks. The Japanese agriculturists are said to have made long sojourns on several outlying atolls.

3. Collection and study of indigenous and introduced economic plants in a central experimental garden. This is essential to any long-term plan for the improvement of existing varieties and would form an important element in the training of the agriculturist himself. Few Americans have had first-hand experience or training in the cultivation of breadfruit or Micronesian taro, for example. Such a garden would serve also as a center for exchange of promising economic plants with other regions of the Pacific.