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Cultural Methods of Pest Control on Taro (*Colocasia esculenta* Schott) in American Samoa

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Abstract—In December 1989, a Rapid Rural Appraisal (RRA) of taro agriculture was held in American Samoa. A survey of 32 farmers revealed several traditional methods of insect, disease and weed control. Planting *Coleus blumei* Beuth in or around a plantation was alleged to control the cluster caterpillar (*Spodoptera litura* (Fabricius)) and the taro planthopper (*Tarophagus proserpina* (Kirkaldy)). "Smoking" a field with a torch of coconut fronds 3 times a week reportedly controlled the planthopper. Allowing chickens to roam taro fields in search of cluster caterpillars for food, and leaving a cluster caterpillar-infested field fallow for 3 to 5 months supposedly suppressed cluster caterpillar numbers. Control of weeds was accomplished by mulching with coconut fronds and banana leaves. Using the shade of papaya and banana trees and growing taro in high density or in an intercropped scheme were also identified as weed control measures. Pulled and slashed weeds are frequently used as mulch, and the mat of mulch is periodically turned over to break up any rooted weeds. Paragrass was cited as a "fertilizer" weed and "mile-a-minute" (*Mikania micrantha* Kunth) was regarded as a helpful plant. Herbicides promoted the growth of a different, more persistent weed population which was more difficult to control. Taro corm rot was controlled by selecting disease-free planting material, replanting in fallowed areas, and avoiding areas near *Hibiscus tiliaceus* L. trees.

Introduction

Pacific Islanders have developed traditional practices that help sustain their resources to support viable agricultural systems in their fragile ecosystems. These practices not only assist in maintaining soil fertility but also address the challenges of pest management. Taro (*Colocasia esculenta* Schott) is a staple crop in several Pacific Island agricultural systems. The purpose of this study is to document traditional pest management practices in the production of taro in American Samoa.

Methods and Materials

From October 31 to November 10 1989, a Rapid Rural Appraisal (RRA) of taro agriculture was held in American Samoa, bringing together a multidiscipli-

nary team from the areas of agricultural economics, agricultural extension, agronomy, animal science, environmental psychology, entomology, geography, soil science, plant pathology and weed science to document traditional agricultural practices associated with the growing of taro. Focus was given to pest management, soil fertility and soil conservation practices.

Three teams, each with at least one member from each representative discipline, were organized to conduct the RRA interviews with the local farmers. To accommodate time constraints, 32 farmers were selected to interview. These farmers represented a broad range of taro producers in American Samoa—from commercial farmers to backyard hobby farmers and near-subsistence level farmers. Other factors considered in farmer selection were: age of farmer, years of farming experience, location of farm, site elevation, and slope of land.

The RRA differs from other survey techniques in that the questions are open-ended, with subsequent questions evolving from answers given by the farmer. Consequently, the teams needed to discuss the answers received throughout the day in order to reformulate questions or redefine questioning strategy. Two basic questions were of primary concern: what the farmer perceived as major pests and what control measures were used to manage these pests. If additional pests were observed by the team, their presence was brought to the attention of the farmer for his opinion as to their pest status.

Results and Discussion

Four major pests of taro were identified, in descending order of importance: weeds, taro planthopper, taro armyworm and corm rot. Generalized farmer observations, opinions and control methods are listed for each pest.

WEEDS

Weeds are regarded as the major obstacle to taro production in American Samoa because the farmer reportedly spends most of his time at weed control. Major weeds include Honolulu rose (*Clerodendrum philopinum* Schau) and *Paspalum* sp.

Some farmers regard a few types of weeds as beneficial. Many farmers used pulled weeds as mulch between taro plants. Sometimes this mat of mulch is turned over several times during the growing season in order to disrupt any rooted weeds. Besides functioning as a weed suppressant, the mulch slowly decomposes, thus providing a recyclable nutrient source for the growing taro or subsequent crops.

Mikania micrantha Kunth, commonly known as "mile-a-minute", is a ubiquitous, fast-growing vine that is regarded as a "helpful" weed by many farmers. It is wrapped around banana plants during drought periods, in order to catch dew and hold moisture near the banana. Some farmers report *Mikania* to be the "weed of choice" to overrun a taro plantation during fallow periods, as it is easy to pull and leaves the soil moist and friable.

In addition to mulching with cut weeds, weed control practices include mulching with coconut fronds and banana leaves, planting taro in a high density scheme, or intercropping with a variety of other groups, such as banana, papaya, breadfruit, etc., to provide shade to suppress weed growth.

While about 60% of the surveyed farmers used the nonspecific herbicide Paraquat, use throughout the 6 to 10 month growing season was minimal. Paraquat application can be categorized generally into three main schemes:

1. Spraying during preplanting only, using Paraquat 3 to 14 days before planting. This may or may not be followed by slashing these dead weeds for mulch.
2. Spraying 1 to 3 times during the growth of the taro.
3. Spraying initially to clear the field, then handweeding the rest of the time.

The advantages and disadvantages of Paraquat were clearly recognized by the farmers. Though an additional expense, herbicides were seen as labor-saving devices which allowed the farmer to service a large area in a short time when compared to traditional methods. However, herbicides were also criticized for causing leaf damage, "spoiling" both the soil and taro corms, and excessive expense. Some farmers noticed that the use of herbicides promoted the growth of different weeds, usually grasses, which were more difficult to control. Farmers also observed that weeds grew back more quickly in fields sprayed with herbicides than those where weeds were pulled or slashed.

INSECTS

Taro Planthopper (*Tarophagus proserpina* Kirkaldy)

Farmers report that the taro planthopper can be totally devastating to the crop if there is a severe attack on plants under 3 months old. More commonly, the taro planthopper is an occasional pest on taro plantations. Farmers have developed several strategies for controlling planthopper populations. Planting *Coleus blumei* Benth, *pate* in Samoa, around or within a field is one of them. Various explanations are offered to explain its mode of action. Some believe that the smell of *pate* repels the planthopper. Others contend that *pate* attracts the planthopper, which then feeds on its supposedly toxic juices and dies. Opinions vary widely regarding *pate*'s effectiveness: belief that it works sometimes; belief that it works only when it is first planted; belief that it is ineffective in controlling any insects; and belief that it harbours nematodes which affect the banana. The dark red or purple-colored variety of *pate* is thought to be the most effective in controlling the planthopper.

Another method of planthopper control is through "torching" or "smoking" the plantation. Coconut leaves are bundled and then set afire. Walking through the fields with these torches causes the planthopper to jump from the plant. The belief is that the planthoppers die as their wings get singed or that the smoke drives them from the field. This practice is performed 3 times a week until the planthoppers are gone. "Smoking" is sometimes thought to be effective against the cluster caterpillar as well.

A predator of planthopper eggs, *Cytorhinus fulvus* Knight, lives in close association with the planthopper. It is rarely noticed or recognized by farmers as a biological control probably because of its small size and cryptic hiding behavior.

Cluster Caterpillar (*Spodoptera litura* (Fabricius))

Cluster caterpillars are perceived as a long established pest in American Samoa. Outbreaks reportedly occur every 3 to 5 years and are location specific. Severe infestations often occur after hurricanes. Some believe that cluster caterpillars appear after alternating short periods of rain and sun. Others report "more worms" during the dry season. Honolulu rose is an observed alternate host of the cluster caterpillar. Farmers have devised various strategies for dealing with the cluster caterpillar. One method is planting *pate* in taro fields. Some believe that its scent repels the cluster caterpillar, while others conjecture the caterpillar prefers *pate* to taro.

Another method of control is smashing the cluster caterpillars and their eggmasses, or handpicking and burning them. Chickens are often brought to, or raised in the field because they reportedly peck the cluster caterpillars from the plant. The scratching and feeding of the chickens around the base of the plant was also mentioned as a good weed control as well as advantageous in aerating the soil around the plant.

Allowing the weeds to grow unchecked in a cluster caterpillar-infested field is another control strategy. Farmers believe that when weeds take over the field, the taro will be "hidden from the cluster caterpillar" and the cluster caterpillar will leave the field. After 3 months taro can be planted again with success.

PLANT DISEASE

Corm rot is the most serious plant disease of taro and reportedly can be controlled by selecting disease free planting material. Additionally, replanting taro in a "different hole" will prevent the problem. Taro planted near the "fau" tree (*Hibiscus tiliaceus* L.) was reported to be more susceptible to corm rot. Farmers advised that taro should not be planted near coconut trees unless the soil is deep, since the shallow roots of the coconut would interfere with the growth of the taro corm. There is also a problem with corm rot developing on taro planted in rocky areas when the saprolite layer is near the surface.

Discussion

In American Samoa, traditional methods of pest management have been used to combat a number of pests. Weeds have generally been controlled by hand pulling, slashing and mulching with weeds, coconut fronds, and banana or other leaves. These methods not only suppress weeds but serve to replenish the soil through nutrient recycling.

Insect damage is generally minimal, possibly due to several interacting mechanisms. For instance, taro is planted either in monoculture or is intercropped with one more other crops such as banana, coconut or yams. When monocultured,

it may be in an isolated plot in the forest or surrounded by weeds, or other crops. In either case, it seems probable that the plant diversity of these systems offers increased environmental opportunities for natural enemies, thereby increasing biological control (Altieri & Letourneau 1980).

The multi-story, dense foliar cover associated with intercropping is less visually stimulating to insects which cue in on plants silhouetted against a contrasting background, such as the bare earth or the bright horizon. Similarly, plant diversity provides camouflage and thereby renders the at-risk crop less visible to pests (Perrin & Phillips 1978).

To complement the planting strategy method of pest control, Samoans have also adapted mechanical methods, such as smashing insect eggs and larvae, and up-rooting or slashing weeds. Though time consuming, these methods are environmentally sound and conform to the traditional Samoan practice of the family working together. It is common to see an entire family, from children to the elderly, involved in traditional taro production, even in the area of pest management.

The planting of *pate*, the use of chickens and the use of smoking torches are methods developed over generations of careful observation. While statistically sound evidence of their effectiveness has yet to be collected, continuous, widespread practice of these methods offers some credence in their capabilities. Also, the potential use of these methods at other locations offers hope in the continuous search for effective, alternative methods of pest control.

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