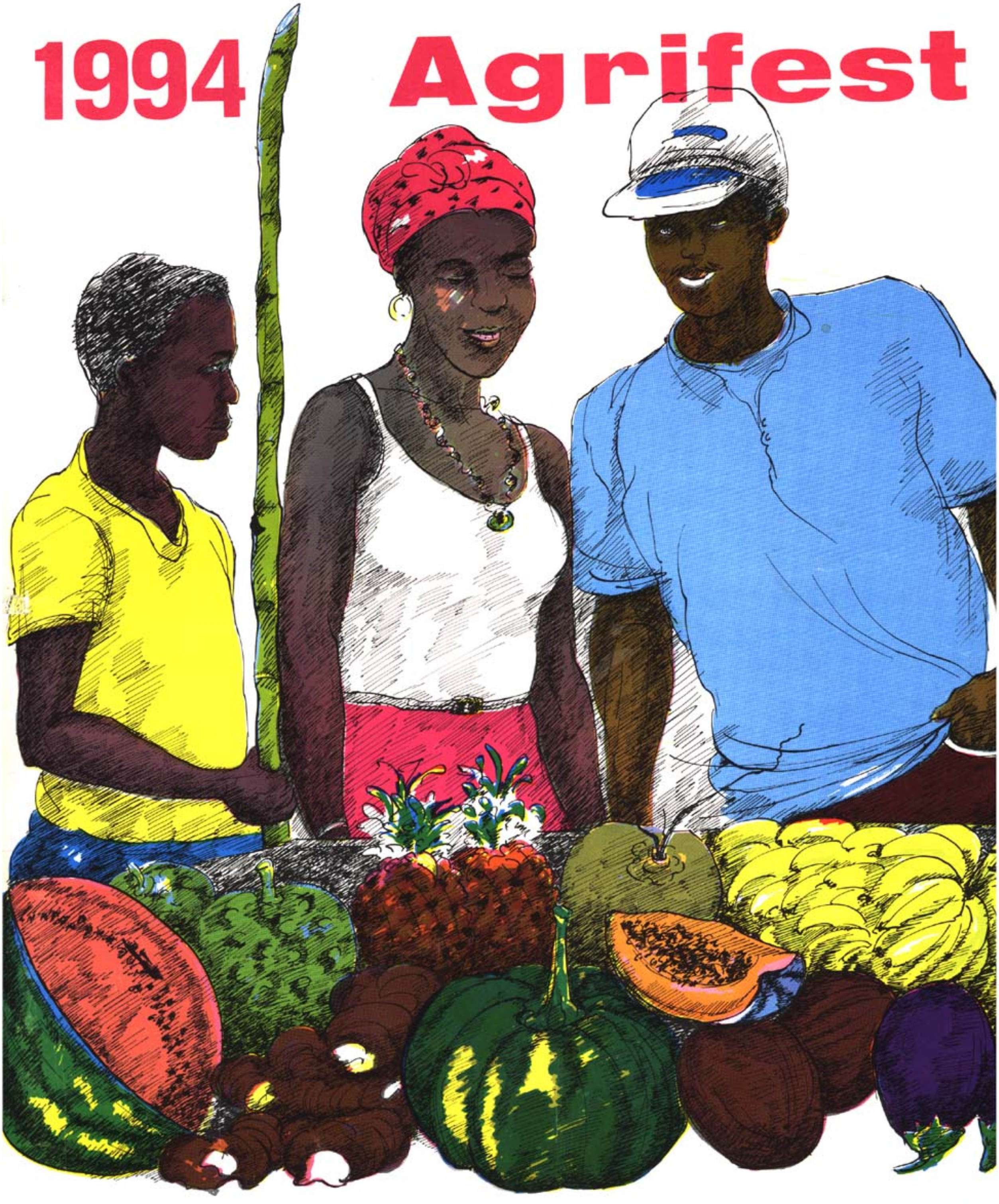
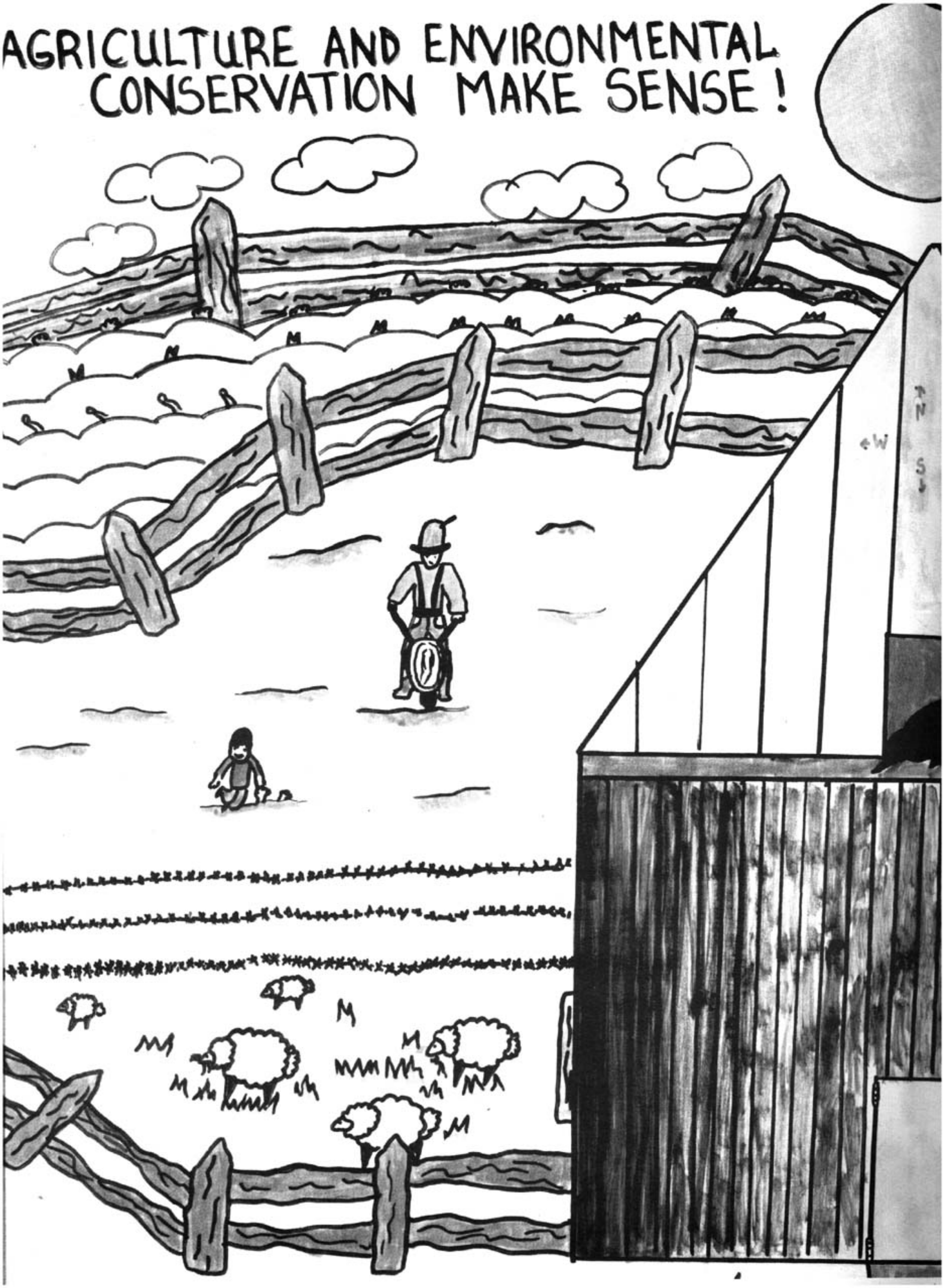
1994 Agrifest



Virgin Islands Agriculture & Food Fair

Bulletin Number 8

AGRICULTURE AND ENVIRONMENTAL CONSERVATION MAKE SENSE!



Agrifest 1994

"Agriculture Enhances Family Cooperation"

Editor ..... Clarice C. Clarke
Editorial Committee ..... Dr. D.S. Padda, Larry Bough
Dr. Erika Waters, Judy Salter

Jointly Sponsored by
The Virgin Islands Department of Economic Development and Agriculture
and
The University of the Virgin Islands
Cooperative Extension Service • Agricultural Experiment Station

An Agriculture and Food Fair Stalwart Remembered

Beatrice "Mopsy" Johnson
1901 - 1993

Beatrice "Mopsy" Johnson will be sorely missed by all whose lives she touched.

Concerned with the preservation of Crucian cuisine and culture, Mrs. Johnson was a part of the Virgin Islands Agriculture and Food Fair since its inception in 1970. Nen Bea's food booth was a popular spot each year, as, dressed in native costume, she demonstrated the preparation of the local foods and drinks she sold.

Although she was not able to attend recent fairs due to her failing health, friends maintained a booth in her name as a tribute to her devotion to preserving Crucian culture.

A Publication of the 23rd Annual Virgin Islands Agriculture and Food Fair

1994

Bulletin Number 8

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I am pleased to extend greetings to the Department of Economic Development and Agriculture and the University of the Virgin Islands' Land-Grant Program, co-sponsors of the 1994 annual U.S. Virgin Islands Agriculture and Food Fair.

Because 1994 has been proclaimed the "Year of the Family," this year's theme, "Agriculture Enhances Family Cooperation," promotes and stresses agriculture as a family effort.

Educating our young people about the land, instilling in them the values and importance of agriculture to the community, and allowing them the opportunity to gain hands-on experience in cultuvation and raising livestock are priorities.

On behalf of the people of the Virgin Islands, Mrs. Farrelly joins me in commending the efforts of the organizers and co-sponsors for their collective efforts in promoting agricultural prosperity and self-sufficiency for these islands.

Alexander A. Farrelly

Message from Dr. Orville Kean
President, University of the Virgin Islands

Welcome to the 1994 Agriculture and Food Fair. This year's theme, "Agriculture Enhances Family Cooperation," is very appropriate as it emphasizes the value of agriculture in our community and its effect on family life.

Agriculture plays a prominent role in the V.I., from the food we eat to the environment we are striving to preserve. It is incumbent on us to acknowledge this role, not only in the actual production of agricultural products, but also in the maintenance of a higher quality of life in our communities.

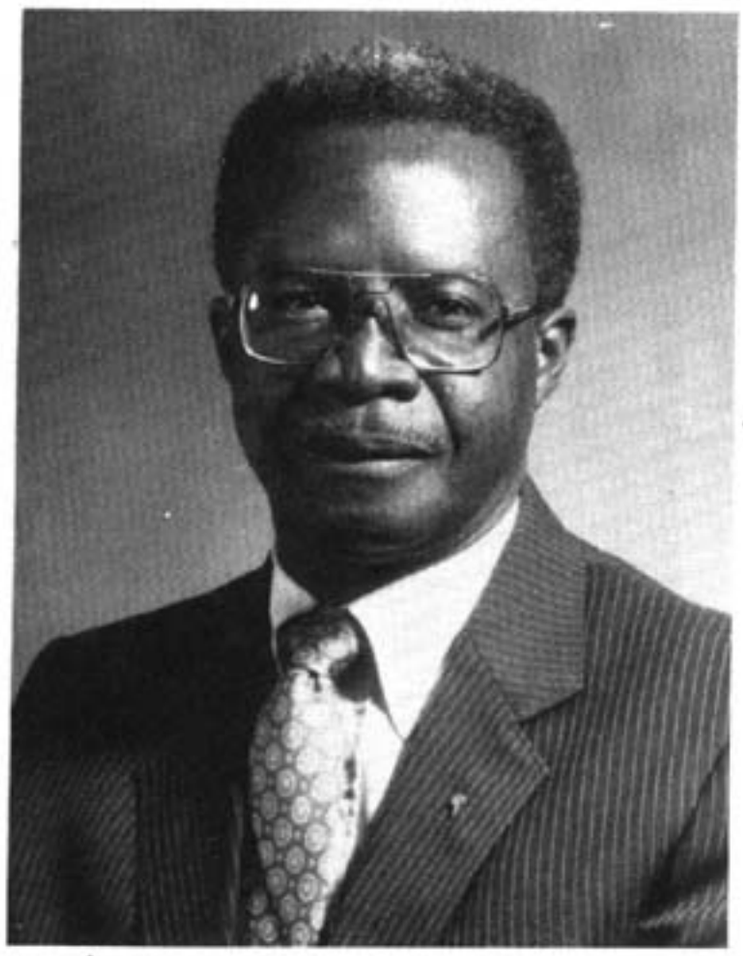
UVI works with families in a number of ways. The latest research on varieties and production techniques is investigated by our AES scientists, and members of our extension team disseminate that information to growers. The Cooperative Extension Service aids families by presenting information and teaching skills for better living.

The Land-Grant staff consistently focuses their research and educational efforts on contemporary issues like youth and families at risk, water quality, resource conservation, food safety and sustainable economic development.

The Agriculture and Food Fair is, as always, a wonderful event for families to enjoy together. Please enjoy the fair, as well as the articles in this bulletin. I wish to congratulate the Agriculture and Food Fair Board for their dedication to providing a meaningful community event for all the people of the Virgin Islands.

Orville Kean

Orville Kean, Ph.D.
President



The Virgin Islands of the United States
Department of Economic Development & Agriculture
P.O.Box 6400, Charlotte Amalie, St.Thomas 00804
(809) 774-8784
FAX - (809) 774-4390

"AGRICULTURE ENHANCES FAMILY COOPERATION"

Historically, the pursuit of agriculture has been a family affair, throughout the world and most definitely in the U.S. Virgin Islands. The involvement of the family in this enterprise has enhanced its growth and advancement throughout the years.

No doubt, we have lost many family farms over a long period of time, but the spirit and determination are not lost. From the community gardens on St. Croix to the farm plots at Northside, St. Thomas, we continue to see families pursuing this vital and viable enterprise.

The St. Croix and St. Thomas Farmers Cooperatives have been formed and will be very important in advancing the quality and quantity of agricultural marketing. It is expected that certain crops will be marketed to the local community, including hotels and restaurants. The Farmers Cooperatives offer a means of enhancing family farms and their productivity.

Let us all ensure that the theme for the 1994 Agriculture and Food Fair receives our support--Agriculture Enhances Family Cooperation.

Best wishes to everyone on this festive occasion.

Sincerely,

Eric E. Dawson

Eric E. Dawson, Esq.
Commissioner

Food, Nutrition and Health

By
Darshan S. Padda, Ph.D.
Vice President for Research and Land-Grant Affairs
University of the Virgin Islands

As we come together once again on St. Croix to celebrate the bounty of food in our Virgin Islands as well as share the latest technical developments in food production, I would like to take this opportunity to step back from the immediate focus. Of course, the scientists and specialists at the University of the Virgin Islands Agricultural Experiment Station (AES) and Cooperative Extension Service (CES) are working hard to improve food production conditions for Virgin Islands agriculturists; it is a crucial part of our work. But, it is also only a part of the overall picture. An equally crucial task is the promotion of good health and sound nutrition.

Consumers' interest in the relationship between what they eat and their health offers an unprecedented opportunity for agriculture. Increased understanding of the relationship between food, diet and nutrition is critical if Virgin Islanders are to achieve optimal health and decrease their health care costs. The U.S. Department of Health and Human Services' 1992 report, *Healthy People 2000*, calls for significant reductions in the incidence of obesity, anemia, premature births, growth retardation and osteoporosis. These conditions can be mitigated by the improvements in the diet.

Nationally, 1993 marks the centennial of USDA's involvement in nutrition research. Locally, as the University's Land-Grant programs enter their third decade, we too have renewed our commitment to the health and nutritional needs of Virgin Islanders.

Good nutrition begins back at the seed, which is why AES researchers are developing new strains of crops and studying ways to produce more prolific harvests and more nutritional food animals while reducing costs and protecting the environment. Excellent examples are the efforts of AES vegetables researchers, who have recently published the results of five years of vegetables and fruit trials designed to help local growers choose the varieties that will produce best under VI conditions, and the Aquaculture Program, which is refining systems that allow small businessmen to produce both fish protein and vegetable crops in limited space with limited input.

The Cooperative Extension Service, with offices on all three islands, has also long been involved in providing people the knowledge to make informed decisions about what they eat. The CES Home Economics Program staff helps people reduce the risk of disease while improving consumer's ability to make informed choices related to food safety, quality and composition.

A specific example is the Expanded Food and Nutrition Education Program (EFNEP), which helps families gain knowledge, skills and behaviors that lead to a healthier diet. Nationally and locally, families who have completed this six-month program are able to make significant improvements in their diets, while spending less money on food. Extension nutrition efforts also concentrate on health diets for diabetics and the improvement of "native foods" in terms of fat, sodium, sugar and calories.

The national EFNEP program has just initiated a new phase of the program specifically designed to help pregnant and nursing women improve their diets, and, as a result, the health of their babies. Training is under way, and this program will soon be available to Virgin Islands mothers-to-be.

EFNEP is also an excellent example of the collaborative nature of Land-Grant efforts. Just as AES researchers work with local growers to provide specific answers to their problems, EFNEP is a program which uses paraprofessionals from the community to work with their neighbors, spreading the knowledge as Virgin Islanders and those who have chosen to make the Virgin Islands their home help each other out.

A strong relationship between diet and health is becoming clear with modern research. Recent findings indicate that many health problems, e.g., heart diseases, arteriosclerosis, cancer, obesity, diabetes, hypertension, osteoporosis and anemia, may be caused or exacerbated by nutrient imbalance or excessive consumption.

The August 9, 1993 issue of *Newsweek* included an eye-opening article entitled, "Do Our Genes Determine Which Foods We Should Eat?" According to the article, native Hawaiians have the worst health profile in America. More than 65% of them are obese, and their mortality rates from cancer, heart disease and diabetes are the highest in the nation. Dr. Terry Shintani, working with native populations, sees diet as the chief culprit. Diet programs are getting increased attention from

health care providers. In the VI, excessive use of fatty and sugar-rich foods are causing health problems.

The relationship between people's diets and their behavior is undergoing extensive study under a branch of anthropology called Nutritional Anthropology. According to Professor Phillip T. James of Rowett Research Institute, U.K., health patterns are changing in developing countries. As a result of changing eating habits, the incidence of heart disease, high blood pressure and various types of cancers is increasing very rapidly. Childhood obesity is now common in the Caribbean and Latin America, and high blood pressure is becoming a huge problem in West and East Africa. Heart disease is escalating in Mexico, India and the Middle East. Heart disease, diabetes and other chronic ailments are known as modern afflictions because of their prevalence in societies where people eat unhealthy diets, lead sedentary lives and live under stressful conditions.

Optimal nutrition enables people to achieve their genetic potential, feel their best, and decrease their susceptibility to disease. Better health through improved nutrition can increase quality of life, productivity, and learning potential and can reduce health care costs. However, expanded investigations are needed on topics such as the relationship of nutrients to gene regulation and expression; role of food choice in promoting optimal health; behavioral aspects of food choice and demand; use of biotechnology to increase the nutritive value of food and retard spoilage after harvest; development of technologies to monitor and maintain product quality; and the impact of food labeling and other nutritional education initiatives on consumer food choice.

The UVI Research and Land-Grant Programs component is dedicated to the idea that nutrition is a comprehensive effort, involving the new information development and problem-solving skills of AES researchers and diligent dissemination of sound, research-based knowledge to the community of CES specialists and agents. The local efforts are also supported by the entire network of 74 Land-Grant universities. Together, we work toward the goal of improving the lives of the people in these Virgin Islands.

Dr. Darshan Padda, Vice President for Research and Land-Grant Affairs at the University of the Virgin Islands, and Dr. James Rakocy, Associate Director, Agricultural Experiment Station, examine varieties of leaf lettuce being cultured hydroponically in a tilapia production system.

Mrs. Miriam Greene, Extension Assistant -EFNEP, performs cholesterol testing at the 1993 St. Thomas/St. John Agriculture and Food Fair.

Recycling

By
Alekisha Petersen
Claude O. Markoe School- Sixth Grade
1993 Agrifest Winning Essay

What is recycling? The definition of recycling is "to cause to undergo processes or treatment in order to be used again."

The common products that can be recycled are paper, aluminum, glass and plastic. After recycling, these products can be used to make more aluminum cans or more of the same products. For example, aluminum cans can be used to make more aluminum cans, refrigerators, stoves or airplanes. Plastic can be used to make radios, toothbrushes and telephones. Paper can be used to make postcards and other paper products. Glass can be used to make windshields for cars.

You may be asking, "Why should we recycle?" We should recycle because our very lives depend on recycling. The birds in the air, the fishes in the sea, yes, the entire environment depends on the recycling process.

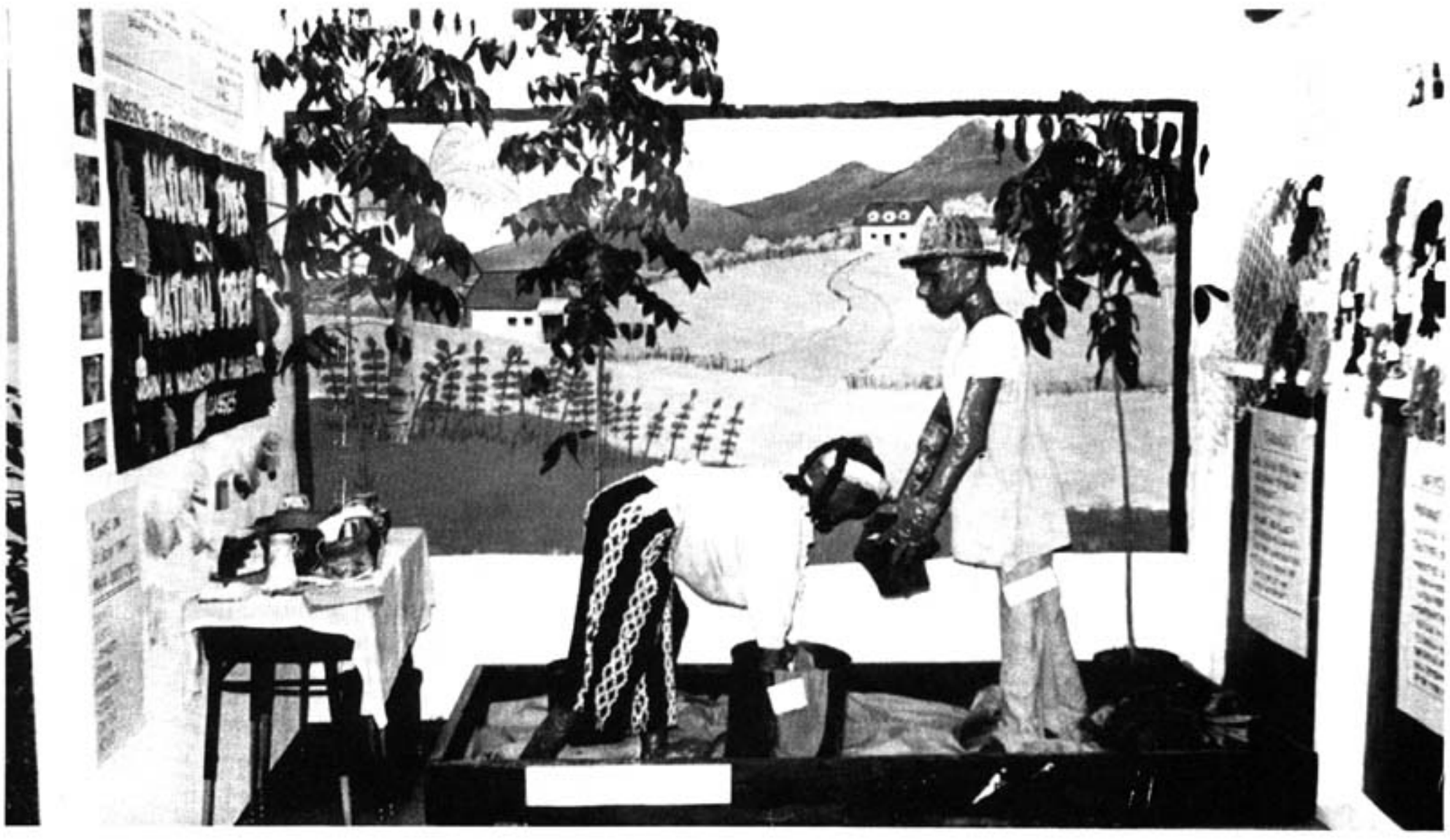
Recycling will also reduce garbage landfills, ocean dumping and incinerator use, which pollute the air.

Recycling is made easier with separate trash cans for recycling products.

I think that more can be done in the area of education. I am in the sixth grade and until researching essay, I knew very little about recycling. All this needs to be changed. Recycling should be taught from kindergarten to college, since our very lives and futures depend on it.

I did not even know of the Anti-Litter and Beautification Commission's [aluminum] can recycling pilot program, which is located right here on St. Croix, at the Boys and Girls Clubs in Estate Peter's Rest. They pay you five cents for each can you take in for recycling. So you see, there is also money in recycling.

Manufacturers can be a great help by making recyclable products and using as little packaging as possible. For customers, it is simple to buy recycled products and recycle. Recycling helps us to have a cleaner environment.



Experimental Efforts to Grow Juvenile Lobsters in the Virgin Islands

By
Norman J. Quinn, Ph.D.
Environmental Research Unit, Eastern Caribbean Center
UVI Eastern Caribbean Center

Division of Science and Math student, Ms. Ginger Chapman, spots a puerilis lobster on a Witham collector. The collector had been in the water for two weeks.

There are about 30 species of spiny lobsters throughout the world in the family *Palinuridae*. They are known as rock lobsters, spiny lobsters, crayfish and langosta. The total annual catch per year for the Caribbean for all species is over 50 thousand tons. The Caribbean spiny lobster (*Panularius argus*) is the largest and the most widely distributed which an important Virgin Islands fishery estimated at over 19 tons in 1988. The Caribbean spiny lobster's habitat occurs from Brazil, through the Caribbean to Florida, the Bahamas and up to North Carolina.

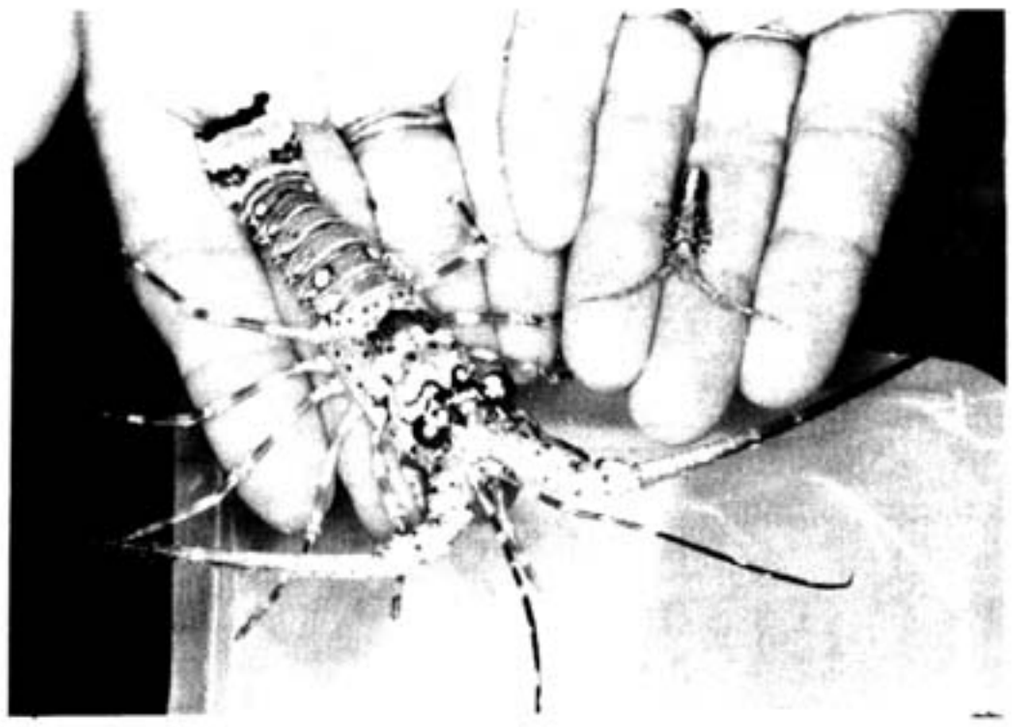
Lobster tails are sold in the local supermarkets for more than $20 per pound and at even higher prices in Europe, North America and Japan. Because of the high demand and excellent prices, scientists are exploring different ways to raise lobsters in captivity.

One approach is full-scale aquaculture, where the lobster is raised throughout its entire life cycle in captivity. Although researchers have successfully mated and spawned spiny lobsters in captivity, they have found it difficult to rear the larvae. The larvae are planktonic and can take up to eight months to complete development. During this time they feed and grow on plankton, going through about eight metamorphoses in 8 - 12 months. The Japanese have been successful in raising lobsters found in the Pacific from egg to *puerilis*. However, this has proved to be expensive and risky as there is high mortality in the larval stage.

Another approach is to collect *puerili* from the wild as they drift inshore. The transparent *puerili* settle readily on artificial habitats, called Witham collectors, consisting of PVC frames from which fibrous material is suspended. Air conditioning filters made from hog's hair are common, but mesh bags filled with sea grass, and algal-fouled ropes also have been used. Within three days after settling, the *puerili* will metamorphose into a pigmented stage with a carapace length of 1/4".

In the Virgin Islands, settlement occurs all year round with most settlement occurring from April to October. Within any month settlement is strongly influenced by lunar phase and the strength and direction of water currents. Settlement is higher in and around mangroves than off shore.

In our studies we found that a small, experimental collector with about 18 square feet of settlement surface area, located in a good settlement site, could collect up to 75 *puerili* per year. A commercial operation, depending upon its scale, would probably need to consider using more and larger collectors at given site, perhaps with more frequent collections during the period with the highest settlement.



Growth comparison over 10 months. The lobster on right, caught on a Witham collector, weighed less than 0.1 gram. The 20 gram lobster on left was grown in university aquariums.

Clearly the collection of *puerili* is a cheap, easy and fast technique with which to establish an aquaculture industry. The practice, however, is equivalent to fishing and would reduce the number of lobsters in the wild which could potentially mature into adults.

In Trinidad, studies have found high numbers of *puerilis* in coastal waters but few adult lobsters on the reefs. Scientists there concluded that destruction of mangroves and sea grass meadows and release of toxic compounds have created a "bottleneck" and reduced the juvenile lobsters' survival potential. In certain areas, it is possible that lobster production can be stimulated by collecting *puerili* and raising them in a controlled environment to a stage where they can be released into the environment and have a greater chance to survive.

During 1993, a pilot survival/growth study was conducted at the MacLean Marine Science Center (MMSC). Recently hatched brine shrimp (*Artemia sp.*) were fed to first stage juvenile lobsters. After their initial molt in the aquarium, which occurs in 25-33 days, they were fed shrimp, fish scraps, dried fish flakes and algae.

Studies by the Harbor Branch Institute of Oceanography (HBIO) found that lobsters fed primarily on fish or fish meal suffered high mortality during molting. In a study supported by a Florida electric power company, it was discovered that the greatest growth rate for lobsters occurred when the water temperature was sustained between 29° - 30°C. As the water cooled, the time period between molts increased and growth slowed.

At the MMSC flow-through aquarium, water temperatures varied between 22° and 30° C. Over a 10 month period the lobsters we observed grew from 0.1 g at collection to 15 - 18 g. This probably is too slow for most commercial operations.

A third approach would be to capture lobsters of the minimal legal size (3.5") and place them in a controlled, contained area connected to the sea. At 29°C, HBIO found that molting occurred every 50 - 60 days with an average increase in body weight of approximately 40%. That means the weight could double in four months.

Rapid growth at high temperatures over 2-3 months makes this effort more plausible. However, the economics would have to be considered carefully. A secure, well-flushed location situated close to a cheap source of catch by-products is essential, as is a plentiful supply of small lobsters. That is a situation that is not common in the Virgin Islands.

There is also the additional risk of destruction of the facilities. The period for fastest lobster growth is June through October when sea water temperatures in the Virgin Islands are commonly above 28° C. This coincides with the hurricane season, which increases the risk of aquaculture facilities being wiped out and the stock lost.

Interest in lobster mariculture is likely to continue to increase as diet-conscious humans increase seafood consumption. Maximum sustainable yields in many islands have already been exceeded.

Presently, there is sufficient information and need to begin pilot programs which could focus on establishing commercial aquaculture production techniques that include the development of optimal feeds for rapid growth, more efficient *puerilis* collection, the effect of puerilis collection on natural population levels, and the survival of raised juveniles released into the wild.

Ms. Eve West, research assistant, examines a lobster.

The Quality of Our Beef

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St. Croix the taste treat and
eye appeal
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CASTLE NUGENT FARMS = GASPERI

The Search For The St. John Baobab

By
John Rashford, Ph.D.
Department of Sociology and Anthropology
College of Charleston

I have been mapping the distribution of baobab trees (*Adansonia digitata*) in the United States Virgin Islands over the past five years as part of a wider project aimed at documenting the ways in which this species is being dispersed in the Caribbean.

Although there are reports in the literature of baobabs in St. Croix and St. Thomas, there are no reports for St. John. In the spring of 1990, I submitted a grant to the Virgin Islands Humanities Council for support to continue this project. I was told by Magda Smith, Director of the Council, that one of the council members from St. John who had read my proposal was familiar with a baobab tree on St. John. I was surprised.

Not only were there no reports of baobabs on St. John, but I had made three trips to the island and despite my many inquiries, the results were always negative. There were two cases where people said there were baobabs, but on close questioning, they turned out to be cotton trees (*Ceiba pentandra*) instead. Others told me they tried to grow baobabs on St. John but the young trees died after a few years.

This paper then documents the search for St. John's baobab tree.

Description and Distribution

The baobab is a large deciduous tree native to the seasonally dry regions of tropical Africa. It is immediately distinguished by its enormous trunk or trunks that appear strangely disproportionate to the tree's moderate height, and its thick, rapidly tapering branches. This makes it a conspicuous feature of the environment wherever it grows.

The African baobab is one of the best known members of the small paleotropical genus *Adansonia* of which there are eight related species--seven in Madagascar and one in Australia. The genus was named after the French botanist Michel Adanson who encountered the tree while traveling in Senegal from 1749 to 1753. Adanson was a student of the eminent French botanist Bernard de Jussieu, and it was Jussieu's report of Adanson's findings that led Linnaeus to mention the tree in his *Species Plantarum* published in 1753.

Digitata, the specific epithet of the species, refers to the five fingerlike leaflets of the baobab's broad compound leaves. The tree blooms in the spring and summer, producing large, waxy, hibiscus-like flowers that are white or creamy, and hang upside-down on long stalks.

From these flowers develop big, woody, oblong fruits containing a white acidic pulp in which are embedded many seeds. A fully grown baobab produces hundreds of fruits. They mature through the summer and autumn and ripen and fall from the tree in the winter, spring and early summer.

The African baobab now grows in many parts of the world although it remains a rare tree in most places. Many beautiful examples can be found scattered throughout the Caribbean. I have seen them in St. Croix, St. Thomas, Antigua, Barbados, Jamaica, Trinidad, Tobago, Puerto Rico and St. Kitts.

There are also reports of the tree in Guadeloupe, Martinique, St. Martin, Haiti, St. Vincent, Nevis, Dominica, Bahamas and the Dutch Leeward Islands. Of the islands I have visited, St. Croix has the most trees, the widest variety of forms, and some of the most beautiful individual specimens.

The Search

On Saturday, December 15, I met Elroy Sprauve, at 10 a.m. at the Julius E. Sprauve School as we had agreed. He was the member of the Humanities Council who had told Magda Smith about the baobab on St. John. With him was Jim Provost, a science teacher at the school, we picked up Melville Samuel, a retired teacher from the same school. This was a search indeed, for while Elroy remembered a baobab growing in the midst of many large rocks, in Estate Sieben, he had not been back to that spot in many years.

Jim provided transportation with his jeep. From Cruz Bay, it was 3.3 miles along the Centerline Road to the dirt road where we turned south to Estate Sieben. About a tenth of a mile along the dirt road we came to our first real obstacle: a huge trunk and branches from a dead tree were strewn straight across the road. We cut away the branches with machetes. We hooked the trunk to the jeep with a plastic rope, and, using a large branch as a lever,

maneuvered the trunk aside. It was here we had our first encounter with the Catch-and-Keep plant (*Acacia westiana*), whose thorns clung to the skin as readily as they clung to clothing.

Another 1.4 miles along the dirt road and we were at the place from which Elroy said we could walk to the tree. Elroy was born on the estate and spent summer holidays there when he attended school in the states. But it was now more than 33 years since his father had sold the 200 acre estate which became part of the National Park Service and he had not been back since. The place was covered with a thick bush that had overgrown the area since it was last inhabited.

Armed with machetes, we began to clear a small path in the direction of the tree. After an hour and fifteen minutes of slow going, we realized we had passed the place where the tree was thought to be. Elroy, Jim and Melville know the area from many years of experience and it was enlightening to listen to them reminisce.

As we made our way through the bush which occasionally gave way to thick stands of small trees, especially in the gut, they talked about the history and ownership of the area, and of its plants and animals.

Melville was the gatherer of the group. He collected continuously as we made our way to the tree, sharing his love for and knowledge of St. John's plants and their traditional uses. At first, he had a brown paper bag in which he had limes, ferns for planting, and bay leaves. The bay leaves, he said, were traditionally placed in kitchen cabinets to keep insects out of flour and cornmeal. When the paper bag began to fall apart, he took his undershirt and, with a few knots, transformed it into a carrying bag. It was Melville who provided Elroy and me with our first taste of the fruit of a species of *Bromelia*. It was very sweet and of an agreeable texture.

From where we were, we realized we had missed our mark. We could see the bluff overlooking Fish Bay where Elroy remembered seeing the tree, so we started in that direction. We had met at the Sprauve School at 10 a.m. and it was now 12:10 p.m. In a short while, however, Elroy sighted the top of the baobab and pointed it out to the rest of us. We could see it clearly; its bright yellow and orange autumn leaves stood conspicuously above the green leaves of a thick growth of trees covered with vines.

St. John's Baobab

It was a beautiful tree about 25 to 30 feet tall with a single conical trunk. It was partly covered with vine and access to the tree was blocked by small trees and shrubs that had grown up at the foot of it. After removing these plants, we measured the tree at 3 feet from the ground. It was 14 feet 11 inches in circumference. Elroy did not think it had grown very much over the past 30 years. This was a small tree in comparison to the largest baobab on St. Croix, which grows in Grove Place and measures 55 feet in circumference at 3 feet from the ground.

It was clear the tree had lost many of its branches from the impact of Hurricane Hugo in September 1989. Similar to other trees I saw in St. Croix, this one also had dead branches hanging from it, and there were also dead branches on the ground.

Elroy said the tree bore fruits, but he did not remember anyone eating them. With most of the fruit-bearing branches destroyed, there were no fruits to be seen on the tree. I searched under the tree for evidence of floral parts or fruits and found none.

As with baobabs in St. Croix, this tree also had termite trails on the trunk and branches, and there were lizards on the trunk. I have often found wasp nests on baobabs in St. Croix, and we encountered a few as we made our way through the bush, but there were none on this tree.

Standing at the base of the St. John baobab are (left to right) Jim Provost, Melville Samuel and Elroy Sprauve.

A curiosity of the St. John baobab is that water enters the tree through cavities that develop where large branches have broken off close to the trunk; there were several such places. Old baobabs are frequently hollow and they become natural reservoirs. This is one characteristic that makes this species so valuable to people, especially in the dry tropics to which the tree is naturally adapted. The St. John baobab collects water, but it passes through the trunk and flows out via a large hole at the base of the tree.

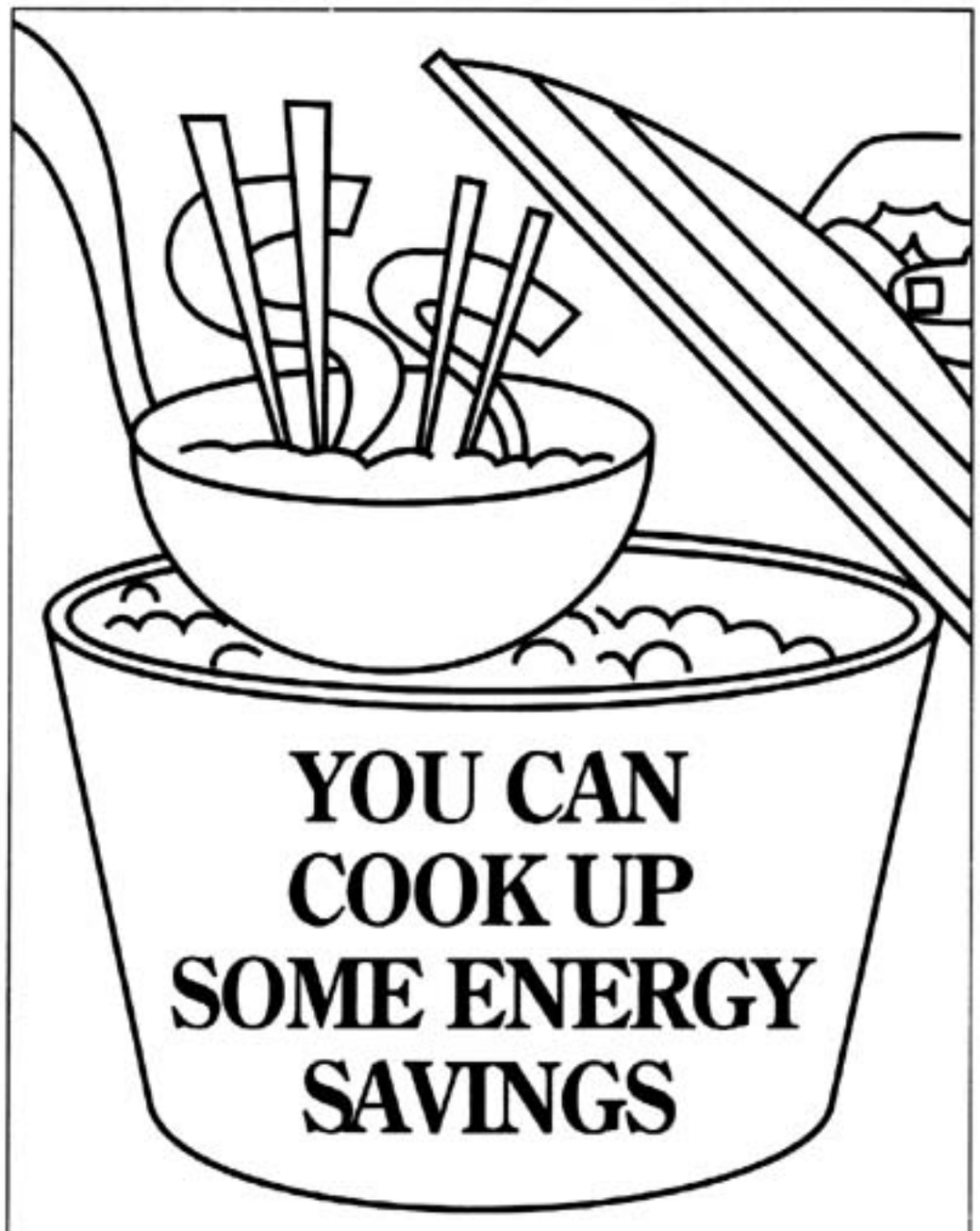
Perched on a bluff overlooking the Caribbean Sea and

partly surrounded on the southeastern side by huge rocks that provided comfortable places to sit, the baobab and its location were as interesting as Elroy had described them. Whether by accident or by design, the tree and its setting did have the atmosphere of a special place.

Elroy remembered that this was where he and others would play. He wondered in what ways the tree might have been important to people before his time. The St. John baobab is one of several I have found in the Caribbean growing in places that are remote from human activities.

Yet, wherever I learned about the history of these trees, they were always associated with settlement activities in the past. It struck me that as in Africa, there are baobabs in the Caribbean -- like this one on St. John--that reveal the site of a former settlement.

Hole at the base of the St. John baobab.



You can cut your cooking costs and whip up some energy and cost savings right in your kitchen. Here's some easy ways to do so:

1) Use the smallest appliances possible — such as slow cookers, electric grills, and toasters — because they use less energy than a conventional stove or oven.
2) Cover pots and pans to allow food to cook faster.
3) Keep your oven and burners clean to operate at their most efficient.
4) Avoid opening the oven door to peek at what's cooking.
5) Cool food before putting it in the refrigerator or freezer.
6) Thaw frozen foods in the refrigerator before cooking.
7) Think about what you want to remove from the refrigerator before you open the door.

VIRGIN ISLANDS WATER AND POWER AUTHORITY

Citizen Politics

By
Joseph Fulgence
Extension Specialist - 4-H
UVI Cooperative Extension Service

The lack of a more viable agriculture industry in the U.S. Virgin Islands is a problem which must be addressed by the people. For too long, we have waited on the government to do something to rectify this solution. A more viable agricultural industry would reduce our food costs, provide us with a higher quality of fresh produce, employ more Virgin Islanders and strengthen our economy. During election campaigning, agriculture is given a high priority among candidates seeking office. However, after the successful election of these candidates, agriculture is pushed back from the "top of the priority list." Citizen politics can be used by committed people to bring about a change in the state of the V.I. agriculture.

From its inception, Cooperative Extension Service has recognized the important role people in need must play to receive help from the government. This observation can be found in the motto of the Cooperative Extension Service--"Helping people help themselves." Too often, the majority of the population believes governmental efforts are the first recourse to fixing what is wrong with society. "It is the politician's job," you will hear them say.

Politics: Of the Citizen

Politics sometimes makes people think of corruption, backroom deals, or negative ads on TV. Some feel it is what other people (experts, politicians, lobbyists) do - or even worse, do to us. But politics used to mean something else. The word meant activity "of the citizen"--that is, by ordinary people. Politics was the way communities made decisions and rules that people lived by. The role of citizenship wasn't a boring duty, and it didn't mean just voting. It meant the chance to make a difference. Early citizen politics in the U.S. can be traced to the Continental Congress of 1774 and 1775, which established a relationship among the 13 original colonies and created the Declaration of Independence to address removing British sovereignty from U.S. soil.

Another definition of politics is the process of who gets what, when and how. A person who determines such a decision has demonstrated power. Power is the ability to influence another's behavior. It may involve force (coercion), persuasion or reward. The more power one has over another, the greater is the change or the easier is the change to accomplish. Power, like money, is a means to an end.

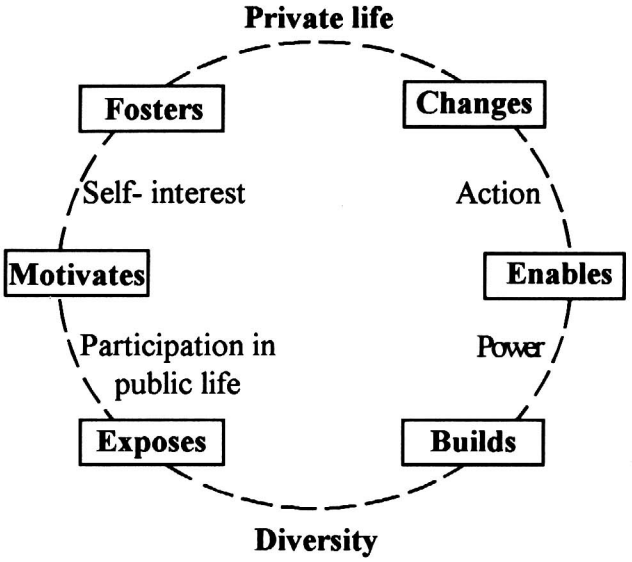
Failure to exercise your power to create change in your living conditions can be considered an act of apathy. Apathy is as much a political position as is activism. Either position will influence who gets what in our society. In the words of a congressman, "government is faced every day with a number of decisions and competing priorities. The one that gets the greatest attention is the one that more people are vocal about." Therefore, safe streets, good schools, and clean food are all political decisions influenced by who participates in them, who is prevented from participating, and who chooses not to participate.

People Must Take Action

The problems facing our society and the world today are so overwhelming and complex that proper solutions to them will involve many actions and approaches. Young people and adults must begin to do something about important issues in their communities such as drugs, the need for recreational and learning centers, improving schools, protecting wildlife habitat and the environment, fighting poverty and homelessness.

They have already decided to help make a difference and to be heard. Groups such as Our Town Frederiksted, St. Croix 2000, and St. Croix Now are examples of people who have begun to understand again what politics means: ordinary people--not experts or political professionals by themselves--possess the wisdom and imagination necessary to solve major problems. Wisdom and imagination come from people working together. This is called citizen politics, which can be illustrated using the following diagram.

The explanation is as follows: A person's private life fosters his or her self-interest; self-interest motivates participation in public life, and participation exposes him or her to the diversity of opinion and the individual concerns of his community. Including many people with different opinions and contacts to address a problem



builds power. Power enables action to solve problems and create changes in our living conditions or our behavior (our self-interest).

Making It Happen

If you already have an idea for change that's worth working for, the first step towards making it happen is to incorporate a working group around the issue. Surround yourself with people who can be supportive and inspirational. It doesn't have to be a big group or your closest friends. Talk with them about your idea(s) and work through the details. Try to agree on fundamentals. If it is necessary, revise your ambitions and break up big challenges into smaller ones. Be a team before you go out there.

Common ground is the key to expanding your team's base of support. Networking among your communities is the best way to garner power and find friends in high places who agree with you and can be very useful. Not everyone is good material for your team. If the change you want to make is an important one, you'll encounter pressure and possibly harsh treatment. But building power means you do not think in terms such as, "it's all unfair to me." Rather, it is important to see the world for what it is. You need to develop a practical solution or reaction to what you see as a problem.

Unfortunately, most groups don't survive this most important phase. But if everybody understands that life is the art of compromise, as well as that the plan of action should be a collective agreement, not one individual's agenda, then the group will be successful.

After completing a plan of action, get involved with "mapping out power." Understanding who holds what power, where and what type of power they have will help determine the type of actions you can take. Understanding where someone's power lies is useful in figuring out how to bring them into your work.

When you have completed each separate action in your plan, evaluate your success. Evaluation helps the group figure out if it is heading in the right direction or following its mission.

Remember politics is an art, and collaborative problem solving takes a lot of time. But it's worth it. So take the time and trouble of building relationships with people you need to work with and find out what you really want out of the work you are doing together. Practice judgement and deliberation. What is the problem? Who is involved? What solutions do they offer and how do they see the problem? What can we agree on, and what can I give up? Think about those questions and talk about them with others, and please try to have fun.

Politics is something we have some good natural instinct about, but we need to practice. Watch for who has particularly good skills in some areas, and ask them to teach others. Remember if you are going to be effective you need to diversify your group as much as possible. The greater the diversity the more credence it gives to your group's mission.

Some of these methods can assist our farmers and other individuals to form cooperatives and to address problems facing the establishment of agriculture as a viable option in our economic growth. Our young people can also use it to form groups to address problems that will affect their future, and to improve the world they are about to inherit.

Proper Use of Pesticides in Your Garden

By
Olasee Davis
Extension Specialist - Natural Resources
UVI Cooperative Extension Service

My first garden was one of the great experiences of my life. It reinforced an idea that I had long believed in--that one should do for oneself everything that one can. Growing even a small plot of your own food has tremendous implications physically, psychologically and even politically.

Over the years, gardening has become a pleasurable family activity in the Virgin Islands, and one way many families reduce their food costs. However, some gardeners find it difficult to grow certain vegetable crops in the islands because of pest problems.

Some gardeners have turned to pesticides for a quick solution, yet pesticides have their disadvantages. They must be used properly and carefully to achieve the best results while protecting the user and the environment.

Gardeners who use pesticides should dress properly. Chemicals used in the garden are potentially toxic, particularly for children. The key to safe gardening in the Virgin Islands is to view all pesticides as potentially hazardous and to read the label before applying any pesticide to your garden.

The four major routes for possible overexposure to garden pesticides are contact with the skin, contact with the eyes, inhalation of dusts or vapors, and oral contact with fingers, hands or arms.

One way to avoid chemicals from contacting the skin is to wear gloves. While gloves do not have to be thick to be safe, they should be high-topped and preferably able to be sealed over the long sleeves of a shirt or coveralls.

To protect the eyes, manufacturers of pesticides always recommend some type of protective face mask or eye gear. Wearing protective gear such as goggles or safety glasses protects against damage from twigs and branches as well as pesticide sprays. Gardeners who wear contact lenses should know that chemicals that get trapped under a lens can be particularly damaging.

Gardeners should not smoke when using pesticides because of the increased possibility of inadvertent hand-to-mouth transmission. The most common symptoms of exposure to commonly used gardening chemicals, such as organophosphate or carbamate, include either dry mouth or excessive salivation, tingling of the fingers, tearing of eyes, blurred vision, burning or itching sensations, frequent urination or defecation, abdominal cramps, nausea or vomiting, excessive sweating and muscle tremors. If you experience any of these symptoms, immediately contact the hospital emergency room or a physician. For prompt and accurate help, be prepared to name the substance involved. Next, take a long and thorough shower. If possible, have someone else in the household call for assistance while you shower, because symptoms of overexposure can progress quickly.

Medical specialists recommend that, even if symptoms appear to be minor, avoid the garden for the remainder of the day.

Special precautions are needed to protect children from the effects of garden chemicals. Remember, infants and toddlers are at particular risk of overexposure. They may crawl through the garden, or eat or even suck on the chemically treated leaves and earth.

Children should be kept away from all sprayed or treated areas as long as the chemical persists, which may take from days to weeks, depending upon the specific chemical used and weather factors, such as wind or rain.

Garden chemicals should be treated as potential poisons. Chemicals should be kept out of the reach of children. Never store leftover chemicals in common household containers, such as jars or bottles that may be easily mistaken as containing something edible or drinkable.

The University of the Virgin Islands Cooperative Extension Service conducts free classes on pesticide safety and other relative pesticide topics. As a society, we must consider both the immediate and long-range effects of our actions on irreplaceable natural resources.

Become a 4-H Member or Volunteer

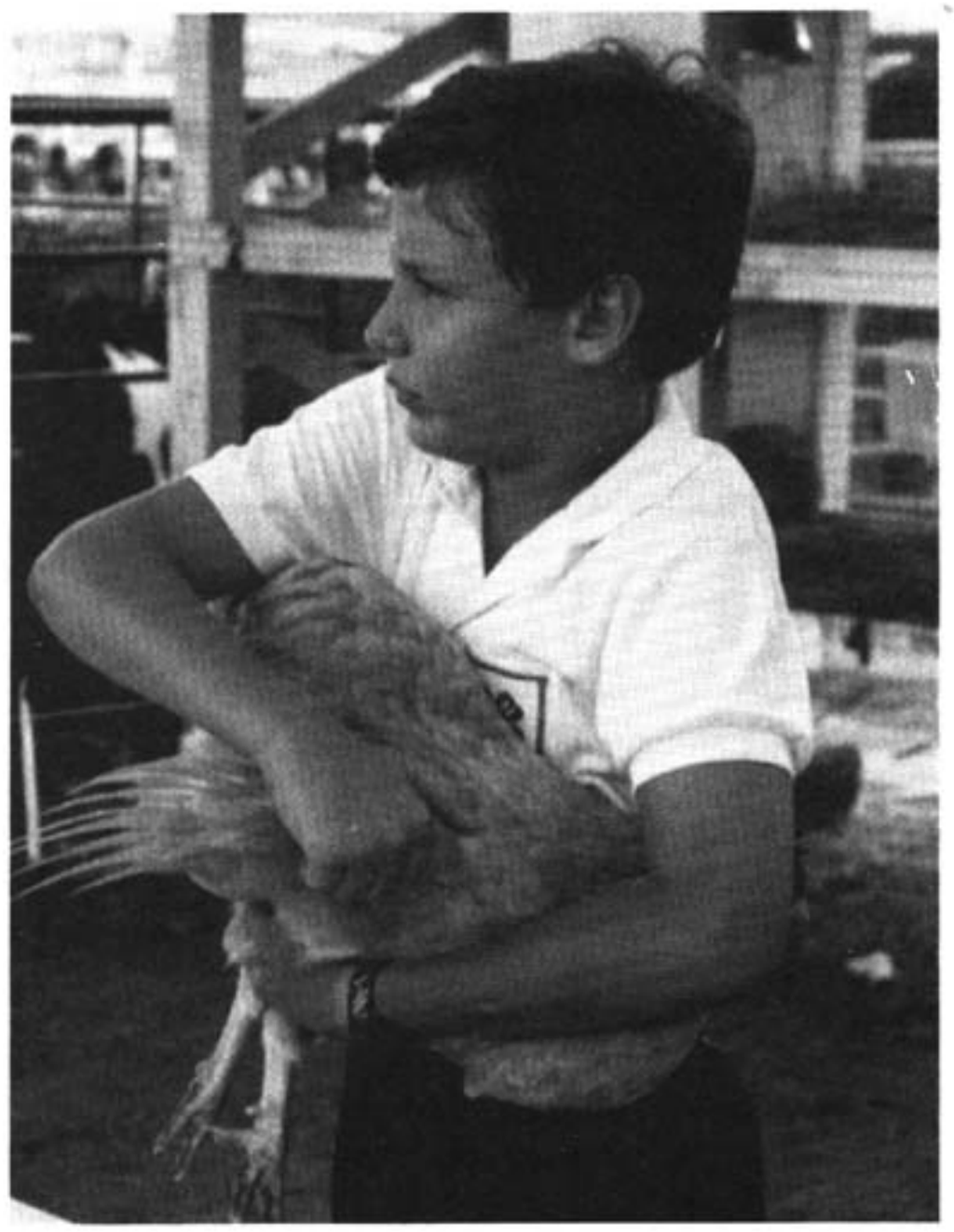
The University of the Virgin Islands cooperative Extension Service 4-H Program offers hands-on experience in project areas such as arts and crafts, citizenship, cultural awareness, foods and nutrition, community service, leadership, and small livestock (rabbits, sheep, goats, chickens, etc.).

4-H'ers meet new friends, learn new skills, participate in club meetings, workshops, projects, community service activities and summer camp. Any youth age 5-19 may join.

Any interested adults with the time and willingness to work with children are welcome to be a part of the Virgin Islands 4-H program.

For further information contact one of the 4-H offices:

ST. CROIX - 778-0246
Ms. Zoraida Jacobs, 4-H Program Leader
Mr. Joseph Fulgence, 4-H Specialist
Mrs. Sarah Smith, Agent
Mrs. Jillian Webster , Administrative Assistant
ST. THOMAS - 774-0210
Ms. Yvonne Phillips, Extension Assistant II
ST. JOHN - 776-6492
Ms. Carmen Wesselhoft, Extension Agent I



Harvesting Nature's Diversity

By
Kofi Boateng
Program Supervisor - Agriculture
UVI Cooperative Extension Service

On October 16, 1993, the University of the Virgin Islands Cooperative Extension Service sponsored the 13th World Food Day celebrations at the new Research and Extension Center. This celebration consisted of workshops and demonstrations on plant propagation, food preservation and safety, and 4-H youth activities. A large crowd from the community participated.

The Cooperative Extension Service has commemorated World Food Day on October 16 for the past 13 years. This has led people to inquire about the significance of this important occasion.

World Food Day was first observed in 1981 by the 150 nations represented at the conference of the Food and Agricultural Organization (FAO) of the United Nations (UN). The Food and Agricultural Organization is the primary agency of the UN for technical assistance, research and policymaking in world agriculture, fishing and forestry. This celebration commemorates the date of the founding of FAO. Today, more than 150 nations celebrate this important occasion.

World Food Day is observed to increase public awareness of the world food situation and to develop national and international support for the struggle against poverty, hunger, and malnutrition. It is also a time for stock-taking on what can be done throughout the year to advance the goals of food security for all people.

In the Virgin Islands, we observe World Food Day because we are concerned about food production in the territory, world food problems and what can be done to alleviate them. This is especially true as the world becomes increasingly interdependent. Food deficit countries cannot solve these problems alone and it is in our interest, as part of the international community, to help to find ways to address the food problems. We are aware that a society that guarantees the basis of life--food--is also offering the hope for all that other blessings of peace and justice are attainable as well.

The theme for this year's World Food Day, "Harvesting Nature's Diversity," was chosen by the FAO to focus specifically on biodiversity and its contribution to humanity and food security. This is to increase awareness of the threat to biodiversity and to mobilize action to conserve this heritage and use it sustainably and equitably for present and future generations.

The diversity of life on earth--plants, animals, and the ecological systems of which they are a part --is essential to the survival of humanity. Yet, we are losing nature's biodiversity at an unprecedented rate. Natural habitats are being destroyed, degraded and depleted with the loss of countless wild species. Traditional crop varieties and ancient animal breeds are being replaced by new ones better suited to modern high-tech agriculture. In India, 10 rice varieties will soon cover three-quarters of an area where once more than 30,000 different varieties were grown. In Europe, half of the animal breeds that existed at the start of this century are now extinct.

The traditional knowledge and skills of indigenous people, who selected, bred and cultivated these varieties over thousands of years, is disappearing, often along with the people themselves. These losses threaten world agriculture and, in the longer term, humanity itself. When natural diversity is lost, so too is irreplaceable genetic material. In order to breed and develop new adaptable and varied strains, this genetic information must be saved. We can only guess at the potentially valuable animals, aquatic life, trees and plants that have already been lost, unrecorded and unexplored by science.

Biodiversity to Feed People

Biodiversity provides the raw materials, in this case combinations of genes, that are the essential building blocks of the plant varieties and animal breeds upon which agriculture depends. The thousands of different, genetically unique varieties of crops and animal breeds in existence are the result of millions of years of natural biological evolution, as well as careful selection and nurturing by our farming and herding ancestors during 12,000 or so years of agriculture. They are supplemented by wild resources such as fish, game and forest products, many of which, although used, have yet to be properly evaluated.

Crop and Livestock

Thousands of plants are edible; a few hundred are

used as human food. But only nine--wheat, rice, maize, barley, sorghum/ millet, sweet potato/yam, sugar cane and soybean--provide three-quarters of the plant kingdom's contribution to human energy. The wealth of crop varieties built up over thousands of years is being lost at an alarming rate. It has been estimated that, since the beginning of this century, about 75 percent of the genetic diversity of agricultural crops has been lost.

The reduction in the crop gene pool has accelerated since the 1950s when the Green Revolution introduced intensive agriculture to large parts of the developing world. The traditional diversity of cross varieties has been replaced by monocultures of high applications of pesticides and fertilizers over vast tracts of land. Yet, many of the varieties being lost may contain genes that crop breeders and biotechnologists could use to develop even more productive varieties or to increase pest resistance. When genetic uniformity left the United States maize crop vulnerable to a blight that destroyed almost $100 million worth of maize in 1970, for example, resistance to the virulent disease was eventually found in an African maize variety.

A similar pattern of genetic erosion and increased vulnerability is occurring among domesticated animals. The threat to livestock diversity comes mainly from the highly specialized nature of modern livestock production. One in four breeds found outside Europe could be at risk of extinction. Yet, to be productive, commercial breeds introduced from the developed world often need management and technologies that are neither affordable nor sustainable for most farmers in the developing world.

A typical example of successful breeding is the Senepol cattle found in St. Croix and other parts of the United States. This cattle is highly adapted to the subtropics and resistant to many tropical ticks because its original parent is the N'dama cattle of West Africa. The N'dama has developed resistance over thousands of years to trypanosomiasis, a devastating disease that threatens millions of cattle in Africa. When a breed does become extinct, an already narrow genetic base shrinks irreversibly.

Forest Resources

The world's forest covers between 3,000 million and 3,500 million hectares--an area equal to North and South America combined. Home to an estimated 300 million people, they are declining at an unprecedented rate. Of greatest concern are the tropical forests. Scientists estimate that they were destroyed at a rate of 15.4 million hectares per year between 1980 and 1990. The causes vary from region to region but include clearing of forest land for agricultural use, excessive cutting for charcoal and fuel wood, unsustainable shifting cultivation, uncontrolled logging, expansion of urban and industrial areas, and conversion to pasture.

When forests decline or are removed, the animals and plants living in them disappear as well. Present rates of destruction of closed tropical rain forest could mean the loss of as many as 100 species per day, many of whose potential value to society and ecological importance have yet to be discovered. The bark of the western yew tree was recently found to be the source of taxol, one of the most potent anticancer substances ever found.

Everyone depends in some way on the planet's biological resources. To halt their decline is, therefore, everyone's responsibility. In response there has been a grassroots conservation movement spreading throughout the world, spearheaded by Greenpeace. In the United States, a network of nearly 1,000 farmers and gardeners, the Seed Savers Exchange, locates and conserves thousands of endangered vegetable varieties.

The Extension System also has embarked on a vigorous program of sustainable agriculture through its programs and is teaching farmers how to conserve and protect the environment while still deriving a good profit. Sustainable agriculture and rural development highlights the need for the conservation of genetic resources and biodiversity.

World Food Day provides an urgent reminder of the need for global, national and local action to conserve and utilize biodiversity. Continuation of this action will help ensure the survival and influence the future evolution of both human civilization and life on earth.

Helping Families With Money Management Problems

By
Dorothy Gibbs
Extension Assistant - Home Economics
UVI Cooperative Extension Service

How to Make Your Money Go Further

The way you spend your money today will determine what you have six months from now, a year from now, five years from now or in your lifetime. You control your financial destiny. You are responsible for the amount of money you earn and the amount of money you spend.

Good money managers manage their money and do not allow the money to manage them. They use the money for the things that are important to them. In other words, they use the money for things they need and not for things they want.

Do you have control of the way you spend your money? Do you live within your income, or do you have to borrow or use savings to meet your expenses?

Living within your income requires careful planning. It requires self discipline and the ability to say no to unnecessary spending.

The ability to manage money has to be learned, developed and practiced, not once in a while, but on a daily basis. The following are eight steps to successful money management:

1. Get yourself organized.
2. Set goals. Decide what you want to do with your money.
3. Look at all available resources.
4. Decide how much your money is worth.
5. Find out how much money you make.
6. Find out how much money you spend.
7. Set up a plan for spending your money and stick to it.
8. Evaluate your spending plan.

Following these eight steps will help you get control of your spending habits.

Here are the Danger Signals of Too Much Debt:

If many of these danger signals seem familiar to you, then you may be headed for financial trouble.

1. You think of credit as cash, not debt.
2. Your debts are greater than your assets.
3. You owe more than seven creditors.
4. You are an impulsive or compulsive spender.
5. You and your spouse are dishonest with each other about your use of credit.
6. You don't know how much your monthly living expenses are and how much your total debt is.
7. Your expected increase in income is already committed to paying off debts.
8. You depend on extra income, such as earnings by a second person or overtime by the breadwinner, to help you make ends meet.
9. You have less than two months take-home pay in cash or savings which you can get to quickly.
10. You have to pay back several installment payments that will take more than 12 months to pay off.
11. You have more than 20% of your take-home pay committed to credit payments other than your home mortgage.
12. You get behind in utility or rent payments.
13. You have to consolidate several loans into one or reduce monthly payments by extending current loans to pay other debts.
14. You cannot afford to pay regular living expenses or credit payments; therefore you:
    - are being billed for payments,
    - take out a loan,
    - withdraw savings,
    - skip payments, or
    - pay only the minimum amount due on your charge accounts.

How to Get Out of Financial Trouble

Our dollar buys less and less these days. As the dollar has lost its value over the years, more and more individuals and families have turned to credit as a source of extra income.

More people have used credit because it has been freely available.

There is a way you can get out of debt. You can set up your own debt management plan. Completing this debt management plan will take patience. You will have to

stick with it until all your debts are paid. Paying a little back is better than doing nothing or worrying about the problem.

Paying a small amount will give you a sense of control. It will start you on your way to solving your financial problems.

To Set Up a Debt Management Plan, Follow These Steps:

1. Find out who you owe and how much you owe.
2. Decide how much you can pay back and when you can pay it back.
3. Set up a plan for paying back your debts.
4. Discuss your plan with your creditors.
5. Control your spending by sticking with your debt management plan until all debts are repaid.
6. Occasionally look over your plan to see if you are keeping up with your debt and your daily living expenses.
7. If there is a change in your income, you may need to raise or lower your monthly payments.
8. Repay debts within a specified length of time.

The UVI-CES, Home Economics program conducts free money management classes that will teach you how to control spending and maintain discipline in your financial arrangements.

The Status of Tropical Yams

By
Stafford M. A. Crossman
Research Specialist
UVI - Agricultural Experiment Station

Yams belong to the genus *Dioscorea*, which includes predominantly tropical plants. The tubers of these plants are annual organs which produce shoots, then shrivel away. New tubers are then produced which remain dormant before producing new shoots.

Yams are an important crop in the Caribbean where, because the crop is expensive to produce, prices are higher than for other root and tuber crops. However, the Caribbean is second only to West Africa as a producing region. The crop is important because it provides a high quality of staple food calories.

The nutritional qualities of yams are comparable to potatoes and are higher than most other root and tuber crops. *D. alata* has 30% dry matter, 28% starch, 1.1-2.8% crude protein, 5-8 mg/100 mg vitamin C. Carbohydrates are the major dry matter component of yams. Most of the carbohydrate is starch. The protein is low in sulfur containing amino acids.

Tubers of some cultivars may be irregular in shape, which makes peeling an arduous task. Additionally, when the tuber is cut, a sticky, slippery substance (mucilage, which is mostly glycoprotein) exudes from the cut or peeled area.

Yams may be boiled and served in sliced pieces, in soups or mashed. They also can be roasted, baked, or sliced and fried.

Caribbean Yam Species

The species of yams grown in the Caribbean are as follows:

Dioscorea alata (Greater yam, Water yam, Winged yam, Asiatic yam or White yam).

First cultivated in Southeast Asia, this was carried to Africa and the New World by Portuguese and Spanish traders. It is the highest yielding of the cultivated yams, and is the preferred species in most parts of the world.

In the Eastern Caribbean it is the most popular yam. A large number of cultivars have been recorded, varying in shape and color of leaves, stem and tubers.

The normal growing period is eight to ten months and the tubers have a dormancy period of three to four months before sprouting. Plants produce one to several tubers which may be entire or branched and may occur in many shapes (such as spherical, cylindrical, spindular, deltoid, and clavate). The bark of the tuber varies in shades of brown. The flesh may be white, cream, yellow, pinkish or purple, and the cortex may be a different color. A combination of characteristics can be used to identify varieties.

The most widely distributed species of yam, *Dioscorea alata* is the most extensively cultivated in the Caribbean. It is also the only yam species grown commercially in the Virgin Islands.

D. bulbifera (Aerial yam).

The subterranean tubers of this variety are reduced and usually hard, bitter and unpalatable. Aerial tubers, or bulbils, produced in the leaf axils are fleshy, flattened and gray or brown in color. They are succulent and edible but may require detoxification.

D. cayenensis (Yellow yam or Twelve month yam).

A native of West Africa brought to the West Indies in the 16th century, this species requires 12 months to reach full maturity and can be harvested at any time of the year. If the tuber is carefully removed, leaving the head of the tuber attached to the parent plant, another tuber or group of a few tubers soon will be produced.

This species is hardier, higher yielding and may be harvested over a longer period of time than *D. rotundata*. The tuber flesh is usually pale yellow in color, has a short dormancy period and does not store well. Stems of the plants are spiny.

D. esculenta (Lesser yam, Potato yam).

This yam produces a cluster of small, ovoid, shallowly produced tubers resembling potatoes. Tubers have a thin brownish skin and bruise very easily. They have a short dormancy period, soft texture, whitish flesh with very low fiber content and good palatability, and are free of toxicity, with a slightly sweetish taste. Stems of the plants are very spiny. This species is seldom utilized in cooking.

D. rotundata (White yam, Guinea yam, Eight months yam).

This is the most important cultivated species in West Africa where it originated, it was taken early in the post-Columbian times to the West Indies. A crop is produced in 8-10 months.

The dormant period of the tubers permits extended storage in good conditions. The tuber flesh is white in color and the plant stems are usually spiny. Similar to *D. cayenensis* in production and method of harvest, *D. rotundata* is grown on a greater acreage than any other species in the world.

D. trifida.

Native to South America, this is the only food yam which originated in the New World. It produces a group of small, flavorful tubers. The flesh may be white, yellow, pink or purple.

Yam Production in the Caribbean

In most local yam production fields, the crop is not fertilized, has applied irrigation and usually is only weeded when infestations are severe. The crop is planted and expected to grow with minimum management, even though research has demonstrated that this crop does respond to increased levels of inputs and technology. Yields can be substantially increased if plant nutrition, water requirements and germplasm selection are given adequate attention.

Ideally, yams require deep, loose, free-draining, friable soil in which to grow. However, the soil in the Virgin Islands poses some stress conditions for plant growth --high soil pH, deficiencies in phosphorous and micronutrients, heavy soils and low annual rainfall (a deficit in 10-12 months, annually). Clay soils can become waterlogged and allow insufficient aeration for the roots and tubers; these soils also make harvesting difficult.

Compared to other root crops, yams require the most intensive management and highest soil fertility levels to obtain a high yield of good quality tubers. The crop requires a great deal of labor for its cultivation; as a result, the tubers are an expensive commodity.

Yams are usually planted on mounds, hills, banks or ridges. Harvesting is very laborious but is simplified if planting is done on ridges. Yams do not grow well in poor soils and do not tolerate prolonged periods of drought without a drastic reduction in yield. Avoiding moisture stress is critical during weeks 14 to 20, a period when all of the food reserves of the seed piece have been exhausted. At that time, the plant shoots are then making rapid growth before vigorous tuber bulking. Moisture stress also delays tuber initiation.

Tubers develop best when rainfall or irrigation is frequent, so that the soil is almost constantly wet. But, they also require good drainage for best growth. Standing water causes waterlogging, which prevents normal root respiration and encourages rots and wilts. Yams have fibrous root systems which grow more or less horizontally within the soil and lie close to the surface. Most roots occur within the top 30 cm of soil and are easily damaged by cultivation, weeding or drying-out of the soil.

In the Caribbean, the growing season for yams is fixed. Planting occurs during the month of May. This is easy to remember because MAY is YAM spelled backwards. May also is the month when farmers are assured of some precipitation to break the drought of the previous months. The long days of summer are favorable for vine, while the short days later in the growing season are ideal for tuber formation and growth.

Early planting does not necessarily increase yield, however, because the yam must go through its normal dormancy period. Planting late reduces the length of the growing season and results in reduced vine production and thus reduced yield.

Research in the Caribbean has shown that increasing yam plant populations by closer spacing causes a reduction in tuber size, a larger proportion of better-shaped yams and increased yields. Closer spacing also reduces the amount of time needed for plants to cover the soil, reducing competition from weeds. Healthy, mature yam plants are vigorously competitive with weeds and usually shade-out most weeds during the second half of the growing season. However, weeds can be a serious problem before plants become well established.

When weeding, care must be taken to avoid damaging the plant roots. Mulching helps to reduce weed growth, conserve moisture and moderate the soil temperature. Mulching is more important in yams than in other root crops, because, unlike sweet potatoes, yams are more susceptible to mechanical injury that occurs during hand-weeding operations.

Yams produce higher yields when provided with supports for climbing. Usually referred to as staking, this practice increases the photosynthetic area for plants.

Yams are frequently used in intercropping systems. This is a normal practice in Caribbean nations. Corn, pigeon peas and cassava are popular intercrops used in the Virgin Islands. Corn should be interplanted with yams when the yams are at a stage requiring support soon after the corn has matured.

The crop develops most rapidly during the final months and vines usually die back at maturity. Harvesting normally is performed from December to February.

The Use of Fertilizers on Yam Crops

Because newly planted yams can feed on a food reserve in the seed pieces during the early stages of growth, the crop requires high levels of nutrients for later growth. Different yam varieties will respond differently to the same fertilizer application. Therefore, it is important to know the response potential of a particular variety before fertilizer recommendations can be made. These recommendations will vary based upon soil type and local climatic conditions. Intensively managed and fertilized yams will produce high yields of marketable tubers.

Nitrogen is considered to be the most important nutrient element in yam production because its application significantly increases yields. This element appears desirable during the first half of the growing season, and, when applied 60-90 days after planting (or germination if planted before sprouting), causes the plants to produce better yields than earlier or later applications. Potassium is not very important, while phosphorous, which is efficiently used by the plant, gives only small positive responses.

Late applications of fertilizer, particularly nitrogen, can cause damage to the plants if the fertilizer comes in direct contact with the plant foliage; physical damage also may occur during the actual application. Ideally, it is best to apply all fertilizer before the crop develops a dense foliage cover.

Fertilization of yams is best achieved by use of organic manures and slow-release fertilizers which can be applied before, at, or soon after planting, and which provide nutrients over a long period of time. If the crop is irrigated, nutrients can be easily supplied at any stage of plant growth by the fertigation method.

Fertilizer application is most beneficial if the nutrients are available during the time the plant changes its dependence from the seed piece to true autotrophy. Fertilizer can be applied about one to two months after emergence. At this time, the root system is extensive enough to absorb and utilize the fertilizers. Nitrogen application will allow the development of a large leaf area to provide a sufficient photosynthetic area for rapid tuber development and growth.

Yam Plant Propagation

Yam plants can be propagated by tuber cuttings (seed pieces), small tubers, bulbils, seeds, vine cuttings or tissue culture. Vegetative propagation by tubers is by far the most common and commercially important. The selection and preparation of good quality planting materials is perhaps the most important aspect and is certainly the quickest way to increase crop production. Many farmers do not use good quality seed, despite the obvious advantages. Farmers are slow to change from the old practice of setting aside their planting materials on a nonselective basis, as seed for their next crop. The usual practice is based upon economics; the best yams are sold to generate maximum farm income, leaving inferior tubers for use as planting material. However, selected tubers should be large and from vigorous, healthy plants.

At the end of the dormancy period, the yams begin to sprout. Seed pieces taken from the top of the tubers sprout more readily and give higher yields than from other tuber sections (middle and bottom). This is because the headpiece of the tuber contains preformed buds (in the primary nodal complex) which sprout readily.

Other cut pieces do not contain buds, but rapidly develop buds on the skin surface. Cut surfaces of the seed pieces should be allowed to air dry for at least one to two days or they can be treated to prevent rotting. When the tuber is cut in the process of seed-piece preparation the integrity of the protective layer is broken; the cut surfaces are weak areas through which rotting can begin. In general, the greater the cut surface on the seed piece, the greater its tendency to rot after planting.

Because the cut flesh surfaces are more subject to rotting than other parts of the yam, they often are treated with lime (calcium hydroxide), wood ashes or fungicides. The aim for each seed piece should be to maximize the amount of tuber skin and minimize the amount of cut surface through which rotting can occur.

Seed pieces can be planted a few days after the cutting operation or held until they sprout. Planting can stimulate germination. If held until they sprout, the seed pieces must be handled more carefully and be correctly oriented in the soil when planted. If planted before sprouting occurs, weeds might germinate before, during or just after sprouting. This means weeding will have to be performed during the early stages of germination, risking damage to the young sprouts. Mulching or the application of a preemergence herbicide can reduce this problem, when seed pieces are planted before they sprout.

Large seed pieces sprout more readily and produce more vigorous plants than smaller pieces. Tuber yield has been found to increase with larger seed pieces from the middle portion of the tuber, but not from seed pieces from the tuber head. Similar yields will be obtained from both large and small seed pieces from the head of the tuber, regardless of plant spacing.

Yams and their role in African life

Yams serve as a dietary staple in Africa, where the crop plays an important role in the socio-religious life, especially in the yam zone of West Africa where most of the continent's yams are produced.

Important annual festivals are held at planting and harvesting. The harvest festival is known as the "New Yam Festival." The festivities for this crop indicate the high status and sentimental attachments given to the yam.

Status is often determined by the quantity of a man's yam harvest, regardless of how much of any other crop he produces.

The highest indigenous cultures in Africa developed (Ashanti, Dahomey, Ife and Benin) in the "yam zone." In West Africa, the yam is served to visitors and is preferred to other root and tuber crops, despite the fact that yams are more expensive.

Large seed pieces ensure crop survival if drought conditions occur soon after planting. Small pieces, although more likely to rot, produce smaller yams, but probably yield more on a weight per weight ratio basis than larger pieces. A much higher planting density can be utilized with small pieces. Seed piece size can be used to control the desired size of the harvested tubers. Planting distances also must be adjusted with seed piece size.

Yams can be left in the ground after maturing and harvested when needed for marketing or consumption. When left in the ground for extended periods, they will become predisposed to weed overgrowth, praedial larceny, attacks by insects and rodents, sun-scalding or exposed tubers and premature sprouting. Yams that are damaged during harvesting must be used almost immediately, before they become infected with fungi which can quickly cause the whole tuber to rot.

Yams store well for periods up to several months after harvest and are easy to handle. They may lose flavor and quality during storage.

The tubers must not be cut or bruised if they are to be stored. Yams are harvested over a limited period of time so the tubers must be stored for several months. However, they do store well and are easy to handle.

The tubers lose weight during storage, usually 10-15% during the first three months and 30% or more after six months. The major cause of this loss of weight is respiration. Storage rots, particularly where tubers are damaged, may cause appreciable losses. Flavor and quality also are affected during prolonged storage. Some chemicals can increase the dormancy period by inhibiting sprouting.

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Pre-planning for Home Grounds Improvements

By
Carlos Robles
Extension Agent - Agriculture & Natural Resources
UVI Cooperative Extension Service

Have you ever been walking along on a sidewalk and come upon a section where the roots of a large tree have displaced the sidewalk? Do you have a soursop tree that, every time the wind blows, one of its branches disconnects your telephone line?

If you had only known that the lovely bush that grows so well on your uncle's rocky soil would end up taking over your whole yard, you probably would not have planted it there. (Fig. 1).

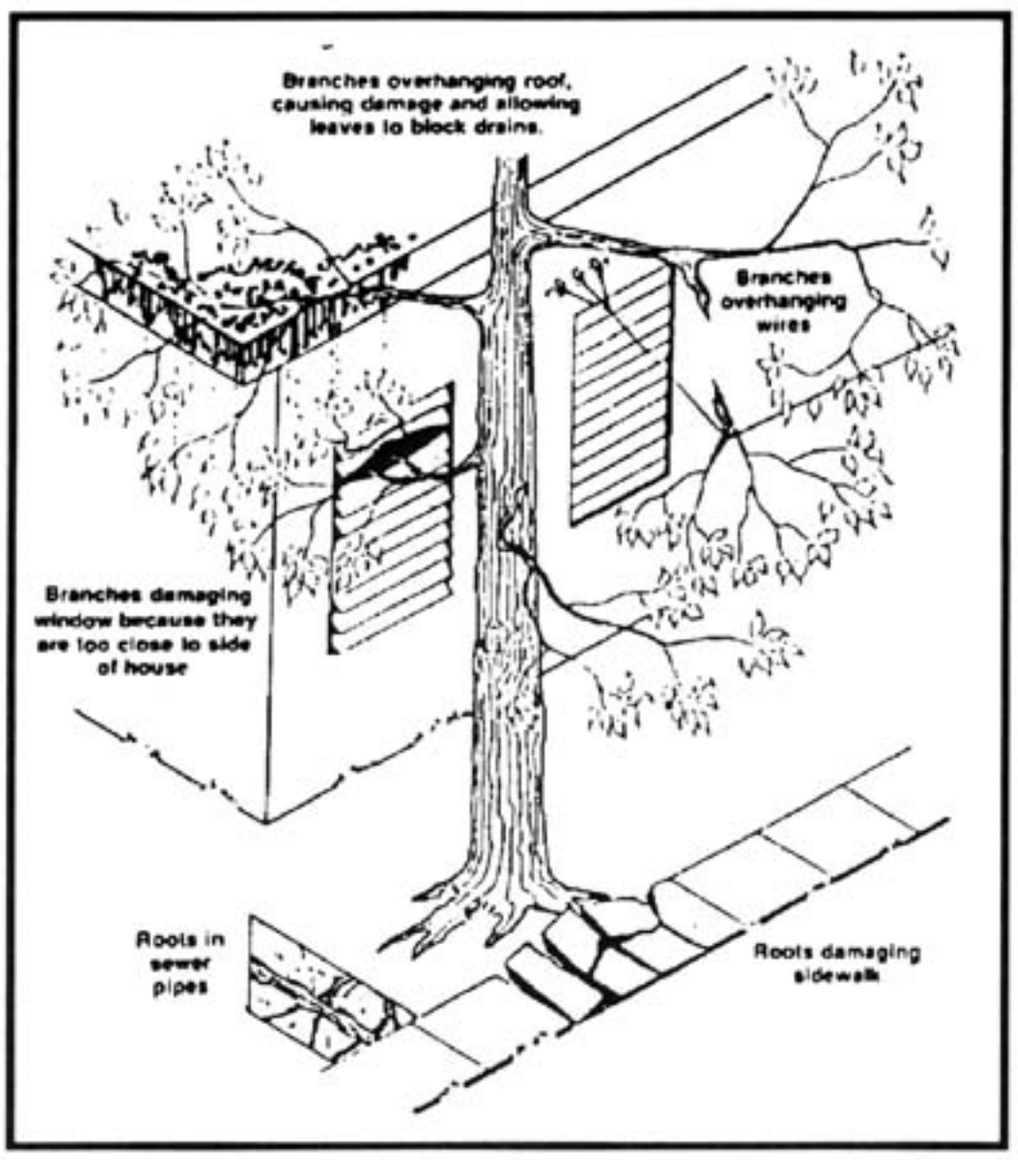

Figure 1

These are just some of the very real situations that occur in and around homes and other landscaped areas in the Virgin Islands. Many of these situations could have been prevented if a plan of the landscape had been made prior to installation.

Pre-planning your home landscape could save you the time and expense of having to make costly corrections to your property.

This article will discuss the importance of planning as well as the process of designing your landscape on paper. These concepts can be used for undeveloped landscapes or adapted for existing landscapes.

The Importance of Pre-Planning

Pre-planning your home landscape is important for several reasons. One is that the plan helps you to organize your thoughts, ideas and actions.

A written plan will help you to organize the where, how and when of your actions. This will facilitate the decision-making process.

Pre-planning affords you the opportunity to see potential problems and make the necessary corrections on paper, rather than in the landscape, which could be costly.

One of the most important reasons for planning is that a good plan allows you to have a "bird's eye" view of your landscape before, during and after any changes are made in the landscape.

Imagine yourself in a helicopter looking down on your property. You can see everything on your property from one end to the other. Things that couldn't be observed from ground level come into plain view. Having a "bird's eye" view helps to put into perspective all the other reasons for pre-planning.

Items Needed in Planning

To obtain that "bird's eye" view, a sketch pad for drawing your landscape is necessary. If you have a site plan or property map, either one will be adequate. The house doesn't have to be included on either, but it would be helpful. Having the map or making the drawing will allow you to document what's on the property.

Before you begin drawing, you may want to walk around your property and take notes of such things as plant names, problem areas, changes in soil color, and things you like about your landscape. Anything that would help you or a professional in the decision-making process should be written in your notes.

Two other items that are useful, but not necessary, area a camera and a plant press. A camera provides a pictorial perspective of before and after scenes or may serve as evidence in court if a dispute arises.

A plant press is used in the collection of unknown plants for identification purposes. The Natural Resources component of the Extension Service can provide you with information on how to prepare a plant for identification.

The Planning Process

Document What is on the Property

Now that you have your sketch pad or your site plan, you need to begin drawing the basic outline of what is on your property. You don't have to be an artist or a landscape architect or designer to sketch your landscape.

Office supply stores sell landscape templates (Fig.2)

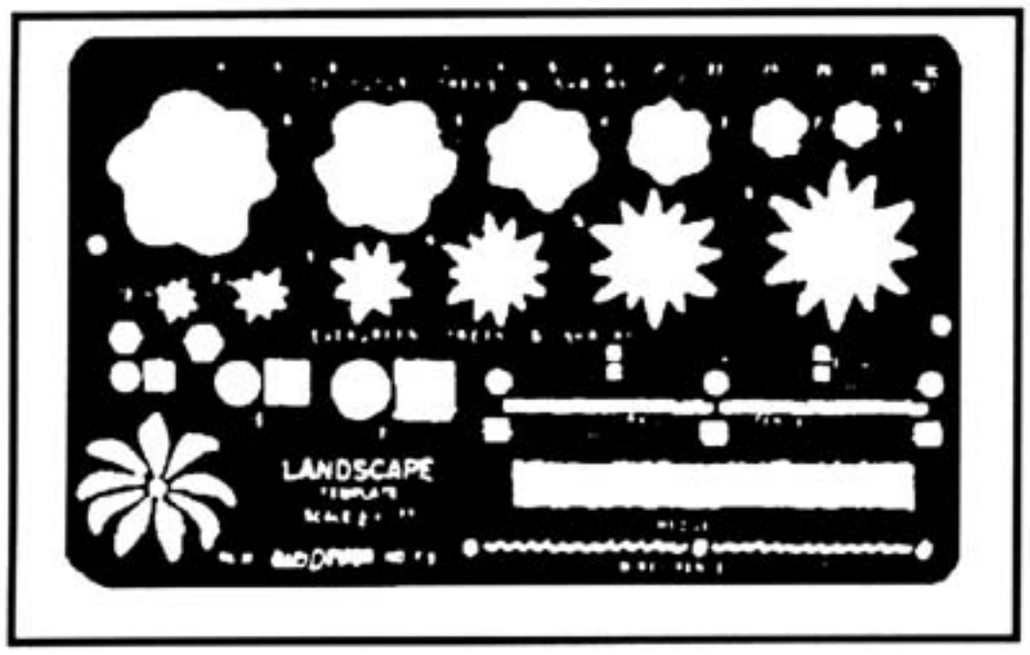

Figure 2 - Landscape Template

that assist you in drawing plants and placing other items on the landscape in actual scale and proportion to the way your property is laid out.

When drawing trees, shrubs, hedges and other items in your landscape, you should include the names of known plants. Indicate not only the distance between plants, but also the distance between the house and other items in the landscape.

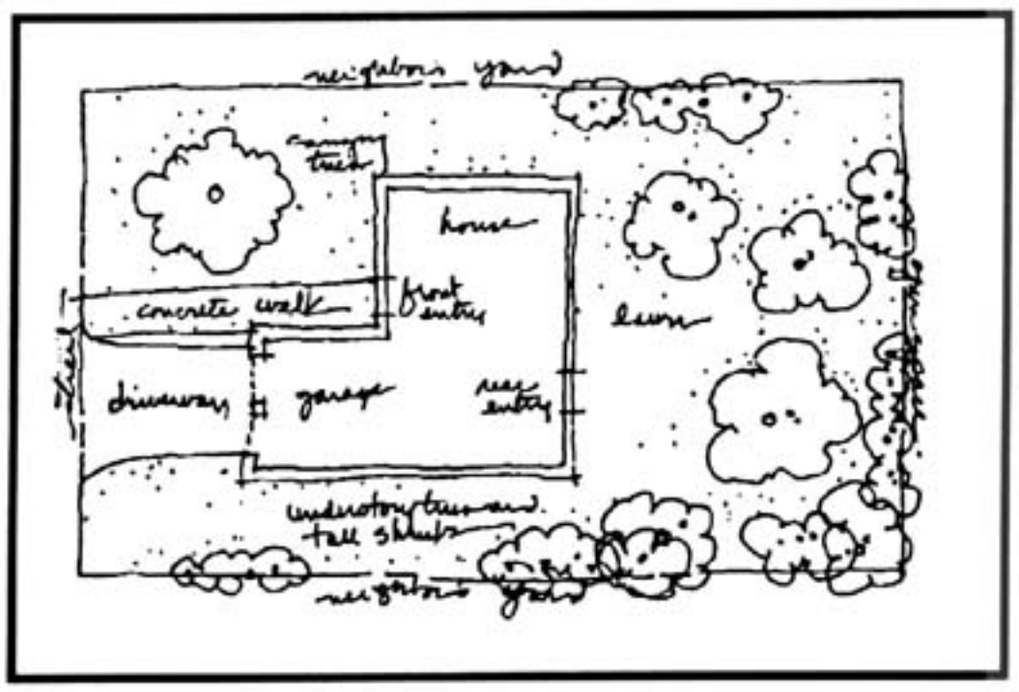

Figure 3

There should also be some indication on your map as to how your land is shaped. For example, show in some way things such as high spots, low spots, hills, level areas, etc.

Utilities (telephone, cable and power lines, the septic system, gas tanks and even wash rooms) are very important items to have on your map. When these particular items are not considered in the planning process, costly problems

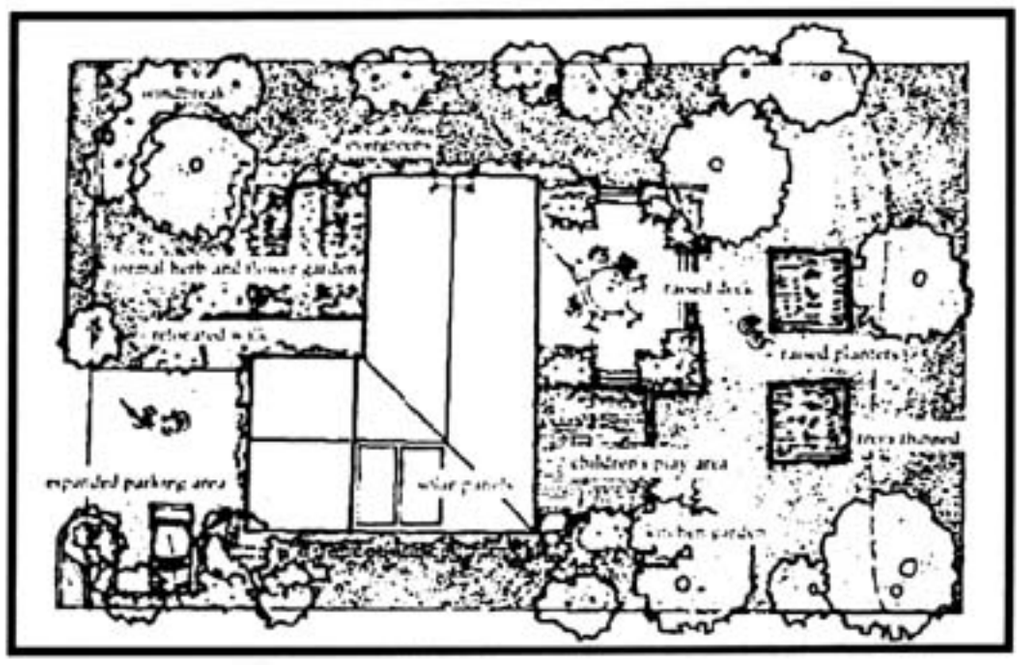

Figure 4

may develop later. Roads, sidewalks, and parking areas should be placed in proportion to the house.

Remember also when drawing the house on the map, to place the house according to where it is situated on the property. Is your house more to the front, the center, or the back of the property? This helps reduce errors when estimating distances.

At this point your map should have all of the items in your landscape, beginning with a base drawing (Fig.3) and a better representation of your landscape (Fig. 4). Don't forget to include your neighbor's boundaries.

Determine What You Would Like on the Property

Before you determine what you want to do with your landscape, there are four things you should keep in mind. One is that you may not get everything that you want or do what you would like to do. A Colorado Blue Spruce might look good in Colorado, but may not last a week in the climate of the Virgin Islands.

Also consider the territorial laws and statutes that govern earth changes and the removal of certain types and sizes of trees and shrubs. The Office of Coastal Zone Management can provide such information.

You need to determine how much time you have to make the necessary changes and the follow-up maintenance that will be required. Are you a daily or weekend gardener? Do you go out into your landscape once a month or once a year perhaps? Knowing this information will help you to decide the extent and degree of the changes made to your landscape.

Do you have special needs such as handicap ramps, storage house, sandbox, or dog houses ..hat should be included? You should plan for these.

Most important of all, how much money do you have to spend? This will determine whether or not you will eliminate some items from your landscape plan or carry out your landscape plan in phases. A general rule is to think generously, then go back and count the cost.

I would Like to Add or Subtract From My Landscape . . .

This is the exciting part of landscape planning -- when you decide what you would like to add to or subtract from your landscape. Start with a basic theme. For example you may want to have an oriental theme in your garden. This could include such things as a mini-waterfall or ponds containing gold fish and lily pads. A natural wilderness may be ideal for your location. Native and/or existing vegetation that attract certain types of birds or insects such as butterflies could work as well.

You may want to consider adding some color or fragrance. The children may have outgrown the sandbox or their mini volleyball court may be nothing but a patch of Guinea grass. These areas could easily be converted into raised garden beds for herbs, flowers or vegetables.

Is your house on a noisy street corner or in need of some privacy? You can design your landscape for noise

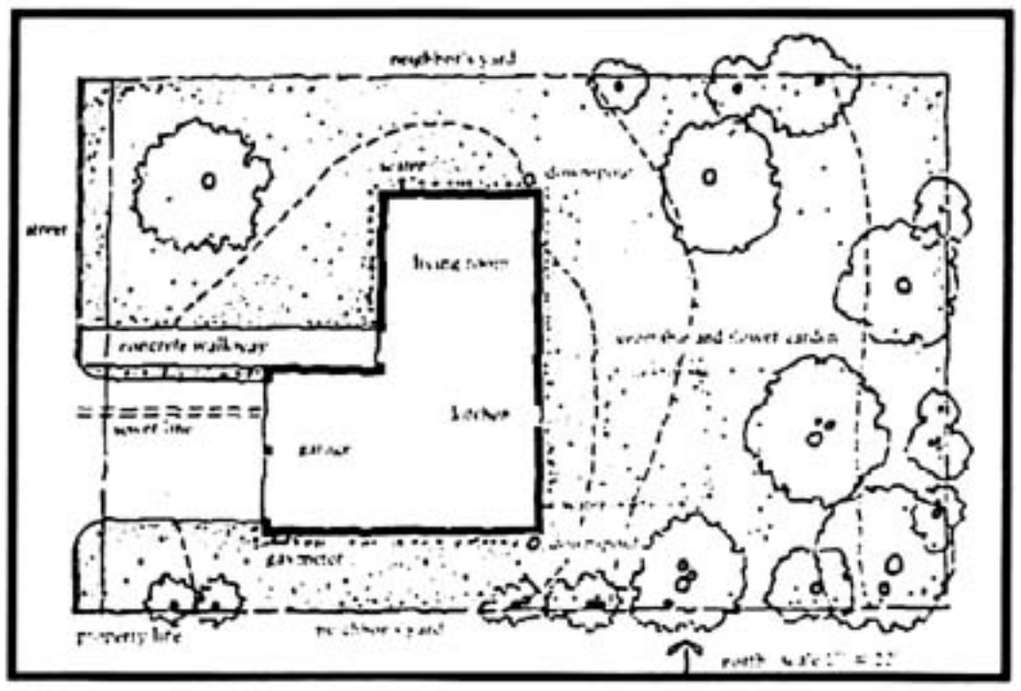

Figure 5

reduction and include plants that will create a barrier between you and your neighbor.

When planning your landscape changes, keep in mind that the little bush you plant next to your patio may grow into a 60-ft. tall tree. Keep plant size in proportion to your home.

After you have rearranged, added and subtracted the items on your map, you should have your "bird's eye" view of your new landscape (Fig.5). At this point it would be a good idea to mentally put yourself on your front porch and imagine seeing the changes you have made.

If you like what you see then it is time to begin carrying out your plans. Remember, all of this is done on paper before the first plant is planted, before the first tree is rooted out, or before you put up the first box in your box garden.

Last but not least, seek professional help from either the Cooperative Extension Service or a reputable landscape architect or landscape designer.

The Cooperative Extension Service does not develop landscape designs, but we can help you to go through the decision making process and provide you with the necessary information you would need to make an informed decision.

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Vegetable Production Using Fish Waste Water in the Virgin Islands

By
Manuel C. Palada, Ph.D.
Research Assistant Professor
UVI - Agricultural Experiment Station

Although the Virgin Isiands receives an annual average rainfall of more than 1,000 mm (40 inches), shortage of water for crop production remains a major problem facing agriculture.

Water resources for irrigation are limited because there are no rivers or natural lakes which could be tapped for irrigating agricultural lands. Most underground wells are not productive and are of low water quality. Therefore, there is a need to explore alternative sources of water for irrigation.

Vegetable production is perhaps the first industry that is most adversely affected by shortage of irrigation water. Vegetable growers lack the incentive to produce vegetables year-round because of erratic rainfall pattern and undependable water supply. These conditions result in an unsteady supply of locally-grown fresh vegetables and drives up the prices of produce at local food stores and supermarkets.

Therefore, alternative water sources for irrigation must be explored if the Virgin Islands wants to be self-sufficient in vegetables and provide a continuous supply of fresh produce throughout the year.

Recycled waste water from households and industries is one alternative. The other is to use saline water which is not fit for domestic use. However, recycled waste water from an intensive aquaculture system (fish culture in container tanks) is a potential source of irrigation water for vegetable crops.

Using fish waste water benefits vegetable production in two ways. First, waste water reduces the need for high quality irrigation water, which is very costly. Second, fish waste water contains some essential plant nutrients useful to crops, ultimately reducing the need for additional fertilizer.

The dual use of fish waste water therefore will reduce the requirement for irrigation water and lower fertilizer use in vegetable production. Growers will be able to reduce overall production cost and increase economic returns.

If vegetable production can be integrated into an aquaculture system, farmers will be able to boost their income from both fish and vegetable crops while conserving water resources and fertilizer.

Review of Related Studies

There are few studies involving the use of fish waste water or manure to irrigate and fertilize vegetable crops. However, integration of fish culture with other farm activities has been practiced in Asia for centuries (Colman and Edwards, 1987). Most of these integrated systems consist of farm activities that benefit fish production. For example, fish are cultured extensively at low stocking rates in ponds and benefit from by-products of crop/ livestock enterprise which provide nutrient inputs (Schmittou et al., 1985; Tan and Knoo, 1980).

The most common method of integrating crops and fish in the same environment is the rice/fish culture in Asia. The practice of stocking fish in rice ponds probably came about from harvesting wild fish that entered the ponds at the beginning of the planting season (Pillay, 1990). Indeed, integration of fish culture and rice farming may increase rice yields as much as 15% while producing 500 kg/ha of fish per rice crop (Lightfoot et al., 1990).

Most of the few studies performed in the past involved growing vegetable crops in a hydroponic system containing water coming from fish culture in tanks and recycled back into tanks (Nair et al., 1985; Rakocy, 1989a, 1989b).

In North Carolina, studies by McMurtry, et al., 1993, demonstrated the potential of using waste water from recirculating aquaculture systems of tilapia in irrigating greenhouse tomatoes. They found that tissue concentrations of major nutrients such as N, P, K and Mg were not limiting. This indicates that irrigation with fish waste water provides optimum nutrient levels for tomatoes.

Olson (1991) also evaluated the potential use of trout manure as a fertilizer in Idaho. In a greenhouse study comparing fish manure and a commercial fertilizer with the same nitrogen content, results showed that the yield of spring wheat from manure was comparable to yields from one third of the commercial fertilizer.

Favorable results have been reported using fish waste water to irrigate leafy greens (Ervin, 1977) and melons (New Alchemy Institute, 1982). In a study using the effluent from tilapia culture tanks to irrigate lettuce,

celery and cabbage, researchers at the New Alchemy Institute found no improved yields using fish waste compared to a control.

They suggested three reasons for this result. High rainfall may have leached the nutrients deep into the soil, mulch applied to the plots may have supplied nutrients at levels adequate for plant growth or nutrients in the fish tank effluent were not immediately available to the plants.

At the University of the Virgin Islands Agricultural Experiment Station (UVI/AES), a project has been initiated to integrate fish culture in tanks with field production of vegetable crops. One of the objectives of the project is to evaluate the use of fish waste water for enhancing vegetable production, thereby reducing irrigation and fertilizer requirements.

The purpose of this article is to present the results of field trials conducted in 1992 and 1993 using bell peppers. The results presented are data obtained from the crop component of the integrated project.

Approach and Methods

The project was initiated in September 1992 using the research facilities of the Aquaculture Program at UVI/AES. The source of fish waste water and sludge was from tilapia raised at low and high stocking densities in culture tanks containing 31.2 cu.m. (8,237 gallons) of water.

Culture tanks were aerated with vertical-lift pumps and wastes were removed daily using settling tanks. The fish were fed daily using commercial feed. The fish were raised for a total of 20 weeks.

Pepper Trial 1992

Pepper seedlings were transplanted on August 25 into three-row plots measuring 4.2 m long and 1.8 m wide. Seven treatments were arranged in a randomized, complete block design with four replications. The choice of treatments allowed a comparison between fish waste water and conventional inorganic and organic fertilizers. The treatments were as follows:

T1 - Low stocking density culture water. The culture water from the three low stocking density tanks were combined and applied to individual pepper plants by hand. This treatment represented lower concentration of nutrients in the waste water.

T2 - High stocking density culture water. This treatment was similar to T1, but with waste water from the high stocking density culture tanks. This treatment represented higher concentration of nutrients in the waste water.

T3 - Sludge. This treatment consisted of liquid sludge combined from six settling tanks and applied to individual plants by hand. This treatment represented fish manure.

T4 - Liquid inorganic fertilizer (drip). This treatment consisted of nitrogen fertilizer applied at recommended rate using drip irrigation (Fertigation).

T5 - Liquid inorganic fertilizer (manual). This treatment was similar to T4, but applied by hand.

T6 - Granular inorganic fertilizer. This treatment represented the conventional method of applying fertilizer. The fertilizer was applied in bands around individual plants at the recommended rate.

T7 - Cow manure. A dry composted cow manure was incorporated into the soil prior to transplanting of peppers.

Treatment	Plant height (cm)	Dry weight (g/plt)	Fruit size (g)	Total yield (t/ha)	Marketable yield (t/ha)
Fish water 1	16	8.5	71	2.82	1.85
Fish water 2	17	11.6	81	4.12	3.75
Fish sludge	18	17.0	74	6.62	5.00
Fertilizer (drip)	22	18.6	69	10.60	8.98
Fertilizer (hand)	21	13.9	58	5.28	4.54
Fertilizer (gran)	20	13.5	67	5.60	4.63
Cow manure	18	11.4	52	4.68	3.98

Table 1. Plant height, dry matter weight and yield of pepper as affected by fish waste, cow manure and commercial fertilizers. UVI/AES, 1992.

Initial applications of 100 kg/ha of phosphorus and potassium were made to all the inorganic fertilizer treatments. Nitrogen was applied at the rate of 100 kg/ha to T6 (granular inorganic fertilizer). Fish culture water and sludge were applied 10 times throughout the experiment. The liquid inorganic fertilizer (both drip and hand) was applied seven times for a total application of 200 kg/ha. Cow manure (2% N) was applied at a rate of 10 tons/ha.

Peppers were harvested three times over a four-month growing period. Data were collected on plant height, dry matter weight, fruit size, total and marketable yields.

The unusually heavy rainfall in September through November resulted in disturbance of plots, washing, and leaching of nutrients applied in different treatments. Despite this, significant differences among treatments were observed.

Data in Table 1 show that plants grown with inorganic fertilizers were generally taller than plants grown with organic fertilizers (cow manure, fish waste water and sludge). Mean plant dry matter weight was highest with drip fertigation, followed by plants grown with sludge. Lowest plant dry matter weight was observed in plants grown with the low stocking density culture water. Plants grown with the tilapia culture water and sludge had higher average fruit weight (indicating better quality) than plants of the other treatments. Plants grown with drip fertigation produced significantly higher total and marketable yields than from the other treatments.

Plants applied with fish sludge produced the second highest yield, suggesting the potential of this manure in vegetable production. Although yield differences were not significant, yield from this treatment was higher than commercial fertilizer treatments applied manually either in liquid or granular forms. This would indicate that fish sludge is a good substitute for commercial fertilizer. Thus, for a vegetable grower who wants to cut his fertilizer cost, use of fish manure is an alternative.

Analysis of fish culture water and sludge indicated that concentrations of nitrogen and phosphorus increased with time. As the trial progressed, application of fish waste water and sludge provided additional nutrients to pepper plants. This suggests that nutrient contribution from fish sludge may reduce or eliminate the need for commercial fertilizer in resource-limited vegetable production enterprises.

Pepper Trial 1993

A similar trial was conducted in 1993; however, the treatments were modified. The fish waste water treatments were applied by drip irrigation and treatments with cow manure and hand-applied liquid inorganic fertilizers were eliminated. Fish waste water resulting from two water exchange rates (0% and 5% by volume) were applied using two types of drip emitters. The Hardie

Treatment	Water exch. (%)	Drip emit.[1]	Plant height (cm)	Fruit size[2] (g)	Total yield (t/ha)	Marketable yield (t/ha)
Fish water 1	0	TK	40	69	12.4	7.1
Fish water 2	0	E-2	32	65	13.0	7.3
Fish water 3	5	TK	37	70	13.0	10.0
Fish water 4	5	E-2	33	68	11.0	6.4
Fish sludge	-	BSG	36	68	15.4	10.4
Fertigation	-	E-2	32	64	10.5	5.8
Fertilizer (G)	-	E-2	32	58	10.4	6.9

[1]TK = Turbo-Key, E-2 = Hardie E-2, BSG = Bow Smith Gripper.
[2]Based on marketable fruits.

Table 2. Plant height, fruit size and yield of pepper applied with fish waste water and sludge under drip irrigation. UVI/AES, 1993.

Turbo Key emitters and the Hardie E-2 emitters were selected on the basis of reducing clogging in the drip system. The liquid sludge treatment was applied through the drip system using the Bow Smith Gripper emitters.

The fish waste water and sludge treatments were applied once or twice per week for a total of 25 applications over a three-month growing period. Treatment with fertigation received 12 applications. Granular fertilizer treatment received three band applications. Peppers were harvested eight times during the period from July to August.

Differences in plant height at final harvest were not significant between treatments; however, plants grown with fish waste water and sludge were taller than plants applied with inorganic fertilizers (Table 2). There were no differences in the average fruit size among treatments, but again plants applied with fish waste water and sludge produced relatively larger fruits than plants applied with inorganic fertilizers.

In terms of total yield, small differences were observed among treatments; however, the highest total yield was obtained from treatments applied with sludge (15.1 t/ha). Treatments applied with fish waste water had similar total yield and were slightly higher than treatments with fertigation and band application.

In terms of marketable yield, plants grown with sludge produced the highest yield (10.4 t/ha) followed by plants grown with fish waste water at 5% exchange rate using the Turbo Key emitters (10.0 t/ha).

Generally, treatments applied with fish waste water and sludge had higher marketable yields than treatments with fertigation and band fertilizer application (Table 2).

This result would suggest that waste water and sludge from fish culture are definitely good alternative sources of irrigation water and fertilizer for vegetable crops. Pepper yields from plots applied with fish wastes are comparable to or even higher than yields from plants grown in plots with conventional inorganic fertilizer.

Summary and Applications

The two years of field trials demonstrated the positive benefits of using fish waste water and sludge (manure) in pepper production. In the first year, yield of peppers applied with sludge was comparable with yield of fertigated peppers. In the second year, yield from sludge treatment was better than yield from conventional treatments of fertigation and granular inorganic fertilizers. It is possible to grow vegetable crops using fish waste water and sludge without external inorganic fertilizer inputs.

Yields can be sustained and maintained at levels comparable to yields obtained by using commercial inorganic fertilizers. The economic implications of the results of the experiments on peppers would impact vegetable growers in the Virgin Islands in the way they grow and manage their crops. Reducing production cost could translate into increased economic returns. Savings from water and fertilizer costs can result in increased profit.

Therefore, from both economic and environmental perspectives, growers should consider the potential of using alternative irrigation water and fertilizer sources such as fish waste and sludge.

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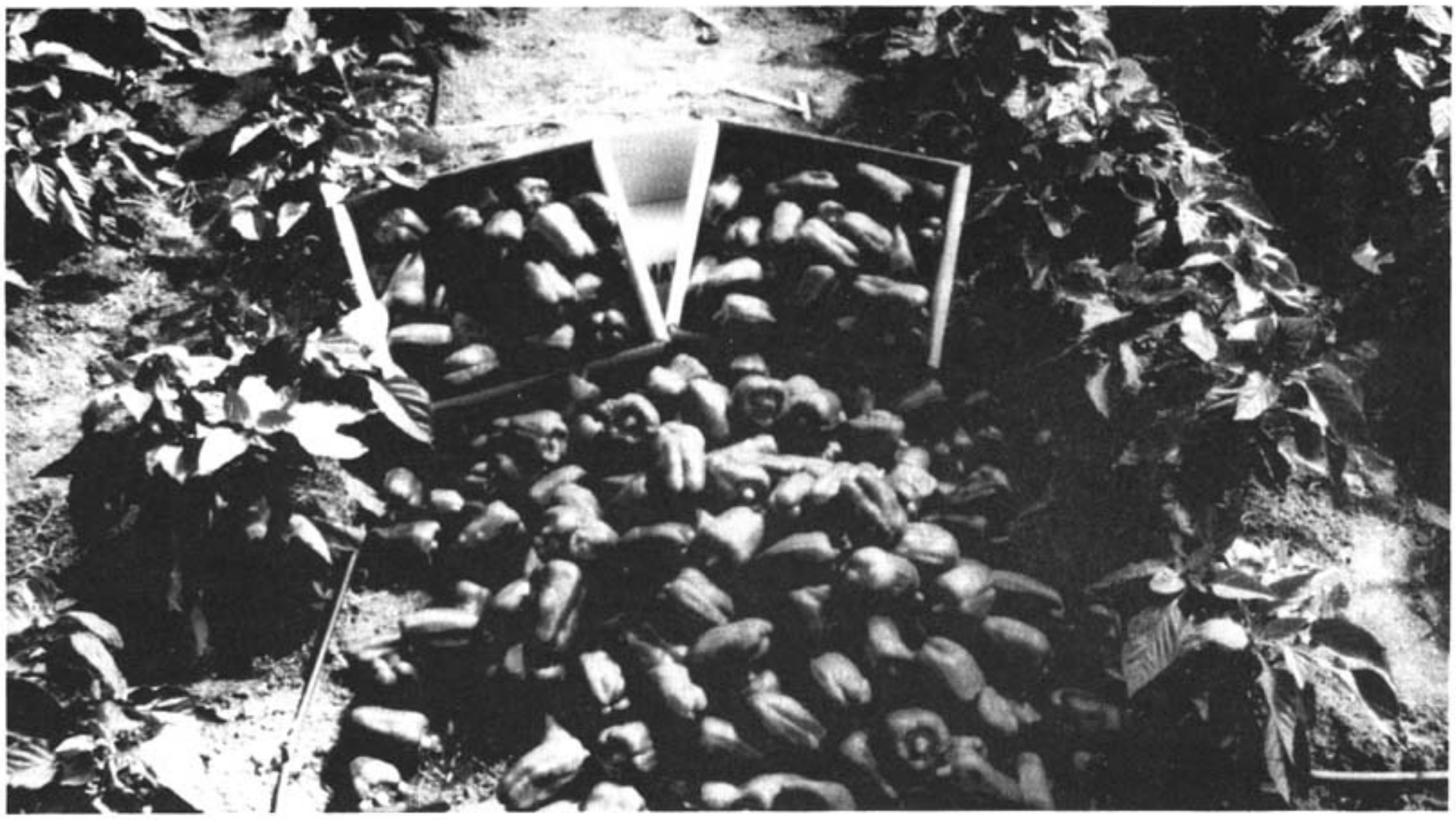

A Day at the Fair - Agrifest 1993

Educational, Cultural and Fun!

Dr. Darshan Padda presents first place award in Rabbit Showmanship, senior division, to Roseanne Will. Kofi Boateng, Agfair Livestock Director, looks on.

Kai Burk, center, was recipient of the 1993 Youth Award. UVI President Dr. Orville Kean presents the award while Extension Agent Sarah Smith looks on.

Sen. Bingley Richardson, left, presents Environomental Recognition Award to Olasee Davis.

Dr. Darshan Padda presents third place award in Rabbit Showmanship, senior division, to Jeff Girton.


Science & Technology Fair


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Marine Occupations on St. Croix

By
Marcia G. Taylor - Marine Advisor
University of the Virgin Islands
Eastern Caribbean Center
Virgin Islands Marine Advisory Services

A visitor to the Virgin Islands is immediately struck by the overwhelming presence of the sea--its color and scent permeate the atmosphere of the islands. But there is more to the Caribbean than its azure beauty.

These clear, productive waters provide enormous opportunities for employment. In addition to fishing, the islands' diverse marine life and clear warm waters provide abundant opportunities for recreational industries and other marine related occupations. The marine recreational industry alone is estimated to be 7% of the Gross Territorial Product. Indeed, our waters are one of our most valuable natural resources.

Although many opportunities exist for employment in the marine occupations, they are not recognized and enjoyed equally by all parts of the population. Jobs in water sports, marine science, and yachting seem to be dominated by people from the continental U.S., and many of the fishermen and small boaters are from Puerto Rico or other Caribbean islands.

Recently, as part of course I took at UVI--Career

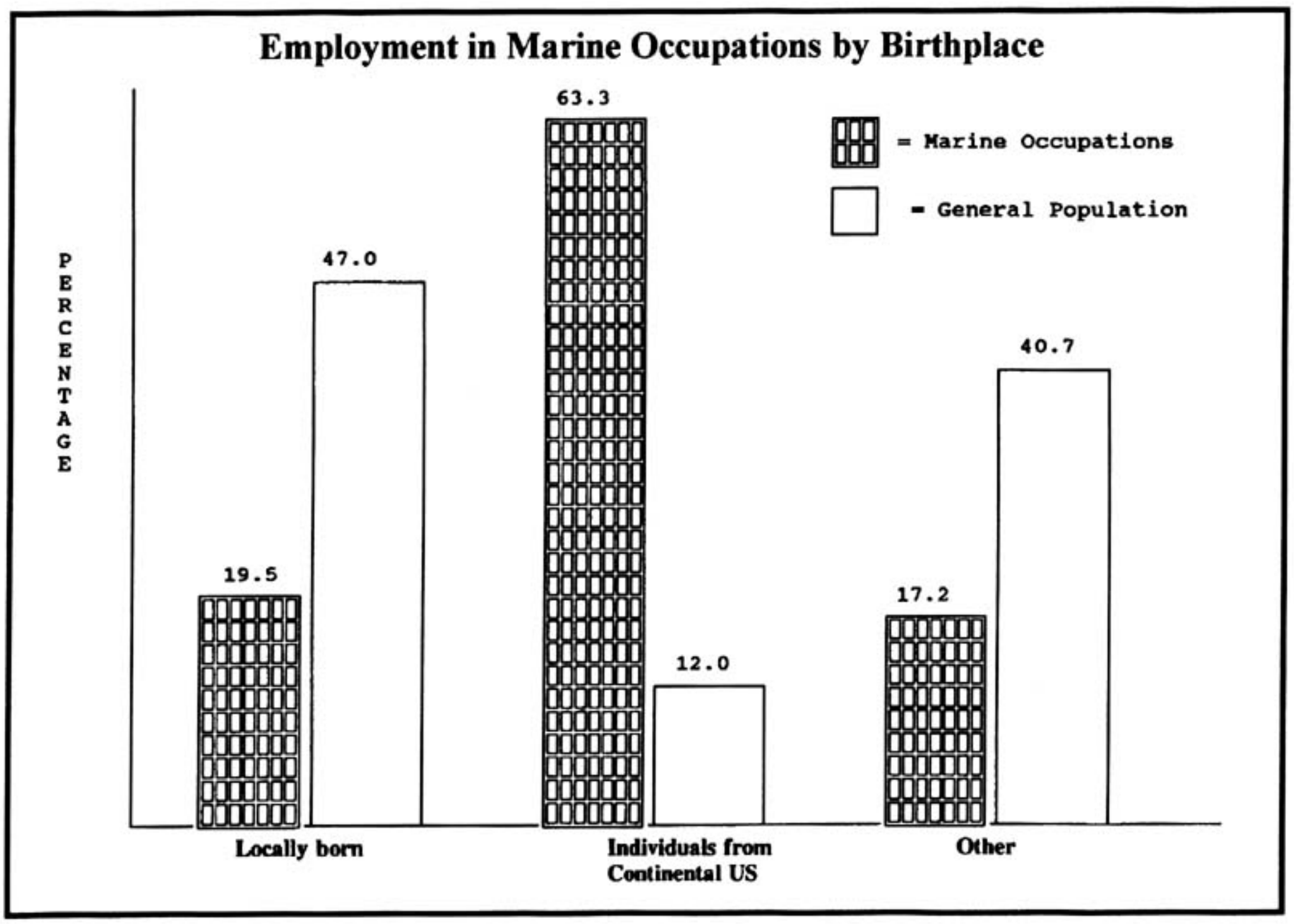


Figure 1.

One way to get children interested in marine activities is to enroll them in the Kids And the Sea Program (KATS).

Development Counseling--Sandra Baldauf and I surveyed individuals working in marine occupations on St. Croix. We took a list of marine businesses previously compiled for another study and updated it by adding new marine employment opportunities and deleting those that no longer exist.

All businesses and agencies on the list were either called or visited and queried about the number of employees in marine occupations and their place of birth.

A total of 43 businesses and agencies provided information about the birthplace of 218 employees working in marine occupations. In addition, 44 fishermen were surveyed. Of this total of 262 workers, 19.5% were locally born, 63.3% were born in the continental United States, and 17.2% were born in other areas (other islands or countries).

We interviewed 100 workers to find out why they entered marine occupations. More than 70% said that early childhood experiences most influenced their interest in the marine environment. More than 90% also indicated that they knew how to swim.

The percentage of locally born individuals in marine occupations was calculated and compared to census data (Figure 1). The data collected in this study suggests that the percentage of locally born individuals employed in marine occupations is less than half the general population, while the percentage of people from the continental US in marine occupations is five times that found in the general population.

If what this study suggests is true, why does this disparity exist? Perhaps it can be attributed to the lack of early exposure to the marine environment and the limited educational opportunities on St. Croix. There are few opportunities for local children to learn how to swim, dive or boat. More Virgin Islands' youths should be encouraged to take advantage of the many marine occupations available in these islands.

At least one program which began recently seeks to give high school students more exposure to their coastal resources, at Central High School's Wilson Marine Center. But it is impossible for those who are interested in studying the marine environment to seek a graduate degree in any of the sciences on St. Croix.

In an occupation which does not require formal training, such as fishing, representation of the local population is much higher, but is still lower than that of people from Puerto Rico and other Caribbean islands.

Because the sea and the activity that it inspires and generates are so much a part of St. Croix's environment, it is important that everyone takes advantage of the many opportunities it affords. Children should be encouraged to learn to swim and snorkel at a young age and participate in aquatic activities.

One way to get children interested in marine activities is to enroll them in the Kids And the Sea Program (KATS) developed by the Virgin Islands Marine Advisory Service (VIMAS) and sponsored by the Rotary Club of St. Croix Mid-Island.

The KATS program teaches basic seamanship and small craft handling to children 9 - 14 years of age. Children learn water skills using small boats and a variety of topics such as weather, navigation, first aid, and marine life. It allows children to have fun and become more comfortable in the marine environment. VIMAS or the Rotary Club of St. Croix Mid-Isle can supply information about the KATS program.

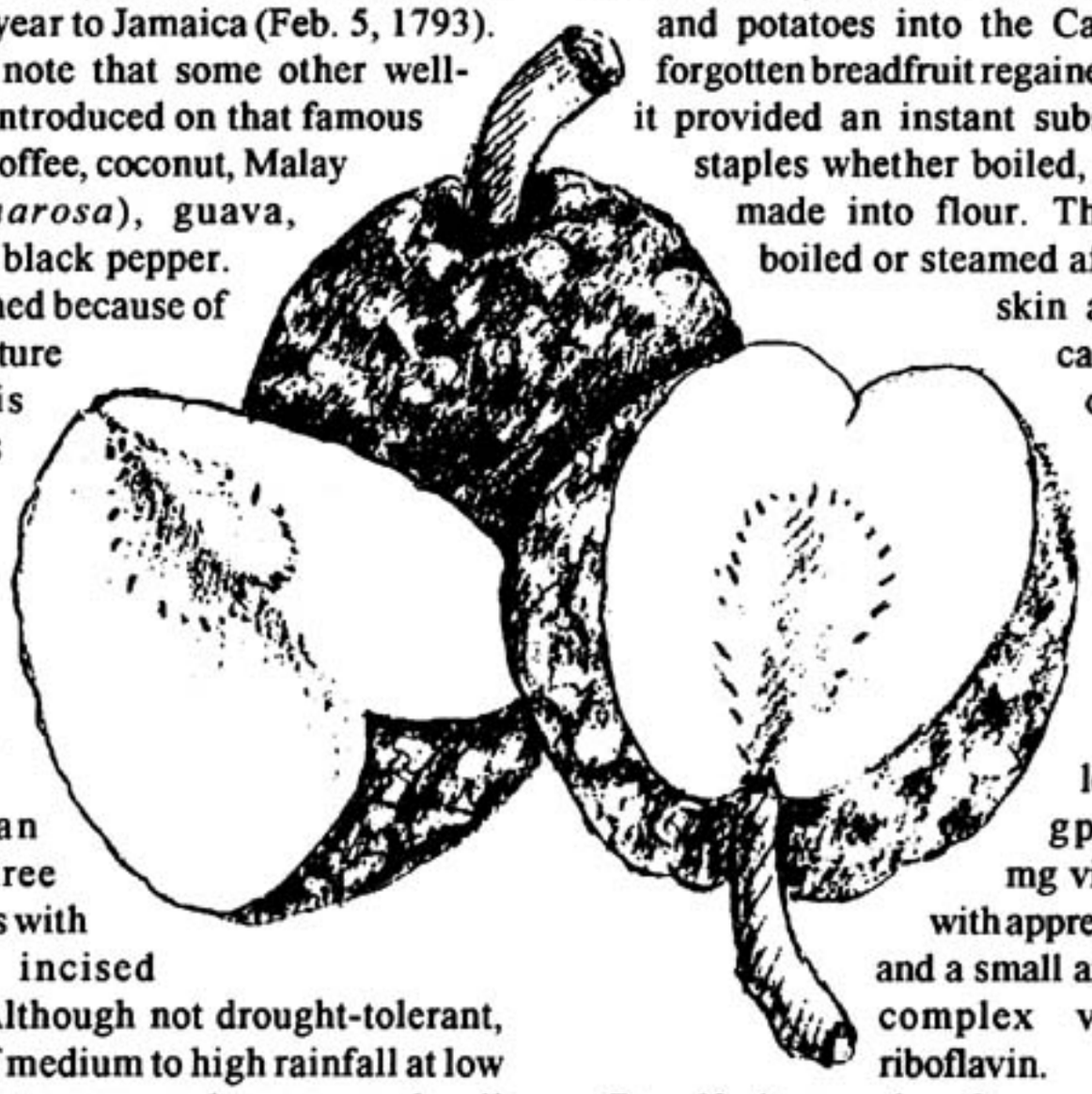
Breadfruit - An Old Fruit With New Potential

By
Christopher Ramcharan, Ph.D. - Horticulturist
UVI Agricultural Experiment Station
and Ramonita Caines - Extension Specialist, Foods and Nutrition
UVI Cooperative Extension Service

Did you know that the breadfruit (*panapen, pana*) so common in the backyards and home gardens of the Virgin Islands is not indigenous to the Caribbean, but a native of Polynesia? There it is known as *ulu, kuru, uru* or *uto*.

The breadfruit was introduced by Captain William Bligh (of *Mutiny on the Bounty* fame) on his second voyage 200 years ago, initially to St. Vincent (Jan. 22, 1793) and later the same year to Jamaica (Feb. 5, 1793). It is also interesting to note that some other well-known Caribbean crops introduced on that famous voyage included mango, coffee, coconut, Malay apple (*pomerac, pomarosa*), guava, jackfruit, carambola and black pepper.

The breadfruit, so named because of its similarity in flavor, texture and usage to bread, is botanically known as *Artocarpus altilis* syn. *A. communis*, and belongs to the family *Maraceae*, which includes other well-known plants such as ficus, Trumpet tree, fustic and jackfruit.



The breadfruit is an attractive, branching tree growing up to 15-20 meters with large, glossy, deeply incised palmate-shaped leaves. Although not drought-tolerant, it can grow best in areas of medium to high rainfall at low elevations and can tolerate some salt spray and soil conditions.

Under Virgin Islands conditions, the breadfruit thrives best in wind-protected areas with adequate irrigation that can include gray cistern water. On caliche-based soils it is best to shallow-plant the breadfruit and continually build up the surrounding topsoil with compost or other organic matter. A periodic application of a complete NPK fertilizer such as 10.10.10 at 0.4 kg (1 lb.) per 2.5 cm. of stem diameter, applied to the dripline area of the tree is recommended.

The tree is monoecious, but with separate male spikes and female flowers on the same branches. The fruit is multiple, 20-30 cm long by 10-20 cm in diameter with an average weight of 1-4 kg. A healthy tree can produce up to 700 fruits per year. The edible portion of the pulp is white, fibrous and mealy, but becomes yellow and softer as the fruit matures.

During the Second World War, when German U-boats severely restricted the importation of wheat flour and potatoes into the Caribbean, the previously forgotten breadfruit regained its prominence because it provided an instant substitute for the imported staples whether boiled, roasted, baked, fried or made into flour. The breadfruit is usually boiled or steamed after removal of the outer skin and central core, but it can be roasted whole, even on an open fire.

It is a relatively nutritious fruit, with 77% moisture content and a nutrient composition per 100 g sample having a relatively low energy level of 81 kilocalories, 1.3 g protein, 27 mg calcium, 29 mg vitamin C and 1.8 g fiber with appreciable levels of potassium and a small amount of iron and the B-complex vitamins--niacin and riboflavin.

Breadfruit can, therefore, substitute as an excellent staple in a controlled or weight-reducing diet because of its relatively high fiber content and low energy level. Among its fatty acid constituents is linoleic acid, essential for proper body growth and development.

Many recipes using breadfruit contain high energy sources such as coconut milk and cured meats, which make up for its low energy level. Breadnut, or seeded breadfruit (*chataigne, pana de pepita*), has higher energy and protein levels, with only 20% moisture and 434 kilocalories, 15 g protein, 29 g fat, 66 mg calcium, 380 mg potassium and 320 mg phosphorus and 6.7 mg iron

per 100 g of dried seed sample, but with only negligible amounts of Vitamin C.

Drawbacks in Breadfruit Production

Among the many constraints of breadfruit production and utilization are the large size of trees, the lack of simple propagation methods, the low shelf life and perishability of the fruit itself. The first limitation can be alleviated by varietal screening for low-growing cultivars with good yields and desirable fruit characteristics.

Traditionally, the breadfruit is propagated by ringing the roots or taking root cuttings. However, repeated usage of this method puts great stress on the parent tree, making it more prone to pests and diseases and lowering its productivity.

Micropropagation, which is increasingly being used to propagate fruit species, could be an ideal method for propagating breadfruit. A Caribbean Basin Administrative Group grant awarded to the University of the Virgin Islands Agricultural Experiment Station (AES) is specifically designed to research the micropropagation of breadfruit.

This is one of the first projects to be undertaken in the new biotechnology laboratory of the Research and Extension Center.

Fruits of the breadfruit are normally harvested in the mature green stage, which, by experience, is determined by size, firmness, skin color and low latex flow from injured fruit stems. However, within two to three days of harvesting, mature fruits under ambient conditions ripen and soften, thus severely limiting local marketability and restricting export potential of the fruit. Retardation of ripening is therefore critical for improving the market prospects.

At the post harvest physiology laboratory of the University of the West Indies in Trinidad, a storage temperature of 16° at 90% relative humidity was found optimal for extended storage life up to 10 days. At 16° C and a controlled atmosphere of high RH and 5% carbon dioxide and 5% oxygen, storage life was further extended up to 25 days with little skin deterioration and loss of firmness of fruits.

A less expensive, but just as effective, method involves modified atmosphere (MA) storage in which the fruits are wrapped in polyethylene film and then stored at 16° C. Alternatively, waxing of refrigerated fruits also improves storage for up to two weeks, further retarding skin browning. The prospects for improved storability are excellent.

Breadfruit can be processed in a variety of ways. Breadfruit flour can be made by sound processing techniques; reconstituted slices of dried breadfruit have been found to have good texture and flavor comparable to freshly cooked slices. Similarly, rehydrated freeze-dried breadfruit has good eating quality.

Fruit slices canned in brine are a well-recognized Jamaican export item and breadfruit chips have had consumer acceptance comparable to that of potato chips in Puerto Rico.

There is also the potential for producing animal feed from the breadfruit skin and inner core--two fruit components normally discarded.

Prospects for processing breadfruit into a variety of products for both the local and foreign markets are therefore virtually unlimited.

Two hundred years ago, the breadfruit was introduced into the Caribbean, where it was considered an ideal crop to solve the famine and malnutrition of the slaves.

Today, with its aesthetic and nutritional value, storage and processing potential more fully understood, the "lowly" breadfruit has truly come into its own. The breadfruit is now grown and appreciated throughout the Caribbean. Its versatility as a food crop is highlighted in the following recipes.

Information for this article was provided courtesy of the *Extension Newsletter*, a publication of the Department of Agricultural Extension, Faculty of Agriculture, the University of the West Indies, St. Augustine, Trinidad, Vol. 24 No. 2, June/July 1993.

Selected Breadfruit Recipes

Breadfruit Salad

1/2 medium breadfruit (cooked
1/2 cup cooked carrot
1 tsp. minced onion
1/2 cup diced sweet pepper
1 large tomato
2 tbsp. mayonnaise
Lettuce leaves
Salt and pepper to taste

Cut cooked breadfruit into 1-inch cubes or as desired. Add peas, carrots, sweet pepper, onion, mayonnaise and salt and pepper to taste. Mix well. Arrange breadfruit mixture on a platter with lettuce leaves and tomato.

Breadfruit Fish Cakes

2 cups cooked flaked fish or soaked and washed dried fish (minced cooked meat may be used)
1 medium onion
1 tsp. lime juice
2 egg whites
2 cups riced breadfruit
1 oz. margarine
1 tsp. thyme
1 stalk green onion
Salt and pepper to taste
Oil for frying.

Mince the seasoning and sauté in the margarine. Remove from fire. Beat the egg whites until stiff, stir into the riced breadfruit and flaked fish, then add seasoning. Beat well. Check taste. Add again. Drop spoonfuls into bread crumbs, shape as desired. Fry in hot oil, turning to get brown all over.

Drain on absorbent paper. Arrange on a flat dish. Garnish with slices of sweet pepper. Serve warm as a main dish for breakfast, lunch or supper.

Breadfruit Cou-cou (Fungi)

Boil 1 pound breadfruit with 2 or 3 ounces of home corned pork. Mash the fruit smoothly and cut up the meat very fine; add some green seasoning. Leave just enough of the breadfruit water in the pan to "turn" the cou-cou. Add the breadfruit mixture and stir until all the breadfruit water has been absorbed. Bowl and turn on to a dish.

Breadfruit Cream Punch

2 pegs breadfruit (1/4) medium
Sweetened condensed milk
1/2 tsp. nutmeg
1 tbsp. white rum
2 tbsp. wine
4 cups water

Wash breadfruit, cut off 1/2, cut into boiling sized pieces and boil until tender in salted water. Put all ingredients into an electric blender and blend well. Serve on cracked ice.

Breadfruit Porridge

1/2 cup mature breadfruit
1/4 cup skimmed milk
3 1/2 cups water
1/2 tsp. vanilla
1 1/2 tsp. brown sugar

Mix milk in 1/2 cup water. Mix breadfruit in remaining water. Simmer, stir and cook 5 minutes. Remove and stir in milk. Put back to simmer and stir for 3 more minutes or until well-cooked. Add vanilla and sugar. Serve.

Breadfruit-Cheese Pie

1 medium breadfruit
2 1/2 cups water
1 tsp. salt
2 cups cheddar cheese, grated
2 tsp. prepared mustard
3 tbsp. breadcrumbs
2 tbsp. flour
1/4 cup margarine
2 cups milk
1 egg
1/4 tsp. nutmeg

Wash unpeeled breadfruit and cut into 4 pieces lengthwise. Remove core from each piece. Steam boil in 2 1/2 cups water with salt until tender. Grate cheese and divide into three portions. Grease two pie dishes. Heat margarine slowly and stir in the flour, mustard and nutmeg. Remove from heat and stir in two portions of cheese with the milk and the egg gradually. Return to heat. Keep stirring until mixture thickens.

When breadfruit is cooked and cooled, peel and cut into 1/4-inch strips, cutting across the pieces. Heat oven to 400° F. Pour the cheese sauce over the breadfruit pieces. Stir without breaking the pieces. Pour this mixture into the pie dishes.

Mix the remainder of the cheese with the bread crumbs. Sprinkle over top of pies. Brown in oven for about 15 minutes. Cut each pie into eight pieces for main dish or 16 as side dish.

Panapen En Escabeche

1 panapen
4 tazas de aqua
2 chariditas de sall
1 taza de aceite
1 cebola grande, rebandad
2 dientes de ajo, machacados
1/2 taza de vinagre
2 hojas de laurel
1 cucharadita de pimienta en grano

Monde el panapen y cortelo en trojos grandes. Eche el panapen en las 4 tazas de aqua y a hirviendo y sazonada con el sal. Cueza a fuego moderato tapadas, hasta que ablande (15 a 20 minutos).

Corte el panapen cocido, en trozos pequenos. En una sarten, sofria en aceite la cebolla, loa ajos, las hojas de laurel y la pimienta. Anada el vinagre.Cueza la salsa a fueo lento por unos minutos (hasta que la cebolla este blanda). Retire del fuego y vierta la salsa sobre el panapen cocido. Sirva caliento o frio. Puede adornar con tiritas de pimiento morron y rueditas de pimiento verde.Sugerencias para servir: Acompanelo con carnes y pescado.

Grazing Lands Application in the Virgin Islands

By
Mario A. Morales
US Department of Agriculture - Soil Conservation Service
Resource Conservation & Development
USVI Field Office

The USDA Soil Conservation Servicesoon will introduce a new and exciting technology called Grazing Lands Application (GLA) to the U.S. Virgin Islands. GLA is a user-friendly decision support system (computer program) designed to assist resource managers establish effective, efficient and sustainable grazing management plans and/or schemes.

The GLA program combines general and local expertise with the knowledge of the local producer to customize management plans to each land user's situation. The GLA program provides a venue for land users and producers to record and analyze economic and ecological information. The land user is able to create various "what if..." scenarios, associate the various scenarios to information that is in the GLA program and analyze results to make an informed decision.

How does this GLA program work? Six data bases are maintained and localized. These six databases are the foundation of GLA: 1) Client Information, 2) Animal Data Resources, 3) Plant/Soil Resources, 4) Decision Support, 5) Economic Analysis, and 6) Backup & Restore Utilities.

Client Information

This menu provides information about individual clients, forage inventory, herd definition and a grazing scheduler. Client information includes name, address and other business information of individual producers. The forage inventory includes soils and forage inventories unique to the individual farm, feed management systems, and net effects of improvement practices on forage inventories. It also allows for the modification of general forage databases to accurately show forage production of individual farms.

Animal Data Resources

This menu stores animal attributes such as kind, class, breed, age, weight and diet preference. It also includes information on feedstuffs such as nutritive content, digestibility and net energy as it pertains to the individual animal attributes.

Plant/Soil Data Resources

This menu includes general plant information such as species names, plant preferences, growth curves and plant site information. Data can be incorporated to customize all general soils/plant information. Soils/plant production links, plant growth curves and range site determinations are established and can be modified. Woodlands, native pastures, hayland, cropland and improved pasture information also is established and can be customized. Improvement practices also can be analyzed for increase or decrease in production for an individual farm for various time periods.

Decision Support

This includes the following packages: a management evaluation system, a multi-species stocking calculator and a nutritional balance analyzer.

The management evaluation system basically evaluates the chance for the economic success of selected improvement practices. It can be used to double-check decisions made by the producer.

The multi-species stocking calculator can be used to identify livestock type and class ratios that can best utilize the available forage.

The nutritional balance analyzer identifies the nutritional profile and needs of the individual herds. Animal descriptions, environmental factors and animal performance goals are analyzed and compared to the available forage base, available concentrates and roughage and other information. From this data, supplemental feeding schemes can be formulated and price comparisons can be analyzed to obtain the best feeding rations for individual herds.

Econimic Analysis

This helps the producer to estimate the return on investments for range improvement practices and/or grazing management practices. This database can be used to account for annual costs and revenues. The

database can compare any number of management and/or improvement practices. It also can compare various combinations of management and/or improvement practices to each other. These comparisons then can be analyzed as alternatives to present management. This database stores general economic information, animal demand information and rainfall data. It also can assist the producer to project variable costs for specific livestock enterprises, project offspring production and manage animal selling weights and market information. And the producer can create a profile for improvement practices.

Backup and Restore

The last database is the Backup and Restore Menu. That is basically a computer systems management menu. Anyone that has dealt with computers knows that a backup and restore process is necessary.

The GLA program can be of great assistance to producers. If used properly, this system can help producers make better management decisions. It also provides a venue to predict the increased productivity of a single or any number of improvement practices.

The GLA program contains general information that can be modified to fit individual producers and/or farms.

The USDA Soil Conservation Service, in conjunction with the Virgin Islands Resource Conservation and Development Council and the Virgin Islands Conservation District, is extremely happy to bring this new technology to the U.S. Virgin Islands.

This year, we will be gathering the necessary general data. We plan to use this new technology in the Virgin Islands in the very near future.

What's in a Name?

By
Sue Lakos
Extension Agent - Livestock
UVI Cooperative Extension Service

If you have ever stood over the meat counter at the supermarket and pondered over what to buy for supper, this article is for you. With so many different types and cuts of meat available, and current health issues in the forefront, it is no wonder many consumers are confused about what to buy.

Some meats come in only one or two varieties, so the decisions left to the consumer are how large a package to purchase and whether to buy fresh or frozen. These meats include chevon (goat), rabbit, and poultry products such as turkey, goose and duck. No age distinction is made in the naming of these meats. Standard practice is that only young animals are offered for commercial sale. Except in turkeys, distinction between the sexes is very rarely used in these products.

Goat

Chevon (goat meat) is probably the most common and popular of the non-poultry specialty meats. It can be found in almost every grocery store in the V.I., large or small, and is an important part of the cultural diet of the West Indies.

"Goat water" (broth) is an integral part in the celebrations and carnivals throughout the Caribbean and any good cook will have a secret recipe for the ultimate goat dish. Traditionally, chevon has been an inexpensive way to provide high quality protein for families. Much of the goat consumed throughout the Caribbean is homegrown and can be raised more economically than cattle.

Older goat meat, especially that from intact (not castrated) males, will tend to require longer, slower cooking times to assure tenderness, and creative seasoning to cover the musky taste characteristic of goats. Commercially raised chevon is from young does or castrated males (wethers) and will not have the strong, musky flavor.

Rabbit

Rabbit has long been a part of the diet in Europe and the European Caribbean islands and is slowly gaining popularity in the United States. Currently most of the rabbit found in the supermarkets in the Virgin Islands is frozen, but many small farmers have discovered the ease of raising the animals for meat, and it is not difficult for the consumer to find fresh rabbit.

For many years doctors have acknowledged the value of rabbit meat in low fat, low cholesterol diets. It is easier to digest than other meats, yet provides high quality protein. It also is a versatile meat and can be used in any way that a chicken would be used.

Chicken

Chicken is a category all to itself. Distinction is made for both sex and age of the bird at the time it is butchered. The youngest product is the Rock Cornish Game Hen. This bird is about 4 weeks old. It is the smallest chicken on the market and has the highest bone-to-meat ratio, which means that there is less meat than bone in the bird.

Fryers and broilers are 8-10 weeks old at time of butchering and are suitable for exactly what their names suggest, as well as about anything else you would want to use a chicken for. They still are very young and tender and contain enough fat to make them very succulent.

Roasters are usually 10-14 weeks of age and have filled out significantly. These are still tender and have enough fat so that they are still very juicy when baked or roasted. They weigh 6-8 pounds, so one can easily feed a family.

Capons are castrated male chickens that are raised until they are 8-12 pounds. Because they have been castrated, they do not develop the secondary sex characteristics that cause the meat to get tough and unpalatable and can be kept longer before butchering.

Older chickens are called stewing hens, soup hens and stags. These are mature birds that have passed their prime and are usually extremely tough, requiring long, slow cooking to make them reasonably tender.

Sheep

The meat of the sheep comes in two basic categories,

lamb and mutton. Essentially, lamb is a young sheep, of either sex or castrated, that was butchered before it reached 1 year of age, while mutton is sheep older than 1 year. The actual determination is made by the presence or absence of a "break joint" in the knee of the animal.

Lamb is more tender and has a milder flavor than mutton. In addition, it can be cooked by almost any method with satisfactory results. Mutton, on the other hand, is primarily ground or stewed.

Swine

The meat of swine, or pigs, referred to as pork, is utilized in a variety of ways. Small, young pigs such as suckling or feeder pigs often are roasted whole for barbecues. These are pigs that dress out anywhere from 20 - 70 pounds.

Roast pig (lechon) is a traditional "festival" food in the Caribbean. Lechon is a staple for any celebration, large or small. Distinctive seasoning and slow roasting over a charcoal pit produces an end product unequalled in flavor and tenderness.

Standard pork found in the supermarket is from pigs that are older and dress out at about 150-200 pounds. It is from barrows and gilts exclusively, because meat from the intact males (boars) has a very strong, unpleasant odor and taste.

Old pigs are used for sausage because tenderness is not a requirement for meat that is ground and any strong flavors that might be present in the meat are masked by the seasonings in the sausage mix.

Cattle

Meat from cattle is placed into two categories--veal and beef. Veal is from very young cattle raised on a special diet. Usually, this diet is a liquid formula that contains all of the nutrients the calf needs except iron. The formula is designed to allow the calf to grow quickly, yet maintain the very tender, light colored meat that is recognized as veal.

Beef is from cattle over 1 year of age. It is characterized by the vibrant red color of the tissue and is probably the most recognizable meat product in the supermarket today.

Most of the beef comes from heifers and steers. Meat from intact males tends to be tougher and have a stringier texture. Bulls butchered before 18 months of age usually do not present a problem with acceptability of product.

Most of the local Senepol beef sold in the Virgin Islands is from young bulls butchered at about 12-16 months of age. It is a very lean and flavorful product and is in high demand.

Meat from older bulls and cows will be darker red in color and have yellower fat. It is most commonly used for stew meat and ground beef because it is not as tender as the young beef.

ANIMAL	MALE	FEMALE	GENERIC YOUNG	MALE YOUNG	FEMALE YOUNG*	CASTRATED MALE	MEAT
CATTLE	BULL	COW	CALF	BULL CALF/ BULLOCK	HEIFER	STEER	VEAL-LESS THAN 1 YEAR, FORMULA FED BEEF - CATTLE OLDER THAN 1 YEAR
PIGS/ SWINE	BOAR	SOW	PIGLET	N/A	GILT	BARROW	PORK
SHEEP	RAM	EWE	LAMB	RAM LAMB	EWE LAMB	WETHER	LAMB-LESS THAN 1 YEAR OF AGE MUTTON- SHEEP OLDER THAN 1 YEAR
GOATS	BUCK	DOE	KID	BUCKLING	DOELING	WETHER	CHEVON
CHICKENS	ROOSTER/ COCK	HEN	CHICK	COCKEREL	PULLET	CAPON	CHICKEN-CORNISH HEN, FRYER, BROILER, ROASTER, STEWER HEN, CAPON, STAG, SOUP HEN
TURKEYS	TOM	HEN	POULT	N/A	N/A	N/A	TURKEY
RABBITS	BUCK	DOE	KIT	BUCKLING	DOELING	N/A	RABBIT
GEESE	GANDER	GOOSE	GOSLING	N/A	N/A	N/A	GOOSE
DUCK	DRAKE	HEN	DUCKLING	N/A	N/A	N/A	DUCK

* FEMALE YOUNG RETAIN THIS NAME UNTIL THEY HAVE THEIR FIRST OFFSPRING

Benefits of a Marine Fishery Reserve System for the U.S. Virgin Islands

By
Callum M. Roberts, Ph.D.
Research Assistant Professor - Marine Ecology
UVI Eastern Caribbean Center

Virgin Islands Fisheries in Crisis

Over the last 20 years it has become much harder to make a living by fishing in the Virgin Islands. The boom years have long gone when traps could be hauled so full of fish that they would be bursting at the seams.

Joe LaPlace tells of how, in the late 1940s, lobster were so abundant that fishermen could collect them by the armful while wading. They were so common that they once were used to bait fish traps.

Although fishermen's tales are notorious and are traditionally to be taken with a pinch of salt, fishermen in the Virgin Islands should be taken very seriously when they claim catches were much bigger and easier to get a few decades ago. The figures back them up.

In 1950 Joe LaPlace was able to catch enough fish to make a good living using just 12 traps. Now, the average fisherman here sets more than 100 traps and doesn't catch any more fish.

Figures on landings from Puerto Rico paint a bleak picture of what is happening to fisheries in this region. Numbers of fishermen increased by nearly 30% between 1931 and 1989, as has their ability to catch fish. The increase may be due to the fact that they all used motorized boats now, while just over 1% had them in 1931. Nevertheless, catches actually FELL by one quarter over the same period. The fishery is in dire straits.

There are other indications, as well as falling numbers of fishes and declining catches, that all is not well. The average sizes of fish caught are becoming smaller, and in many cases fish are caught well before they become old enough to reproduce. Dr. Yvonne Sadovy reported recently that more than 90% of red hind caught in Puerto Rico were immature.

Managing reef fisheries

Faced with these shocking figures, it is clear that the fisheries need to be properly managed to sustain catches over the long term. Management measures have been in place for some time now, both here and in Puerto Rico.

A complex set of regulations have been put together to attempt to allow stocks to recover from heavy exploitation.

Enforcing these regulations can be very complex and expensive. Not only that, but the regulations themselves

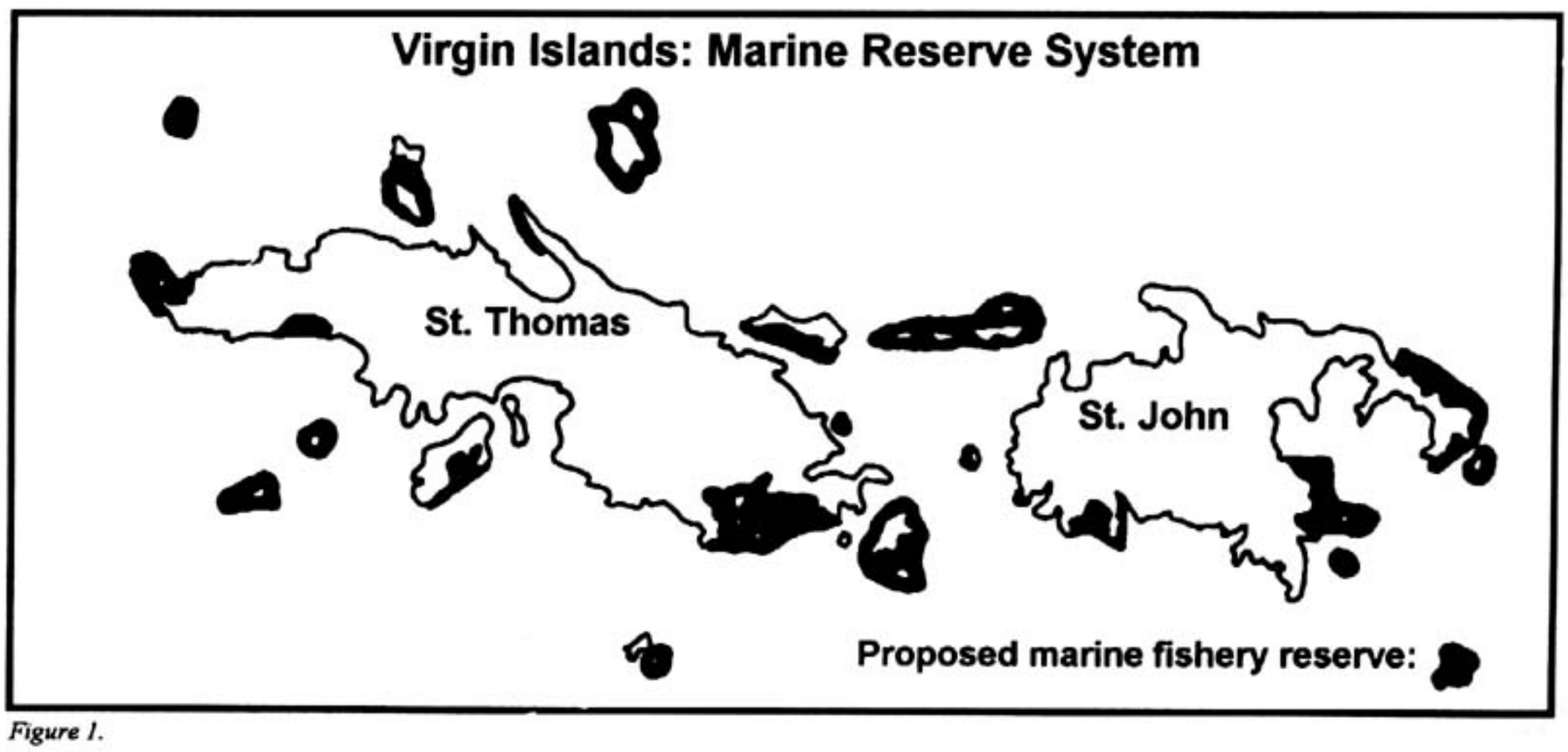


Figure 1.

can be confusing. Next year, Nassau grouper below 20" will be illegal, and the year after that those below 21". The conch regulations recently considered by the Caribbean Fishery Management Council were so complex that even the experts could not agree on what they meant.

Confusion is heaped upon confusion when you realize rules applying to federal waters (greater than 3 miles offshore in the U.S. Virgin Islands and greater than 10.38 miles offshore in Puerto Rico) do not necessarily apply to territorial waters. Despite all these well-intentioned measures, management on a species-by-species basis is not producing the hoped-for results.

Why are Reef Fisheries so Difficult to Manage?

Why are these kinds of measures not working, when similar kinds of restrictions have worked before for fisheries such as those for herring or cod in the northern Atlantic? The difference is that the fisheries of temperate waters are rather simple, usually with only one or a few species being caught at a time by one kind of fishing gear at a time.

By contrast, reef fisheries are incredibly complex. Characteristically, a wide range of species are caught using many different methods, and each gear used is capable of catching many different species. Applying management measures to individual species is fraught with difficulty because the rules which govern temperate fisheries are violated for reef fisheries.

Take the example of the Nassau grouper. This species becomes sexually mature at an age of about six years. By this time it has grown quite large, much larger than most other species which are commonly caught in these waters. Things are complicated further because this species changes sex, starting out as a female and becoming a male later on if it lives long enough. To keep enough males in the population to spawn with the females, it is important that sufficient numbers of very large fish remain.

The usual approach to managing a trap or net fishery is to set the mesh size which will allow enough sexually mature fish to escape to maintain the population. The trouble is, there isn't a trap which catches only Nassau groupers. The same kinds of traps catch a very wide range of species. If you set the mesh size large enough to manage the Nassau grouper fishery properly, you would catch hardly anything else because the other fishes present are typically smaller than Nassau grouper. This is the crux of the problem. Different species require different management methods, and some of those methods are incompatible.

Is There a Better Way?

It is against this background that the idea of using marine fishery reserves to manage fisheries was born. The idea is to completely close off certain areas to fishing. Such a system of reserves could have many advantages over conventional management methods. Some 21 separate benefits have been listed by the South-East Fisheries Center in Florida. The most important benefits are that they can:

1. Protect spawning stocks. This is especially important for species which are very easily caught, such as Nassau groupers.

2. Provide a source of eggs and larvae to restock fishing grounds.

3. Provide supplemental restocking of adjacent fishing grounds through emigration of fishes. Increased catches close to reserves will help to offset loss of fishing grounds due to reserve establishment.

4. Provide some insurance against management failures in fished areas. This is particularly pertinent to the situation in the U.S. Virgin Islands and Puerto Rico. If you virtually wipe out a species outside a reserve, then at least there will be some left inside to keep the species going.

5. Marine reserves are much simpler to understand and enforce than other kinds of fishery regulations.

St. Thomas and St. John already have a system of marine fishery reserves, but it is still only on paper. Figure 1 shows the impressive system established collaboratively between the fishermen of the Virgin Islands and the Division of Fish and Wildlife.

This was approved by the Legislature but still awaits the Governor's signature. To gain approval, the system must be extended also to St. Croix, where fishermen still must be persuaded that reserves will benefit them in the long run.

Research on Marine Fishery Reserves at UVI

Marine fishery reserves have attracted an enormous amount of interest throughout the world and studies into how well they work are being undertaken all over the tropics. In the Caribbean, the University of the Virgin Islands and University of Puerto Rico Sea Grant are leading the field. The United States Agency for International Development recently approved a $100,000 grant for the Eastern Caribbean Center to study the design and function of reserves in the Caribbean. Unfortunately, to find working reserves, we must go to St. Lucia.

Meanwhile, the University of Puerto Rico Sea Grant is launching a 10-year Research Initiative on Marine Fishery Reserves to study how best to establish them and what their effects will be on local communities.

There is already an impressive amount of evidence that fishery reserves will help restore the fishing grounds of the Virgin Islands. While further research will improve our understanding, the time is ripe to get the reserve system enacted here. By the time scientists provide unassailable evidence that reserves are a good thing, it may be too late to save the fisheries of the Virgin Islands and Puerto Rico.

How to Manage Wastewater and Runoff From Confined Animal Facilities

By
Jeffrey J. Schmidt
US Department of Agriculture - Soil Conservation Service
USVI Field Office

Whether a farm is large or small, all operations have common problems relating to confined animal facilities. In the United States Virgin Islands two categories are the most common and at the same time very different. The potential for water quality problems exists with both large and small operations.

In one category, there are less than a few dozen farms with large enough systems (usually more than 75 head of stock) to support controls or measures that are engineered, designed and constructed, but which may require large sums of monetary support. Most commonly, herds on these farms are either dairy, beef, swine, sheep, goats or poultry.

On the other hand, there are virtually hundreds of small operations of confined animals. The animals common in this group are more of a mix than the preceding category. Again, each situation is different, as are the problems. Five goats can be more hazardous than 20 cows if the confinement location is not appropriate.

Of course there are the herds that just roam, graze or browse. Common to this group are horses and goats. It should be noted that any animal can be a roamer, should gates be left open or fences be in dire need of repair. Certain animal types are common to an area in the Virgin Islands, rather than the rule. In other words, these domesticated animals do not roam from coast to coast in search of food or forage, but stay in an area big enough to support the herd, and do not venture from there.

This is commonly referred to as the land's "carrying capacity." This refers more directly to the plants' ability to survive grazing pressure. These roamers also can be detrimental to humans, other livestock herds, and to themselves as well.

Wastewater management problems often arise when livestock are added to a farm without increasing the land base. When land and animals are out of balance--that is, the waste produced greatly exceeds the capacity of the land to utilize the nutrients in the waste product--we find that water quality problems begin to show.

Unfortunately, these problems can go unnoticed for a long period of time. Some examples could be fish kills, odor, drinking water contamination, or even bacteria-related diseases spreading to humans. A common bacteria in these cases is E-Coli.

Careful observation and common sense can often determine whether a given farm practice is likely to cause the quality of water to deteriorate or affect the environment. The quality of water can be adversely affected if manure runs into streams or guts as a result of land application, spillage, storage overflow, or deliberate dumping. Increased bacterial counts can indicate this has happened. Several illnesses can be attributed to high bacteria counts in water systems. Common are typhoid, hepatitis, bronchitis, and even urinary infections, all of which can be fatal if not treated.

Increased nutrients such as nitrogen in the groundwater can cause drinking water problems for water well users. Nitrate poisoning is possible which can be serious, but more so to infants.

More often than not, rainfall transports the waste products into the groundwater and/or across the soil surface. Nutrients in manure applied to the soil at rates that exceed the soil's and plants' ability to break down or uptake the nutrients, can leach into groundwater or be carried off-site with runoff water and eroded soil into the sea. This off-site transport is often referred to as non-point source pollution.

The reasons for developing and maintaining a sound wastewater management plan include: environmental benefits to the public; economic benefits to the farmer; and compliance with laws and regulations concerning environmental quality.

Let us explore managing waste from a large animal facility first to learn the general principles of waste management or runoff control. The two are synonymous. A component of waste management is controlling runoff to and from the confined facility.

A system to manage waste and runoff from a confined animal facility must be developed using a total systems approach. A total system accounts for all the waste associated with an agricultural enterprise throughout the year, from production to utilization, from extra feed to overflowing watering tanks, from parlor flushing to excess bedding, and from manure storage to application. In short, it is the management of all the waste, all the time, all the way through.

With this in mind, inventory all of the resources associated with the agricultural enterprise. This list is not all inclusive. The accuracy of identifying the resources allows more functional alternatives to be developed. Some of the data can

be easily measured, such as the number of acres available to spread waste. Other data may be less tangible, not easily measured, but rather rely on personal discussions, observations, or just plain common sense judgement.

The inventory includes: type of livestock, type of operation, breed, size (number of stock, ages, weights, replacements), feeding components, site location, bedding, present facility, land availability, soils, topography, rainfall, geology, crops, labor availability, equipment availability, level of producer management, adjacent land use, livestock travel routes, confinement days, laws and regulations, utilities, landscape resources, flexibility, expansion opportunities, and producer financial situation.

Once a thorough investigation of the resources is complete, arrange the information into six categories for interpretation and evaluation. They are: 1) Production, 2) Collection, 3) Storage, 4) Treatment, 5) Transfer, and 6) Utilization. Alternatives can be selected that best fit the site conditions, livestock operation, and the producer's objectives. When selecting and considering alternatives, always keep in mind that the purpose of managing animal wastewater is to not detrimentally affect water quality or the environment.

Components of the previously mentioned categories are more commonly known as "alternatives available to manage wastewater and runoff." They include, but again are not limited to: roof gutters, clean water diversions, dirty water diversions, alley scrapers, flush alleys, ponds, tanks, dry stack, lagoons, composters, solid separators, settling basins, pipelines, hauling equipment, pumps, push-off ramps, irrigation systems, spreaders, commercial sale, refeeding, bedding, energy generation, and artificial wetland wastewater treatment. This last alternative is excitingly new for the Virgin Islands and may hold great promise because of our shrinking agricultural land base.

In a smaller operation, all the principles of planning and data collection are the same, but with a smaller land base and less financial capital to build the same controls as needed in a larger operation.

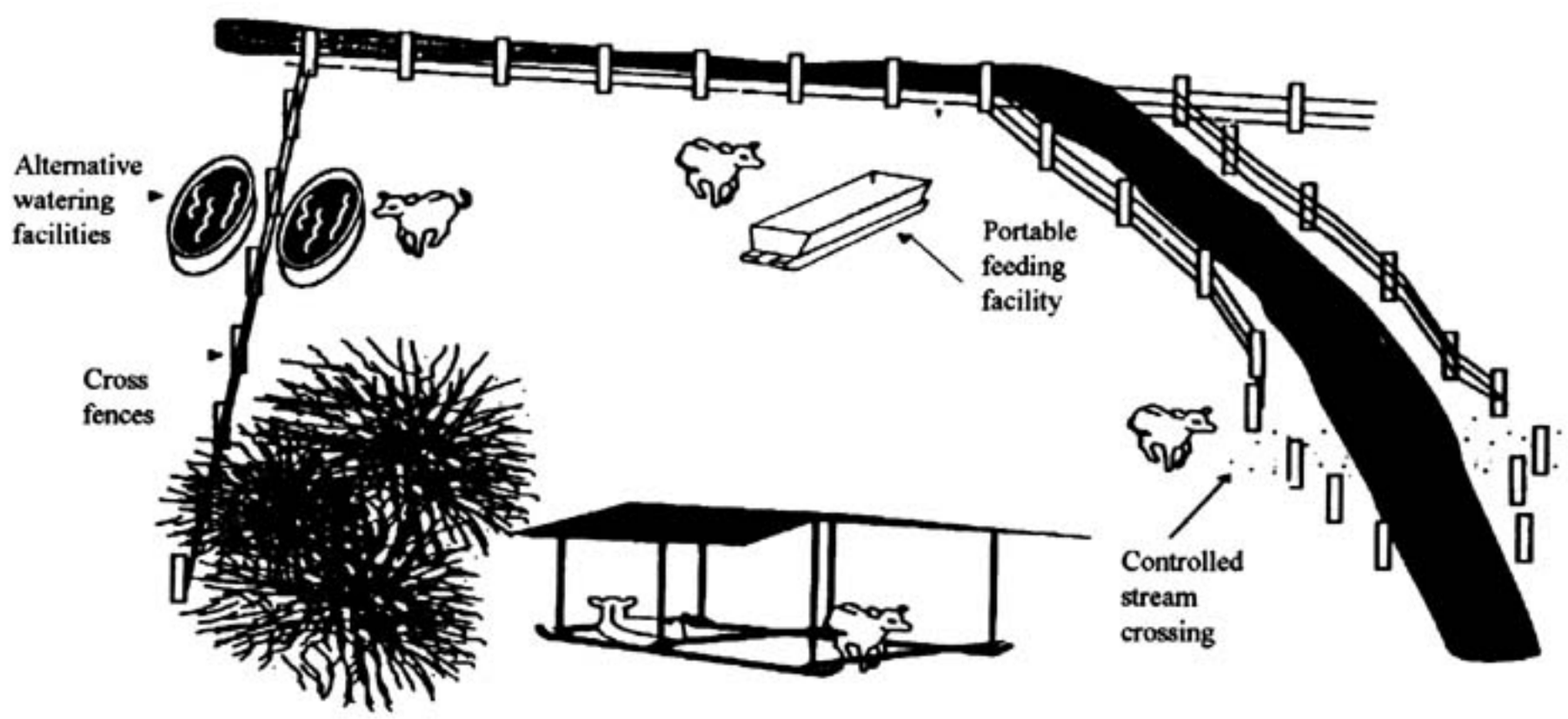
Some suggestions work for larger operations as well. These happen to be virtually cost-free. The first thing that can be done is to reduce the stock size. Prevent stock from entering watering facilities, streams, ponds and diversions; rotate pastures; rearrange feeding areas away from steep slopes; create buffer strips; repair fencing; feed in bunks, not on ground.

Common-sense approaches can be found every day. Animal waste management is not a one-day event, because conditions are constantly changing in any farming or animal management enterprise.

Managing wastewater and runoff from confined animal facilities has many available alternatives as well as many problems. Because of the variety of alternatives, solutions, conditions and situations that the management system must incorporate, no one procedure can be followed to arrive at a one-system design. One recommendation may be ideal for one farm and completely inappropriate for another. Alternatives are always available. Whether they are the ones that fit your operation, or are feasible for you, may be a completely different matter.

The most important thing is to recognize a problem, even a potential problem, and to take positive steps to protect, restore and improve the environment.

Livestock waste management on pasture includes cross fences for rotation, portable feeding facilities, shade areas away from streams, alternate water facilities, and controlled stream crossing.



Basic measures in managing confined animal facilities.

Erosion and Soil Conservation

By
Julie A. Wright
Extension Specialist - Natural Resources
UVI Cooperative Extension Service

Soil erosion is one of the most serious environmental threats facing the Virgin Islands today. Excessive sediment from construction sites, dirt roads and farmland is one of the primary causes of water quality degradation in the Virgin Islands. Because of the small size of our islands, any activity that disturbs the soil can directly affect our coastal waters, often within a very short time period. All land is a potential source of eroding soil.

What is Erosion?

Water erosion is the loosening and removal of soil particles from the land surface by raindrops or running water. (Erosion can also be caused by wind, but that is not a significant factor in the Virgin Islands.) Erosion is a natural process; however, removal of vegetation from the land surface during land clearing for development, planting, or by grazing can dramatically increase the volume of soil lost from the land surface.

The primary factors influencing the extent of erosion are the amount and intensity of rainfall, soil characteristics, the amount of vegetation present, and slope.

Once soils begin to erode, then a corresponding process, sedimentation, begins to occur. Sedimentation is the deposition of eroded soil particles that are suspended in storm water runoff onto flood plains and other low-lying areas, or into guts, ponds and coastal waters. Suspended sediment delivered by storm water runoff is one of the most prevalent pollutants in Virgin Islands' waters.

What are the Effects of Erosion?

A 1986 study of erosion rates on St. Thomas and St. Croix estimated erosion from a disturbed dirt road site to be 591 tons/acre/year (Wernicke, Seymour and Mangold, 1986). This is significantly greater than natural rates of erosion that average 1-5 tons/acre/year. Both surface and ground waters can be adversely affected.

Sediment deposition into coastal waters can have many short- and long-term adverse impacts on salt pond and coastal water ecosystems. These impacts include: increased turbidity (or cloudiness), reduced light penetration (which adversely affects coral and seagrass growth), clogging of fish gills and filters, reduced spawning and juvenile fish survival, and damage to commercial and recreational fisheries (Schueler, 1987). Heavy sediment deposition in coastal waters also smothers seagrass communities and coral reefs, increases sedimentation of channels and harbors (requiring more frequent dredging), changes bottom composition, and leads to loss of use for recreational purposes (such as swimming and snorkeling). The primary cause of coral reef degradation in coastal areas is attributed to land disturbances and dredging activities due to urban development (Rogers, 1990).

How Can I Tell if Erosion is Occurring on My Land?

Although almost everyone recognizes a gully or sediment deposits as a sign of erosion, not all erosion is that easily recognized. Muddy water in a gut or drainage ditch or on a driveway indicates erosion is occurring. But it may be visible only for a short time following a rainstorm. The damage will continue unless something is done to stop it. Here are some other, even less obvious, signs that erosion is occurring:

- Bare spots on the lawn or property;
- Tree roots showing above ground (although some trees, like ficus, grow this way naturally);
- Gullies beginning to show;
- Built-up silt in depressions or low-lying areas;
- Soil splashed on windows and outside walls;
- Drainage or gut channels becoming wider and deeper;
- Increase of fallen trees in guts.

Erosion can occur any place where water flows over bare soil. For example, a site that has vegetation on it can be eroding where grass and brush cover is thin, where weeds with poor root systems grow, and where water flow patterns prevent permanent forms of vegetation from getting started.

How Can I Conserve My Soil by Preventing Erosion?

There are many simple soil conservation steps that individual homeowners and farmers can use to help save their soil.

- Leave as much native vegetation as possible on the site when building or clearing.
- Construct driveways and paths with gravel, crushed stone, or brick rather than asphalt or concrete. This will allow more rain to absorb into the ground.
- Build terraces (using either stone or a bunch grass like vetiver) on steep slopes to slow runoff and trap sediment.
- Rotate livestock among pastures so that the land does not become overgrazed (i.e., do not wait until livestock denude a pasture of vegetation before moving them to a new pasture).
- Keep livestock out of streams and guts. Not only do livestock pollute streams and guts by directly depositing manure in them, they also cause erosion by trampling the sides and bottoms of guts.
- Seed newly graded areas immediately after earth moving is complete, and mulch with cut grasses (like Guinea grass) or wood chips until seedlings are established.
- Build driveways and roads along slope contours rather than up and down the slope.
- Plant crops along slope contours rather than up and down the slope.
- Plant erosion-resistant grasses or ground covers on steep lopes and other eroding areas to hold the soil in place.
- Use erosion control matting or mulch to protect soil from erosion until vegetation is established.
- Plant ground covers in shaded areas where grass is difficult to establish.

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Sustainable Agriculture in the Virgin Islands

By
Louis E. Petersen, Jr., Ph.D.
District Supervisor, St. Thomas/St. John
UVI Cooperative Extension Service

According to the Food, Agriculture, Conservation and Trade Act of 1990, *sustainable agriculture* is an integrated system of plant and animal production practices having a site-specific application that will, over the long-term, satisfy human food and fiber needs; enhance environmental quality and the natural resource base upon which the agricultural economy depends; make the most efficient use of nonrenewable resources and on-farm/ranch resources and integrate, where appropriate, natural biological cycles and controls; sustain the economic viability of farm/ranch operations; and enhance the quality of life for farmers/ranchers and society as a whole.

Simply stated, sustainable agriculture refers to agricultural systems that are designed to be productive while being ecologically sound, economically viable, socially just and humane. These systems are comprised of practices such as composting, intercropping, multiple cropping, crop rotation, terracing, diligent record-keeping, appropriate varietal selection, and the use of drip irrigation.

While some of these methods and technologies may be new to farmers and home gardeners in the Virgin Islands, many have long been in use as a consequence of tradition or necessity.

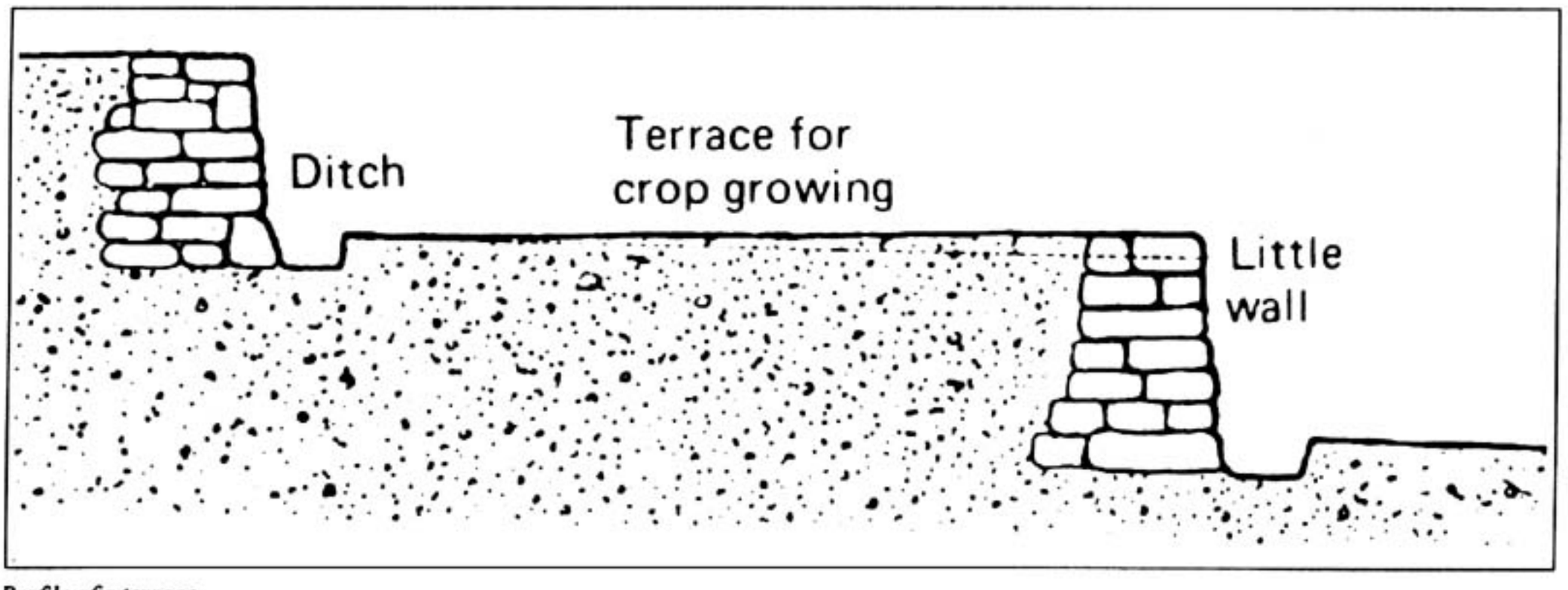
Terracing refers to the construction of earth embankments, channels, or combinations of both across the slope of the land. This has been practiced for hundreds of years in the Virgin Islands, especially on St. Thomas and St. John, where the terrain is hilly and often very steep. The most common type of terrace constructed by local farmers uses rocks to contain and stabilize the soil. This makes good use of the many available rocks which characterize our soils. Terracing reduces soil erosion and runoff as well as creates a more manageable working area for the farmer as the area is leveled.

Another practice which helps to conserve our natural resources is *mulching*. This involves the use of synthetic or organic materials such as straw, grass cuttings, leaves, manure, wood chips, plastic or woven fabric to cover the ground surface around plants to conserve soil moisture and control the growth of weeds.

Mulched plants need water less frequently than non-mulched plants. Mulching also reduces runoff and soil erosion because the materials used provide a protective covering for the soil. Organic materials such as manure and grass cuttings are more commonly used in the Virgin Islands rather than synthetic ones. Organic mulch materials gradually decompose and enhance soil structure and fertility. On the other hand, synthetic options such as plastic are more durable and can last from one planting season to the next.

Biodegradable plastics have been developed and have great potential usage for Virgin Island farmers who avoid the use of conventional grades of plastic.

The importance of proper *varietal selection* of crop types is often underestimated by farmers and home gardeners in the Virgin Islands. By choosing the



Profile of a terrace

appropriate varieties of fruits or vegetables in production systems, lower inputs of pesticides, fertilizers and even water may be necessary. Modern varieties which are tolerant to diseases, insects, existing soil conditions and drought should be used whenever available.

Crop rotation refers to a system of planting crops in a compatible and complementary manner to prevent the potential buildup of pest populations on a given farm site. It is well known that the potential for disease and insect problems (especially soilborne problems) increases when the same or similar crops are grown successively on the same field.

Crop rotation relies on the diversity between plant types to interfere with the natural life cycle of insects and disease-causing organisms. Consequently, the quantities of pesticides used for crop production can potentially be reduced and, therefore, their environmental impact.

In addition, when the same or similar crops are repeatedly grown on the same plot of land, soil fertility levels decline due to the constant demand for the same quality and quantity of nutrients. This usually leads to unnecessary applications of fertilizer to restore soil fertility. Crop rotation uses plants which are appreciably different so that soil nutrient reserves are not exhausted, resulting in "tired soils."

Similarly, the practice of *intercropping* is based on the principle that similar plant types attract similar pest problems while a diversified population of plants guards against this. Hence, intercropping involves the growing of two or more totally different species together in the same field. As with crop rotation, to reduce the potential of a pest outbreak is to reduce the potential environmental impact of pesticides.

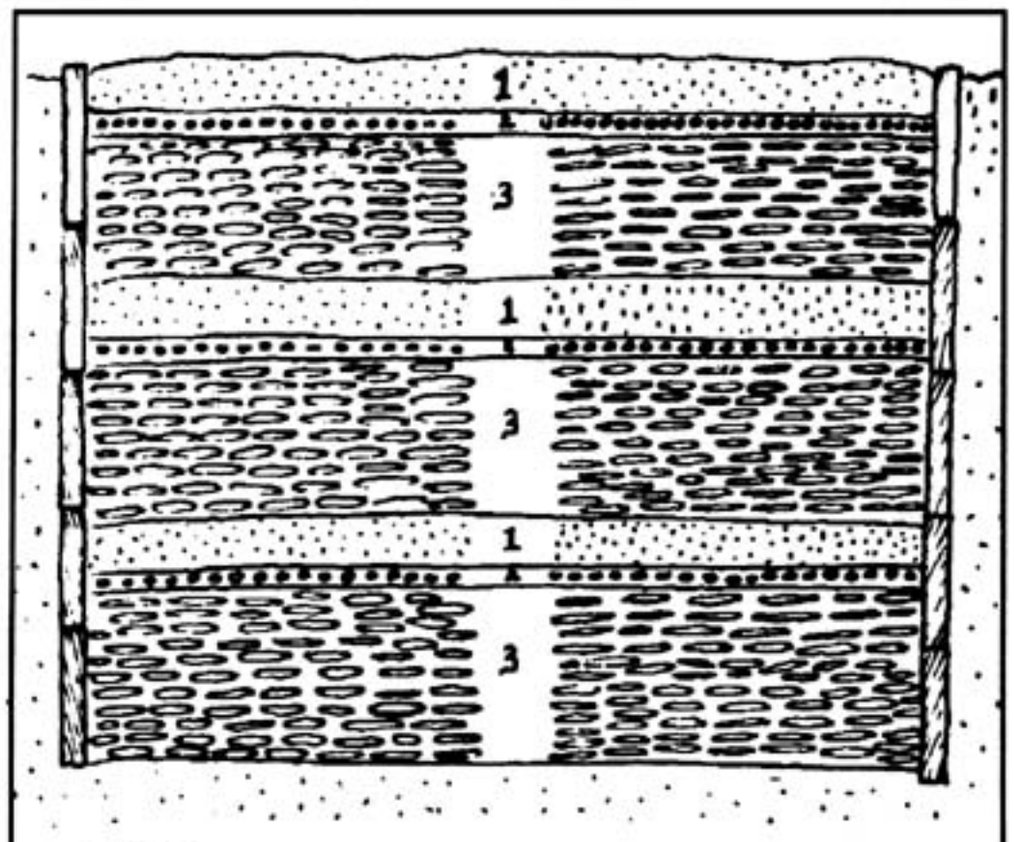
Practically all farmers and home gardeners in the Virgin Islands traditionally practice intercropping due to the unavailability of another very limited and expensive resource--land. Farmers and gardeners must use their land prudently in order to get as much production as possible from small acreages.

Another important practice which needs more attention on the part of Virgin Island farmers is *record-keeping*. Good record-keeping (in conjunction with soil testing) can help farmers decide if, for example, a fertilizer application is necessary. Fertilizer applications often are made at random without considering the date of the last application or the current fertility status of the plot in question. This can result in unnecessary applications of fertilizers which, in turn, can eventually contaminate our aquifers.

A good record-keeping system also documents a crop history (i.e. the sequence in which crops have been planted on a farm site). Such information can facilitate an effective crop rotation system which, as was mentioned previously, is a pest control measure and which prevents the exhaustion of soil reserves.

Fresh water is quantitatively a very limited natural resource in the Virgin Islands. Therefore, measures must be taken to make the most efficient use of this precious commodity.

Many producers in the Virgin Islands still supply water to their crops by means of the "conventional" hose or a bucket. Besides causing mechanical damage to plants, this system makes wasteful and inefficient usage of water. Most of the applied water never reaches the plants for which it was intended, and instead contributes to runoff, erosion and sedimentation of soil particles.



1. Soil
2. Fertilizer (1 cup/layer)
3. Leaves, manure, etc.

Profile of the compost pile

On the other hand, *drip irrigation* technology is strongly advocated for use in crop production because water use efficiency is maximized. This is accomplished by gradually supplying plants with small amounts of water in a dripping manner through tubes for periods of time. This ensures maximum uptake and utilization of the water by plants, and there is no resultant runoff, soil erosion or sedimentation. The use of drip irrigation systems as a production practice is gradually becoming more commonplace among Virgin Island farmers.

Composting is the practice of managing the decomposition of organic matter such as plant or animal residue or waste which results in a rich humus material which can be used as a fertilizer, mulch or to improve soil structure. Composting, therefore, represents a means of recycling the otherwise refuse by-products of agricultural activity and reincorporating these organic materials into continued agricultural production systems.

The concept of a properly managed, scientific system of organic matter decomposition is relatively new to crop producers in the Virgin Islands, but should be strongly encouraged.

Although the examples given herein are from the perspective of crop production, sustainable agriculture is also practiced in livestock production. For example, poor record-keeping in pasture management can result in overgrazing and thus, poor management of animal manure and soil erosion.

Sustainable agriculture represents one of many initiatives to address the issue of environmental preservation. With the assistance of the agricultural agencies of the Virgin Islands, our farmers can also make significant contributions toward the conservation of our natural resources to ensure tomorrow's food production.

Documentation of Medicinal Plant Use in the USVI

By
Toni Thomas
Extension Agent - Natural Resources
UVI Cooperative Extension Service

Until the recent past, much of the information about medicinal plant use in the USVI was effectively communicated verbally or by example from one generation to the next. According to many native Virgin Islanders, these traditional methods of communication are no longer common, and much of this information may already have been lost with the passing of those who possessed this knowledge.

The preservation of what remains of this information concerning traditional plant use is important to researchers, physicians, pharmacologists and ethnobotanists who are searching for natural products derived from plants which may be effective against health disorders. Researchers and others document traditional medicinal plant usage by interviewing knowledgeable informants (oral history techniques) and making collections of plants (herbarium techniques).

These methods of documenting medicinal plant use may also be of value to Virgin Islanders who are in danger of losing information about how plants were used and their associated traditional values. Since 1991, the University of the Virgin Islands (UVI), through the Eastern Caribbean Center (ECC) and the Cooperative Extension Service (CES), has been engaged in a project to broaden the existing information base regarding the use of plants for medicinal purposes in the USVI.

As part of this ongoing project, ECC and CES staff, as well as UVI students, have been interviewing Virgin Islanders who are knowledgeable about medicinal plants. Medicinal plant specimens collected by staff, students and the interviewees are being added to the diagnostic herbarium housed at CES (UVI, St. Thomas campus). Information on traditional plant usage derived from interviews will be presented in fact sheets and an ECC-CES publication.

Learning about plants in the traditional way seemed to be associated with development of values such as responsibility, self-discipline, self-sufficiency, respect for others and the environment. Excerpts from some of these interviews will be featured throughout the remainder of this article. It is the author's feeling that much of this information is best communicated in the actual words of the interviewees recorded in transcripts.

Those who were interviewed expressed similar remembrances of the ways information was passed on to them. One interviewee in St. Thomas, commercial dress designer Idrena Millin Henderson, was asked how old she was when she started learning about plants. She responded that learning about plants was a natural part of growing up:

"You soak it in, they didn't just teach us. . . . If you know a sickness somebody have, they tell you go get this or go get that. They tell you what bush to get and so . . . or how many to get of what, go bring. . . . You're a child; you never forget . . . because you know, the thought of death, it jars you. . . . It does something to your memory that you wouldn't forget because you have to try to save that life. You can't afford to see a life go, and you could have saved it. . . .Therefore, it's an experience, it just get in the brain and it stays in there. It records it . . . and it's back in there, somewhere in there . . . When the time come, this thing just thrown so, in front of you. . . . I was 15 years old. I had to learn how to care for the sick."

When interviewed, Olivia H. Henry of St. Croix, author of a CES publication, *Bush Teas of St. Croix* (1983), recalled how she and other children learned about using plants: *"Mother is cooking on her little wood fire. She says, 'Go over there. Go pick a piece of that, and bring it to me.' When my grandmother had us in the kitchen, we couldn't talk. We had to keep our mouths shut. We had to concentrate on what we were doing."*

Also present at the interview with Ms. Henry was experienced herbalist Cleopha Bennett Brady. Ms. Brady also remembered learning about plants as a child when her grandfather made the gathering of herbs a priority. Ms. Brady described how her grandfather and other *"old people"* instructed her when she came home from school:

"'Go and get the hand weight. I want you to go to the land, and I want you to bring this herb and that herb.' Then after we have done that, they will tell us, 'Sit down now and do your homework, and then you can tell me what happened at school today.' We have forgotten that. . . . My ancestors never wrote books. They passed it on."

Ms. Brady feels that the "hands on" learning experience is more valuable than just written information.

Ms. Henderson learned about plants from her great-

grandmother, who was brought to St. Thomas from West Africa as a slave; she lived well over 100 years. When asked if her great-grandmother ever talked about medicinal plants that she had known in Africa, Ms. Henderson responded: *"No, they never talked about these things. The slave-masters wanted them to forget African culture altogether, and they introduced them to these other things. But something they never forget . . . the weeds is the same; they're tropical and they're the same thing. Most all the weeds . . . they know the use of them because that's what medicine they had when they came over here. . . . These things are growing wild all about. They're native to the place; so they used them."*

Sweet Scent

Interviewees generally acknowledged the primary importance of the Afro-Caribbean influence in the development of local traditional plant usage. The influences of the Caribbean Indians and the Europeans were also recognized. Joseph LaPlace, retired Master Fisherman with the Virgin Islands Division of Fish and Wildlife and member of the St. Thomas French community, learned about local medicinal plants mainly from his grandmother. He claimed that the French residents, who have maintained a long tradition of using local medicinal plants, originally learned how to use them from the African slaves. According to Ms. Henderson, when the French settled on St. Thomas, they cultivated and marketed the "bush" to meet the needs of the African population.

Several interviewees suggested that, during slavery and after emancipation, much of the local population was forced to be self-sufficient, depending upon local plants for medicinal and other basic needs. For example, Ms. Henderson recalled: *"When I was born [ca. 1915], and just before, when my father was growing up. . . . They couldn't buy toothpaste. . . . A man had to work for 35 cents a day! A woman worked for 10 cents a day!"* Her father used **maran bush** *(Croton sp.)*, which grew near the estate where he lived, as a tooth cleanser. *"You take the young part, the end. You rub it up, and you do your teeth, 'round and 'round. The tartar, it takes it all out. It doesn't permit it to grow. . . . It helps the gums."*

Ms. Henderson described another former common *"day to day"* use of the popular plant, **sweet scent** *(Pluchea symphytifolia)*, as a deodorant. *"When I was a kid, a girl, I simply bathed with this in cold water (with the addition of* ***sweet scent*** *tea) for 10-15 minutes . . ."* Or, she said, *"You rub fresh leaves up in the water."*

Felicia Cains Martin of St. John was interviewed by her granddaughter Donna Roberts, project participant from Virgin Islands Environmental Research Station (VIERS-ECC). Ms. Martin also recommended the use of **sweet scent** for removing underarm odor by rubbing five or seven fresh leaves on underarms or bathing in cooled liquid in which 11 leaves have been boiled. (Several interviewees commented on the tradition of using odd numbers of leaves in medicinal preparations.)

Interviewees stressed the importance of plants used during childbirth under conditions that demanded self-sufficiency. Ms. Henderson recalled: *"All babies were born at home. The hospital didn't birth babies until someplace around 1939-40, and we didn't have midwives attending babies. But we were all attended to, and my mother was taken care of by my father."*

Ms. Henderson identified the now locally rare plant of the moist forest, **mother bush** (*Lepianthes peltatum*), as one of the plants used during childbirth when she was a young girl. According to Ms. Henderson, its method of use was kept secret by the women, and unfortunately its use was not passed on to her. She believes that it was used in some way to assist with the delivery.

After the births of her 10 children, Louise Sewer of East End, St. John, used a traditional bush bath consisting of an odd number (usually five) of plants such as **turpentine bush** (*Bursera simaruba*), **bay leaf** (*Pimenta racemosa*), **cotton bush** (*Gossypium barbadense*) and **worrywine** (*Stachytarpheta jamaicensis*). According to Ms. Sewer: *"When a mother gives birth to a baby in those days, eight days after, they have to have a bush bath. . . . You put them [plants] in a brass pot. Cool them down. . . . They claimed that used to strengthen you."* Other interviewees mentioned the importance of bush baths to bathe both the mother and the newborn baby.

The declining numbers or disappearance of traditionally used plants was cause for concern amongst all interviewees involved in this project. Ms. Henry noted: *"A lot of things I used to see around, I don't see anymore."* For instance, Ms. Brady observed that people cut back valuable plants like the native **soapy-soapy** (*Anredera leptostachys*) traditionally used to soothe children's skin rashes. Apparently the **soapy-soapy** has not recovered in the areas where it was cleaned out on St. Croix. According to Ms. Brady: *"It's* ***(soapy-soapy)*** *very*

good, but it's very sensitive. Once you start cutting her, you are saying to her that you don't need her anymore, and she doesn't show back up."

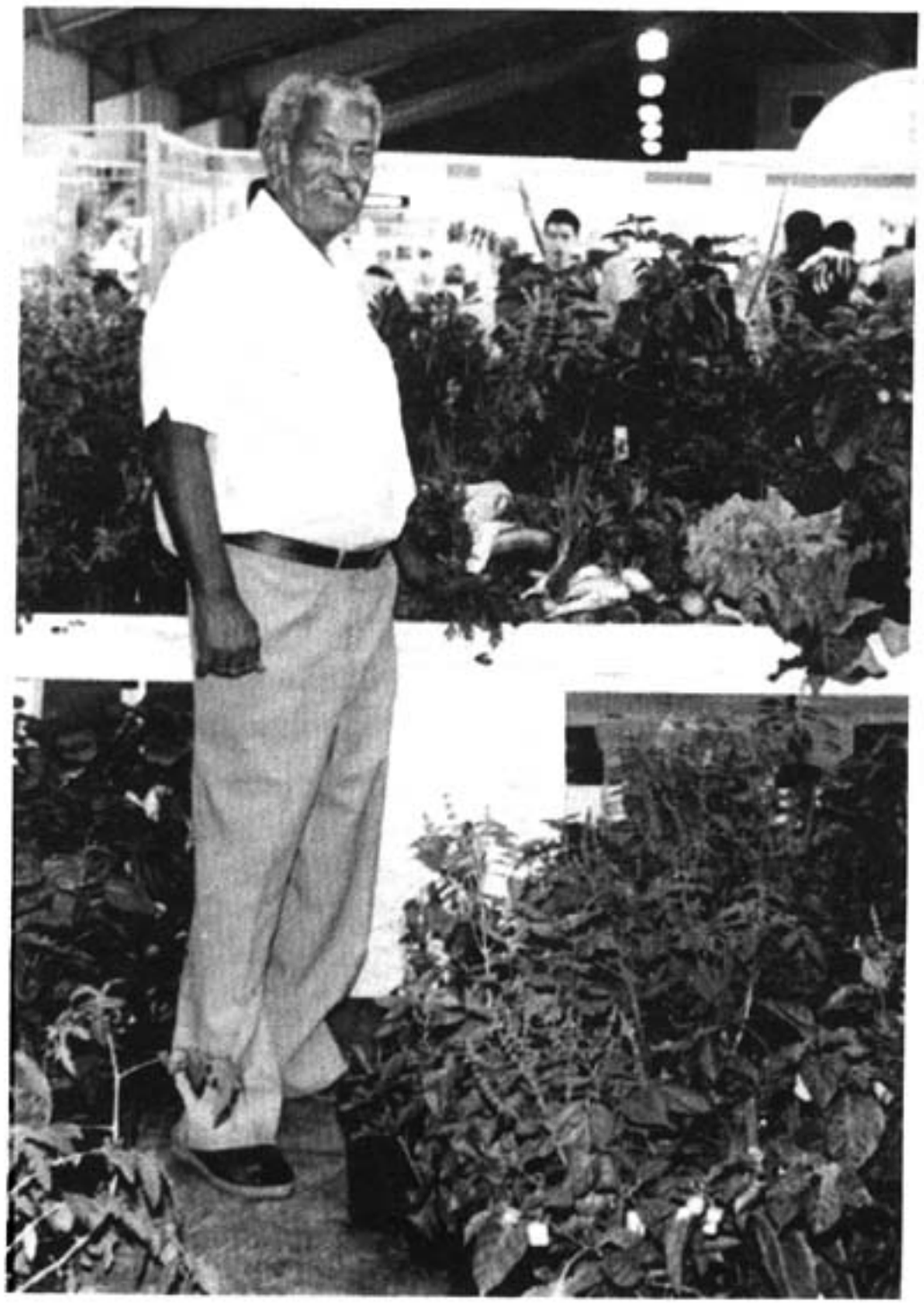
Ms. Henderson is saddened that the earlier mentioned **mother bush** is disappearing along with its native habitat, the subtropical moist forest. She explained: *"The place where this was growing was mostly spring land. The spring used to be there, but this spring takes a lower level under ground once you take the bushes, the trees that used to keep the place cool because the roots of the plants are drawing the water upward. . . . If you cut them down, these things (**mother bush**) are not liable to grow anymore."*

Along with the loss of plants, the loss of details about how medicinal plants have been traditionally used is acknowledged by all interviewees who feel that they don't know as much a their ancestors.

Ms. Martin's detailed recipes are probably closer to those of the past. Her instructions for using **soursop** (*Annona muricata*) for cooling the body and for prickly heat include specific notes on what part and at what stage it should be gathered (*"the fruit . . . when it's full, set in a dark place to ripen."*), preparation (*"Remove seeds from pulp with a fork. Add a little salt, lime and brown sugar and whisk with a fork with enough water to create a drink."*), and dosage (*"one glassful before bed, twice a week"*).

Interviewees stressed the need to preserve what is left of the traditional information base. Ms. Brady expressed one view of why this information is being lost. *"We do not take into consideration our old folks here that have died with their knowledge, and do you know why? They were ignored."*

In addition, Ms. Henderson cautioned, *"All this knowledge will be gone, and we will have nobody to teach us anything. This age people with the traditional knowledge have almost died out. . . . We have to identify these things and where they're growing. Something should be done to preserve the medicinal plants. . . . They should be protected. Look man; spare that tree! Touch not a single bough. For you [the tree] have protected me!"*



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Nitrogen Fixation--A Natural Source of Nitrogen Fertilizer

By
Jim O'Donnell
Research Specialist - Forestry
UVI Agricultural Experiment Station

Nitrogen is one of the most important elements for all life on earth. In both plants and animals it is an essential nutrient required for good growth and development and one of the building blocks of cells. In agricultural production, nitrogen is often the limiting factor that causes poor crop growth and low harvests of many fruits, grains and vegetables.

It is ironic that while nitrogen is all around us, very little is actually available for us to use. Nitrogen is one of the most abundant elements on earth. In fact, the air we breathe is almost 80% nitrogen!

Unfortunately, neither plants nor animals can make use of nitrogen in its elemental form (N_2). Thus, while nitrogen is a very abundant element, the quantity available for use by plants, and subsequently by animals, is actually very limited. In the soil, nitrogen is taken up by plant roots in one of two forms, either as ammonium (NH_4) or as nitrate (NO_3). The quantities of naturally occurring ammonium and/or nitrate in the soil are relatively small and come mainly from three sources: 1) breakdown of rocks and minerals containing nitrogen, 2) atmospheric nitrogen deposited in the soil by rainfall, and 3) nitrogen fixation.

Nitrogen fixation is the process by which nitrogen in the air is combined, or "fixed," with hydrogen or oxygen by microorganisms to make another form of nitrogen--ammonia (NH_3). Certain specialized microorganisms have the ability to convert elemental nitrogen to ammonia. These microorganisms can transfer nitrogen directly to plants or release the nitrogen to the soil when they die and decompose. Nitrogen fixation is the largest source of nitrogen for plant growth in many ecosystems. Scientists have calculated that total nitrogen fixation contributes approximately 110 million tons of nitrogen per year to the earth.

The Role of Legumes in Nitrogen Fixation

Although there are many different soil microorganisms that can "fix" nitrogen, the most widely known is a class of soil bacteria called *rhizobium*. To fix nitrogen, the bacteria rhizobium forms an association with a group of plants called legumes, one of the largest plant families. Pigeon pea, kidney bean, peanut, soybean, tan-tan, flamboyant, tamarind and tibet are all legumes. The rhizobia living in the soil invade the roots of legume plants and form nodules on the roots. The rhizobia inside the nodules then can convert nitrogen gas to ammonia, some of which is used by the plant for growth. Because of its increased growth, the plant can convert more carbon dioxide (CO_2) from the air to carbon through photosynthesis. Some of this carbon is transferred to the rhizobia for use as an energy source. Thus, the association between the rhizobium and the legume is beneficial for both organisms. Such a mutually beneficial relationship is called a *symbiosis*.

Why is the legume-rhizobium symbiosis important to us? Nitrogen fixation, as a result of the legume-rhizobium association, is one of the largest suppliers of nitrogen to ecosystems. Without this input of nitrogen, many of our natural systems, such as forests and grasslands, would slowly decline for lack of nitrogen. Humans and animals depend on nitrogen fixation, either directly or indirectly, to supply much of their protein needs. Nitrogen fixation is also very important to agriculture. Many legume-based cropping systems rely on nitrogen fixation to supply a portion of their nitrogen fertilizer requirements.

Taking Advantage of Nitrogen Fixation

We can take advantage of nitrogen fixation in three important ways. By eating the seeds of leguminous plants, we can utilize the nitrogen directly in the form of proteins--essential building blocks for human growth and development. Many of us already benefit from this when we eat pigeon peas, beans, peanut butter, lentils, soy milk or tofu. We also utilize nitrogen fixation when we feed protein-rich forages to livestock. Animals also require protein for growth. By including legumes in pastures for grazing or by feeding livestock fodder high in nitrogen, we help to improve their production of meat and milk. Finally, we can use legumes as a source of nitrogen fertilizer for our crops.

The use of legumes as a source of nitrogen for fertilizer is an age-old agricultural practice; but it is one that has received new attention recently with the increased interest

in low input, sustainable agriculture. There are a number of ways to integrate legumes into agriculture in order to benefit from their nitrogen fixing ability. These include green manures, intercropping and crop rotations.

Plants that are added to the soil to supply nutrients are called *green manures*. Green manures are organic, low-cost, beneficial for the soil and decrease our dependence on imported chemical fertilizers.

Although any plant can be used as a green manure, legumes are especially beneficial because they have a high nitrogen content and break down quickly in the soil, thus making the nitrogen readily available to the crop. Green manures are chopped up and incorporated into the soil before planting a crop.

Green manures can also be used as mulch around plants. As a mulch they will contribute nitrogen to the crop and at the same time reduce water loss and weed growth. Leguminous trees are a good source of green manure since they produce so much green, leafy material. Trees such as tan-tan, tibet or madreado (*Gliricidia sepium*), can be planted around the edges of a field to serve as wind breaks or living fences and pruned occasionally for green manure. Trees can also be planted in rows in the field with the areas between the tree rows used for growing crops. The trees are cut prior to planting the crop and their prunings used as green manure.

*Interplanting l*egumes with other crops is another way to take advantage of legumes' nitrogen fixing ability. As a plant grows, it is constantly producing new parts and casting off old ones. Root turnover--the process of growing new roots and shedding old roots--happens continuously and is an important way nitrogen is transferred from legumes to other plants. There also is direct transfer of nitrogen from one plant to another when roots come in contact with each other.

Interplanting can take many forms. Rows of leguminous plants such as pigeon pea or cow pea can be alternated with rows of grains or vegetables. Beans can be planted at the base of corn plants and allowed to climb the corn stalks. Or legumes can be planted around other crops to act as "nurse crops," such as leguminous trees around a fruit tree.

Another form of Interplanting is to use legumes as a cover crop or "living mulch." A living mulch is a low-growing or spreading legume that is planted over an entire field. Just enough space is cleared in the mulch to allow planting the individual crop plants. The living mulch supplies nitrogen to the crop plants and reduces weed growth. Living mulches are especially useful in fruit orchards.

In many pastures it is common to have legumes interplanted with grasses. Forage legumes supply nitrogen to the grasses and also are a protein source for livestock. In legume-grass pastures it is important not to allow overgrazing because livestock will selectively graze legumes and eventually eliminate them from the pasture.

The final method to take advantage of legumes in agriculture is *crop rotation*. Instead of growing the same crop continuously in a field, a rotation is used that includes a legume. A farm plot or garden might be divided into three or four sections with a different crop grown in each section. The crops are rotated from section to section each year or growing season. If a legume crop is included in the rotation, the legume will add nitrogen to the soil that can be utilized by the next crop.

A variation of crop rotation is fallowing. Every three or four years a farm field is allowed to "rest" or is left uncultivated (fallow) in order to accumulate nutrients and break to cycle of weeds and pest outbreaks.

In enrichment fallows, a green manure crop is planted in the fallow field and plowed into the soil instead of harvesting the crop. This practice greatly increases the amount of nutrients (especially nitrogen) accumulated during the fallow. By plowing the legume back into the field the nutrients are available for the next crop to use.

Although using legumes in agriculture is a good practice, there are drawbacks. Green manuring is a labor-intensive process. Green manures need to be chopped and tilled or hoed into the soil, or spread on the ground as a mulch. If trees are used as green manures they must be pruned and green material stripped from the woody stems.

Often the green manures must be carried to the farm plot from another site. If grown on the farm, they may take up valuable planting space. Large amounts must be used to equal a given amount of chemical fertilizer. Legumes used as intercrops may also compete with other crop plants for water, nutrients, sunlight and space. For the most part, these disadvantages are far outweighed by reduced feed and fertilizer costs and improved soil conditions.

Because of the importance nitrogen has to all living things, nitrogen fixation is one of the most significant processes in nature. An understanding of the legume-rhizobium symbiosis and the role it plays in nitrogen fixation can be advantageous to the farmer. By incorporating legumes in cropping systems and increasing the use of green manures, we can make use of a free source of nitrogen fertilizer, decrease commercial fertilizer costs, improve our soils and begin to farm on a more sustainable basis.

Antillean Treasure - St. Croix's Salt River

By
Liz Wilson
St. Croix Environmental Association

To find a precious jewel nestled on St. Croix's north shore is surely an event worthy of note. And that is exactly what has been occurring for many 20th century "explorers" during the past three years. Almost 2,000 of them have "discovered" the historical and environmental wonders which comprise the Salt River basin.

Who are these adventurous "explorers?" They are students, most of whom attend St. Croix public schools, although some have come from St. Thomas.

Why don't you join us for a typical field trip around Salt River and learn just why it is considered such a treasure, with so many facets intermeshing to make a harmonious continuum between land and sea?

First we go to Columbus Look-Out on a hilltop in Judith's Fancy. Here we have a breathtaking view of the scenery around the bay, with Blue Mountain and Mount Eagle looming in the west; below are the Concordia hills which also serve as a major source of Salt River's headwaters, mostly in the rainy season.

To the north is the bay mouth near Columbus beach where the first exploring party stopped for water 500 years ago; beyond that is where Columbus' fleet of 17 vessels was anchored. The promontory jutting into the sea was named *Cabo des Flechas* (Cape of the Arrows) by Columbus because it was there that the first recorded skirmish or conflict occurred between Europeans and indigenous peoples of the New World.

Let us drive now to the actual Salt River, which runs parallel to the North Shore Road until it meanders across a large flood plain. This flat area is filled with hundreds of huge land crab holes that help absorb sudden flood waters, thus protecting the bay and reefs beyond.

It is here that the giant swamp ferns grow and great looping vines criss-cross the river until it empties among the black and red mangroves leading into Sugar Bay. Here also you will find ancient fossils of clams and snails and warblers during fall and spring.

If we are lucky we might catch a ride with one of the dive captains at the marina who will take us through the mangroves so we can have a close-up look at sponges , spiders, tiny snails and oysters, all clinging to the mangrove prop roots. One of the Caribbean's largest rookeries was in the tree tops of the most seaward of the large red mangroves prior to Hurricane Hugo. Now, most of the remaining birds nest near the marina. These include occasional white-crowned and scaly-naped pigeons, various egrets and herons; we might even hear the "kuk-kuk-kuk" of the mangrove cuckoo.

Crossing the turtle and eelgrass beds of the shallow middle bay, we tell our "explorers" about this important "grazing" area for conch, shrimp, crab and young lobster. Out beyond the bay mouth we can see the surf breaking and we point out where once Aquarius, the underwater human habitat, lay anchored 60 feet down. It served as a marine research home for aquanauts who studied the many fish living there.

Our boat now heads closer to the eastern shore of Salt River Bay near Crescent Beach and we disembark briefly to explore the rocky shoreline where the endangered Least terns lay their eggs among the coral rubble. Several of the tiny, white fork-tailed seabirds swoop and swirl, all the while emitting tinkling cries, and we maintain a respectful distance from their nesting site which is not far from hawksbill turtle nests. Further inland, on a grassy sward, is the burial ground of Salt River's first residents--Tainos and Caribs--who lived in a village across the bay.

We board our boat once more for our return to the marina, first heading south into Triton Bay. It is late afternoon now and time for a quick look at the small bluntheaded sharks as they come swirling through the water in search of running sprat.

As we sit watching this hunting foray, we suddenly detect movement on the grass bank of the adjacent Nature Conservancy Wildlife Preserve. The bushes part and staring at us intently are a full-sized doe, a two-point buck and small speckled pre-yearling. We know this sanctuary is home to many deer families. With a flit of white tails and a quick leap, they disappear into the bush. Our captain heads west now, into the brilliant sunset--a perfect climax to our field trip to explore St. Croix's sparkling jewel called Salt River.

Vegetative, Erosion and Sedimentation Control Practices

By
Dale E. R. Morton
Extension Agent - Agriculture & Natural Resources
UVI Cooperative Extension Service

Soil--this is the medium in which plants grow and obtain most of their nutrients. The soils in the Virgin Islands are varied in nutrient content, pH, etc. Because the Virgin Islands are hilly and small in size, soil is easily lost from the land to the sea by means of erosion.

Erosion is the loss of soil from an area by the forces of wind and water. Sedimentation refers to the transport and deposit of soil particles due to erosion. Because soil is formed very slowly over many decades and can be lost overnight, it is imperative to do all within our means to conserve and protect this limited resource. Therefore, some type of soil conservation practice should be implemented.

Erosion and soil formation take place all the time. It is when erosion occurs at an accelerated rate, producing large quantities of sediment, that we usually express concern. The loss of soil from croplands, homesites, construction areas, etc., is hazardous to marine life and costly to those who have to pay for the removal of sediment from public places.

The cost and environmental impact of soil erosion can be greatly reduced by using vegetative control measures. Once vegetation is established, the roots hold the soil in place and the canopy of the plant protects the soil from the force of the rain and reduces the velocity of the wind. It is very important to remember to avoid leaving soil exposed for an extended period of time. When it is absolutely necessary to remove vegetation, make sure the smallest possible area is disturbed.

There are several ways to use vegetation to control soil erosion--establishment of lawns, grasslands and pasture, contour farming, grass terraces and windbreaks. In selecting which option is best for a particular situation, consideration should be given to slope, soil type and maintenance, and labor.

Many Virgin Islanders use grasses to make **lawns**. When choosing the type of grass, consider the fertility of the soil, the availability of water and the slope of land. Once selection is made, establishment can be by seed, sprig, plugs or sod. The latter two are not very common here.

To establish the lawn one can broadcast the seed and mulch the area. The University of the Virgin Islands Extension Service booklet, "Virgin Islands Home Lawns," provides more information on selection of grasses for lawns.

Ground covers such as ground orchid or air plant (*Catopsis morreniana*), oyster plant (*Rhoeo bicolor)*, wandering Jew (*Zebrina pendula*), and wedelia (*Wedelia triobata*) are sometimes used in those areas where the slopes are too steep for the establishment of lawns. Ground covers also have to be selected based on the soil condition, the effect desired, and the availability of water.

The beach morning glory (*pomoea pes-caprae*) is an excellent choice to control erosion on or near costal areas.. All of these ground covers have to be dense to provide the best erosion and sediment control. Therefore, close planting and fertilization are recommended to hasten the thickening and to prevent the formation of gullies.

The practice of planting vegetation on the contour of hills should be encouraged. Another vegetative practice is grass terracing. The grass, khus khus (*Vetiveria zizanioides*), is planted on the contour in strips. As a result, the flow of water is reduce; the sediments become trapped behind it. The areas in between are then cultivated and have the advantage of better water infiltration and percolation. This practice is not commonly implemented here, but I think it is one to be advocated in agricultural areas; it would be less labor intensive compared with the rock terraces which are more commonly used in the V.I.

Another means of erosion and sedimentation control is the use of windbreaks. In many Caribbean islands, Australian pine (*Casuarina equisetifolia*) is planted in windbreaks along the coastlines. These reduce the force of the wind, thereby reducing erosion. The trees' needles and cones drop, covering the soil and protecting it from further erosion. Hedges of tan tan (*Leucaena glauca*) can also be used to make windbreaks in areas further inland.

Finally, the best and easiest means to control soil erosion is by allowing areas to remain established in their natural vegetation. These plants are usually well adapted to the area and generally thrive. They maintain a good level of erosion control because the canopy and leaf litter which protect the soil from the impact of the rain and reduce the velocity of the wind.

Farm Family of the Year
1993

Mr. and Mrs. Ickford Benjamin received the Farm Family of the Year Award at the 1993 Agriculture and Food Fair. Presenting the award to Mr. Benjamin for his years of dedication and commitment to farming in the Virgin Islands were Lieutenant Governor Derek M. Hodge and Dr. Darshan Padda, (left).

1994

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