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Organic Farming

An overview of the Organic Farming Industry in Hawaii

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Introduction

Organic farming, the practice of growing crops without the application of synthetic chemicals, is a well established industry throughout the world, and Wall Street is paying notice (Business Week, Oct. 6, 1997). Over the past 20 years the industry has gained popularity in Europe, Japan, New Zealand, Australia, in the U.S., and in many other countries. In the U.S., even though the organic industry is still relatively small, it increased in size by over 20% annually during this decade. The increased popularity of organics has run parallel to the greater consumer awareness concerning the health and environmental risks involved with conventional agriculture- an industry that is highly dependent on synthetic pesticide and fertilizer inputs. As a result several countries, including South Korea, Sweden, Denmark, Norway, and the Netherlands have made goals toward >50% pesticide use reduction in agriculture. The development of organic practices for the intensive production of horticultural crops is less-well established in the tropics than in temperate areas. However, information borrowed from temperate regions can be added to the rich indigenous knowledge that exists in the tropics to develop organic or nature farming practices that are adapted to local environmental conditions. The potential exists in Hawaii to develop a strong organic industry that becomes internationally recognized, which may provide an additional lure for tourists that arrive from regions where a high environmental consciousness exists (such as Europe, Canada, Japan, and the Western U.S). In many parts of the world and in the US, growers are gaining competitive advantages in their markets with 'eco-labels' and with other similar environmentally-friendly marketing schemes. Another benefit of organic locally-grown produce is that the consumer tends to become more familiar with local food security issues, gains a greater appreciation for the need to preserve natural resources, and becomes better informed about the relationships that exist between the food distribution system, human health and the environment.

What is Organic Farming?

Organic farming is a form of agriculture which does not use synthetic inputs such as pesticides and fertilizers because of the disruptive effects that the synthetic chemicals can cause on the ecological balance considered essential to maintain a sustainable system indefinitely. Organic farming thus differs from other alternative ag-

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riculture systems that allow the minimal use of these inputs, and it's from this difference that organic farming gets its name. However, *organic farming is not just farming without chemicals*. Organic growers focus on using techniques such as crop rotation, proper spacing between plants, incorporation of organic matter into the soil and use of biological controls to promote optimum plant growth and minimize pest problems. Application of organic pesticides are considered a last resort and used sparingly.

All agricultural systems disrupt the natural environment to some extent; organic agriculture aims to minimize this disruption and to enhance natural biological cycles. For example, organic farmers emphasize the importance of a healthy soil to promote a diverse biological population, including earthworms and microorganisms such as fungi and bacteria that are beneficial to plants.

While many people involved in organic farming feel that agricultural research has limited itself by focusing on the development of agrochemicals, organic farming is not a movement against progress or scientific development. In fact, organic farming has and will continue to benefit from modern agricultural research in such areas as plant breeding, crop physiology and nutrition, soil fertility, and biological control. In addition, the scientific community's appreciation of alternative agricultural methods continues to grow, as researchers work to increase the understanding of the many interactions that exist in the agroecosystem.

In the box at right are the principles of organic farming as stated by the International Federation of Organic Agriculture Movements (IFOAM, from *Organic Farming* 1990).

Principles of Organic Farming

- To produce food of high nutritional quality in sufficient quantity;
- To work with natural systems rather than seeking to dominate them;
- To encourage and enhance biological cycles within the farming system, involving microorganisms, soil flora and fauna, plants and animals;
- To increase and maintain the long-term fertility of soils;
- To use as far as possible renewable resources in locally organized agricultural systems;
- To work as much as possible within a closed system with regard to organic matter and nutrient elements;
- To give all livestock conditions of life that allow them to perform all aspects of their innate behavior;
- To avoid all forms of pollution that may result from agricultural operations;
- To maintain the genetic diversity of the agricultural system and its surroundings, including the protection of plant and wildlife habitats;
- To allow agricultural producers an adequate return and satisfaction from their work including a safe working environment;
- To consider the wider social and ecological impact of the farming system.

What is Organic Certification?

Certification is an assurance to consumers, retailers and brokers of organic produce that the produce marketed as "certified organic" has been grown under pre-approved standards set by the certifying agency. Due to an absence of state and federal regulations, private organizations were relied on in the past for setting standards and certifying organic farmers. Today, several states have organic programs with minimum standards that all growers must meet in order to market their product as "certified organic". The Departments of Agriculture in these states are either directly responsible for certifying farmers, or accredit certifying agents whose standards meet those set by the state. These accredited agents are then able to certify growers.

The Organic Foods Production Act of 1990 became law in 1993, and gave the USDA the responsibility and authority to develop national standards and regulations for organically produced agricultural products. Once developed and implemented, these standards would serve as the minimum requirement for anyone wishing to market produce as organic in the US. In December of 1997 the National Organic Program (USDA) released their proposed standards and regulations for a period of public comment. The proposed regulations included provisions that allowed for inputs and technologies prohibited by the majority of private and state organic programs (i.e. irradiation, genetically altered plants, sewage sludge, and some synthetic inputs.) Many in the organic industry felt a need for more stringent national standards that better reflected those already held by most in the industry. The USDA is now considering the

public's response. A copy of the National Organic Program's Proposed Rule can be obtained for $8 from the federal register by calling (202)-512-1800.

In Hawaii, the Department of Agriculture does not have an organic program, allowing the industry here to regulate itself. The Hawaii Organic Farming Association (HOFA) and the Organic Crop Improvement Association (OCIA) are two of the organizations which certify organic farmers here in Hawaii. Standards and procedures for certification vary among organizations and are frequently revised. The following is a brief summary of the certification process and requirements as listed in the HOFA Organic Standards Handbook for Certification, 1994.

The certification process

The applicant receives and completes an application/ questionnaire which will include a list of products requested for certification, a three year field history, farm maps from a third party source, sources of seeds, fertility management plan, pest/weed management, and a record keeping system. Once the application is returned to the certifying agent, it's reviewed and an inspector is chosen. An inspection of the farm is arranged and includes

- signing an affidavit of confidentiality
- touring the farm with the grower
- verifying maps and crop plans
- noting the condition of crops, soil tilth, weeds, pests, conservation, rotations, adjoining land use and buffer strips.
- noting the type and condition of equipment, chemical containers, condition and use of storage and processing areas, livestock housing, animal health records and manure management.
- observing water sources—tests may be requested

The inspector completes a report including recommendations and submits it to the certifying agent who convenes a certification review committee. The committee may approve, conditionally approve, or deny the application. Conditional approval may be given if more information is needed and/or changes needed for the farm to be full compliant; a follow-up inspection may be required. Once approved, the grower may sell products as certified organic. A conventional grower wishing to be certified must use organic methods for one year before being eligible for transitional organic certification and is eligible for full organic certification after three years of organic production.

Organic Standards for Certification

Prohibited Substances

Organic farming is probably best known for the exclusion of synthetic chemicals from the production system. A complete list of prohibited substances can be obtained from the certifying agency. Prohibited substances include

- any chemically synthesized material such as pesticides, fertilizers, growth regulators, etc.
- natural poisons that are extremely toxic and/or take a long time to degrade in the environment, such as arsenic, lead rotenone, and nicotine
- ionizing radiation

There are also restricted materials that are prohibited under certain circumstances, such as

- uncomposted manure when applied less than four months before harvest, or prior to planting of crops that accumulate nitrates
- uncomposted agricultural residues and by-products from off-farm sources that are not documented to be free of residues of restricted materials

Again, check with your certifying agency for a complete listing

Record-keeping

Good record keeping is important in all forms of agriculture. It is especially important in organic farming because it's necessary for obtaining and renewing certification. Clear records must be kept of all materials added to the soil or crop in an organic production system including the date, location and amount of the substance applied. The source of all materials brought in from off-farm should be recorded as well as the chemical treatments of any seeds and seedlings used that were not produced on the farm.

Management Plan

Organic farmers rely on a good management program rather than an intensive use of inputs to ensure optimum crop productivity. Many management practices focus on enriching the soil and stems from the belief that a healthy, living soil is necessary for healthy plants. Enhancing the natural biological cycles of the farm is another priority that is reflected in organic farm management. These practices include:

- addition of composted organic matter
- crop rotation for fertility management and to reduce insect and disease pest build-ups
- use of green manures and cover crops to improve soil fertility, promote beneficial organism populations and

to reduce erosion
- reduced tillage to improve soil structure and reduce soil erosion
- use of trap crops, biological control agents, and other habitat manipulation techniques (such as intercropping, or the use of insectaries) to enhance natural biocontrol mechanisms in the farm.

Buffer zones and boundaries are also important management practices to mark the areas under organic production and to help protect those areas from contamination by prohibited substances. Buffer zones around the organic production area are usually 25–30 ft wide and planted with a windbreak or a non-harvested plant.

The Organic Market

The organic food market began growing rapidly at the beginning of this decade, primarily due to increased health and environmental awareness by the general public. The industry in Europe is one of the most progressive, where organic food products can even be found in fast food restaurants and airline meals. The industry in the United States has gotten off to a slower start, but is beginning to take off. Sales of organic produce in the U.S. reached $809 million in 1995, a 35% increase from the previous year, and sales have been steadily increasing in the country by 20% annually. There has been an even larger increase in the demand for organic packaged foods, such as frozen dinners, packaged mixes and soups. With regulations requiring 95% of all ingredients in organic food products to be produced organically, the Organic Trade Association expects that there will be more demand for "everything from organic herbs to organic vanilla."

Natural food stores and community-based open markets have traditionally been the primary outlets for organic produce (see list of natural food stores in Hawaii in the Resource section below). However, because of an increased consumer interest, and faced with competition from these stores, supermarkets have become the fastest growing outlet for organic food, including fresh produce. Organic fruits and vegetables can now be found on the store shelves of several major supermarket chains. In some areas this increased demand has resulted in very big organic farms, which in the past were seldom larger than several acres. For instance, in 1996 a meager 7% of the organic farms in California claimed 75% of the total organic sales in that state.

The organic produce market here in Hawaii seems to be following the national trend. Hawaii-grown organic fruits and vegetables can be found in supermarkets, health food stores, open markets and restaurants around the state. The exact number of organic farmers in Hawaii is unknown; in 1997 there were an estimated 70-75 certified organic farmers here, from all agencies involved (Kimberly Clark, pers. comm.). By 1998 the Hawaii Organic Farmers Assoc. had about 250 members, with half of them being growers, ranging from back-yard gardeners to farmers. Also there are many farmers here who are using organic methods, but who are not certified by any organization. Irrespective of certification, currently about 100 farms in Hawaii may be following organic production practices on over 1000 Acres of land (including both fruits and veggies). The farm-gate value of the organic industry in Hawaii for 1997 was estimated to be between $6-8 million (Kimberly Clark and Mary E O'hora, pers. Comm.). The quality of organically-grown vegetables is often very high and some farmers are finding that they are able to command premium prices for their crop without even specifically marketing it as organic. Several commercial fruits (e.g. white pineapple, avocado, assorted tropicals) and vegetables, including salad greens, tomatoes, beans, ginger, taro, medicinals (e.g. Noni, ava, neem) and herbs are grown organically in Hawaii.

In addition to the growing market here at home, increased interest in fresh organic produce on the mainland and in other countries has improved the potential for selling Hawaii organic produce in markets overseas. Some Hawaii growers are currently shipping organic produce to Japan, Europe and the Mainland (see Japan insert below.)

The Japan market

According to the Foreign Agriculture Service of the USDA, Organic produce sales have increased in Japan due to concerns over food safety. Although Japanese consumers tend to prefer domestic produce over imported produce, some Japanese companies have begun importing organic fruits and vegetables. For example, Daiei has contracted with Australian growers to produce and air-ship organic bananas to Japan to be marketed under Daiei's private label. Pumpkins and onions are the major vegetables imported from the U.S.

Barriers to Organic Farming According to a Grower Survey in the Continental U.S.

(listed in descending order of importance)

1. Lack of knowledge about organic farming (71% of respondents)
2. Uncooperative or uninformed extension personnel (63%)
3. Information unavailable on organic farming (59%)
4. Pressure from other farmers to farm conventionally (31%)
5. Difficulty in obtaining credit for organic farming (21%)

(From R. Marsh and D. Runsten, 1997, The organic produce niche market: can Mexican smallholders be stakeholders. UCLA. Paper prepared for the project, "The Transformation of Rural Mexico: Building an Economically Viable and Participatory Campesino Sector")

Survey of organic farmers in the USA, 1993

(Over 500 respondents from 39 states)

- Sources of info include newsletters, magazines (55% of respondents) and other farmers (55%).
- The most useful sources of info for organic growers in descending order include 1) other farmers; 2) newsletters and magazines, and 3) all types of meetings.
- About 60% of respondents indicated that existing info sources did not meet their information needs.
- Research needs included: consumer demand for organics, relationship between organic practices and nutrition, relationship between plant nutrition and resistance to pests, crop rotation, soil biology, public policy, marketing, cover crops, green manures, habitat management, and other pest control approaches.
- Over 60% of respondents grew vegetables. Those that had livestock (10-20%) used it primarily as a source of fertilizers.
- The median number of commodities grown was between 6-10, but over 20% of respondents grew over 25 commodities.
- About 50% of farmers sell direct on-farm and about 50% to wholesalers.
- 59% of respondents had a bachelor's degree, while 19% had earned advanced degrees.
- Only 28% indicated that most of their income comes from organics.

(UC Sustainable Ag. Newsl. Fall 1994. v. 6 n. 4. 1993 National organic farmers' survey, conducted by the Organic Farming Res. Foundation; and Daniel P. Puzo, Los Angeles Times, April 25, 1996).

Organic Market Factoids

- The value of organic produce in the US is over $4 billion annually In 1996-1997 annual sales of fresh organic produce was about $680 million (Gene Kahn, Frozen Food Age Mag., Sept, 1998 pg. 18).
- Purchasers of organic products are highest among those aged 40-49 (28% of all sales), followed by the age group 18-29 (27%). Those aged 60 and older had the lowest levels of purchase. (Fresh Trends, 1996)
- Three out of four shoppers consider pesticide residue in food a serious hazard. (Food Marketing Institute, 1993)
- A survey found that 85% of respondents wanted national organic produce standards (Gene Kahn, Frozen Food Age Mag., Sept, 1998 pg. 18).
- Organic and natural products now reach 60-85% of all grocery stores and supermarkets (Gene Kahn, Frozen Food Age Mag., Sept, 1998 pg. 18).
- 57% of restaurants in the $25 or more average check size category offer organic items on their menus (29% in the $15-24 category). (Gene Kahn, Frozen Food Age Mag., Sept, 1998 pg. 18).
- Mars Inc., the creators of the Mars candy bar, have developed plans for an organic chocolate product. (Biofact magazine, 1998)
- The surge in organic and natural product confectionery sales over the past 12 months was for chocolate bars 9.9%, other candy, including licorice 15.4%, candy and individual snacks, 26.4%, gums and mints, 32.9%, energy bars, 62.1%, and bulk candy, 69% (Curtis Veerland, Candy Industry Mag., June 1998, pg. 60-66).
- General Nutrition Cos., recently opened in Lake Oswego, Oregon, the first of what it intends to be a national chain of natural foods. At the store grocers will be able to purchase organic products, prescription drugs, homeopathic remedies, and will also be able to take a Yoga class, surf the Net, learn how to grow herbs, have a massage, or soak in a hydrotherapy tub (Marianne Wilson, Chain Store Age Mag., pg. 84-88., Nov. 1998).
- An estimated 25% of U.S. consumers have purchased organic snack foods and deserts, which is the second most popular category after organic fruit and veggies (Gene Kahn, Frozen Food Age Mag., Sept, 1998 pg. 18).
- Swiss Air now provides organic produce in all of its classes (Henry A. Wallace Institute, Alternative Agriculture News, September, 1997)
- 1996 marked the seventh year in a row when organic food sales increased by over 20% per year (Henry A. Wallace Institute, Alternative Agriculture News, July, 1997).
- A survey on the continental US indicated that 64% of

organic farmers self-finance their operations, 10% received loans from friends or family, and 25% received credit from commercial banks, the farm credit system or through a federal bank (Marsh and Rusten, 1997).

Organic Farming Research in Hawaii

Hector Valenzuela, Randall Hamasaki, and Ted Radovich

(Note: For a copy of the recently published Five Year Report, 1993 to 1998, please contact H. Valenzuela at hector@hawaii.edu, tel. 808-956-7903, or fax 808-956-3894).

A long-term experimental plot was established at the UHM Waimanalo Experiment Station with the following overall goals:

1. evaluate the long-term effects of following nature or organic farming techniques on soil quality, pest pressure, and crop productivity
2. develop recommendations (on composting, and techniques to grow specific crops) for the production of vegetables following nature-farming techniques
3. disseminate available information on nature farming, organic farming, and sustainable ag to farmers in Hawaii and other tropical areas

The project, a cooperative effort between the University of Hawaii at Manoa College of Tropical Agriculture and Human Resources and the Mokichi Okada Association- Hawaii Branch, was initiated on early 1993. A 2 Acre plot of land, which had been fallow under a grassy cover for over 15 years was selected for this project. At the onset the soil was extremely compacted, due to the dry weather and needed to be ripped prior to soil preparation. Unfortunately, due to a lack of equipment only the top 6-9 inches of soil were properly ripped. On October 1993 random soil samples from all sections of the plot were collected to conduct soil fertility and nematode count evaluations. Since then similar surveys were conducted periodically. The entire experimental area was divided into three main sections:

1. a replicated experiment consisting of sixteen 30 x 4 - ft beds (4 treatments with 4 replications per treatment).
2. a demonstration plot (Section A) about 250 x 100 ft to grow a variety of vegetables following nature farming guidelines; and
3. a cover crop/fallow section (Section B) about 200 x 50 ft to demonstrate low-intensity field maintenance techniques and the use of several cover crops and green manures for improvement of soil quality and to minimize erosion.

From 1993 to 1998 over 50 vegetable species/varieties and over 40 cover crop or green manure species were evaluated on the cover crop and demonstration sections. On average a crop was being planted and harvested on a weekly basis. This provided the opportunity to evaluate the viability of growing a host of vegetable and cover crop species during the different growing seasons. In 1998 an 8-year rotation experiment was begun on the demonstration plots. This experiment was established to evaluate the effect of rotations and green manures on the long-term productivity of vegetable crops. In the replicated plots, since 1993 seven consecutive experiments were conducted. In this experiment each bed has received the same treatment (control, compost alone, synthetic fertilizer alone, or a combination of composts and synthetic fertilizers) over these five years. In the replicated experiments specific cultural recommendations are being developed in terms of compost application rates, nutrient release rates from the compost applications, yield response from the compost treatments, crop nutrition, and effects of the long-term compost applications on soil quality, crop pests and diseases, and crop productivity. The following observations can be made from the work conducted to date in both the demonstration and replicated plots:

1. Commercially acceptable yields can be made from the application of composts alone. The addition of Nitrogen rich organic fertilizers may result beneficial to meet crop nutrient demands during particular growth stages when fast growth rates occur (such as fruiting in tomato, or heading in lettuce). The data collected from tissue nutrient contents and soil fertility will be helpful as baseline data to develop organic nutrient recommendations for Hawaii.
2. The modest application of composts (10 MT/Acre/year) resulted in a steady increase in the soil organic matter content in both the replicated and demonstration plots. The organic matter content also increased in the plots under cover crop/follow rotational study.
3. A trend was observed toward less nematode pressure in plots that received compost applications. In the demonstration plots nematode pests have not become a serious problem. Nematode infestations and reduced yields are typical in our conventional plots elsewhere at the Waimanalo station.
4. Recommendations can be made based on the work

conducted to date on what crops are more amenable to nature farming, and recommendations can be made for the use of particular plant species or varieties than can be used as cover crops or green manures at low-elevations in Hawaii.

The results and conclusions made from the work conducted to date at the nature farming plots are by no means conclusive. Additional years of work, and further analysis of the data will be required before a better understanding is obtained concerning nature farming in the tropics and its effect on soil fertility, pest levels, and crop productivity.

Resources

This list is provided to aid in a search for more information on organic vegetable production and marketing. It is not intended to be exhaustive.

Certification Guidelines

Hawaii Organic Farmers Association, 1994. Organic Standards Handbook for Certification, 31 Dec., 1994, ver. 4.1., P.O. Box 984, Haiku, HI 96708, tel/fax 808-573-0995

Kauai Organic Growers Association, 1994. Certification guidelines, April 10, 1994, P.O. Box 943, Kilauea, Kauai, HI 96754, tel. 808-828-1966.

Oregon Tilth
1860 Hawthorne Ave. NE #200, Salem, OR 97303
e-mail address: organic@tilth.com

Organic Crop Improvement Association International
1001 Y Street, Lincoln, NE 68508-1172
phone: 402-477-2323, fax: 402-477-4325
e-mail: cert@ocia.org

Bio-Dynamic Farming and Gardening Assoc. Inc.
POB 550, Kimberton, PA 19442
610-935-7797, fax 610-983-3196

California Certified Organic Farmers (CCOF)
Statewide Office
POB 8136, 1115 Mission Street, Santa Cruz, CA 95060
408-423-2263, fax 408/423/4528

IFOAM c/o Okozentrum
Imsbach, D-66636 Tholey-Theley, Germany
IFOAM-SECRETARY@oln.comlink.apc.org
(organic farming international organization)

National Organic Standards Program
USDA/AMS/TMD, 2510-South Bldg., POB 96458
Washington DC 20090-6456

Resources and Educational Materials

Organic Farming Research Foundation
Erica Walz, Program Coordinator
P.O. Box 440, Santa Cruz, CA 95061
408-423-2263, research@ofrf.org

Organic Farmers Marketing Association, OFMA
P.O.Box 159, La Farge WI 54639
cvof@iquest.net, http://www.iquest.net/ofma/

Hawaii's farmer, chef, wholesaler source book: A guide to locating buyers and sellers of local products.
Hawaii Department of Agriculture
1428 South King Street, Honolulu, Hawaii 96814

Organic farming by Nicolas Lampkin, 1990, Farming Press, UK.
Diamond Farm Enterprises, Box 537
Alexandria Bay, NY 13607

Organic farming: Current technology and its role in a sustainable agriculture.
American Society of Agronomy
677 South Segoe Road, Madison, WI 53711

Bio-dynamic farming practice by Friedrich Sattler and Eckard v. Wistinghausen.
Bio-Dynamic Agricultural Association
Clent, Stourbridge, West Midlands DY9 9PX, UK

A.C. Burke
2554 Lincoln Blvd., Suite 1058
Marina del Rey, CA 90291
310-574-2770, fax 310-574-2771
www.acburke.com
home garden supplies, books, organic gardening, small scale farming, videos, software, tools

Arbico Inc.
POB 4247-CRB, Tucson, AZ 85738-1247
www. arbico.com, ARBICO@aol.com
orders 1-800-827-2847, consultant 1-520-825-9785
fax 520-825-2038
supply organic pesticides and fertilizers

Videos Available

(contact: Hector Valenzuela, hector@hawaii.edu, tel. 808-956-7903, fax. 808-956-3894)

Cover crops for perennial and annual cropping Systems, UC
Life in the soil- MOA- description of soil microbiology
Beneficial organisms, UF
Vegetable farmers and their weed-control machines, Vermont

Vegetable pest scouting, MSU
New Tools for mechanical weed control, Cornell
No-till Vegetables
Farm clips of sustainable and organic farmers in Oahu and Big Island
Environmentally friendly Weed control, and Vegetable crops Production (Focus in Ag, 1995).
Sustainable Ag (LISA) for Hawaii, 1993
Ho'olaulima for Hawaii's Sustainable Agriculture, 1995
1994 Veg Teleconference: Alternative weed and pest control.
Profile of organic coffee production, CTAHR

Selected Web Sites
National Organic Program
www.ams.usda.gov/nop
Sustainable Agriculture Network
www.ces.nesu.edu/san/
Organic Agriculture Information
www.sunsite.unc.edu/london/
Rodale Organic
www.rodalepress.com/gardening.htm
Organic Trade Association
www.ota.com
Organic Trading and Information Center
www.organicfood.com/welcome.htm
Organic Farmers Marketing Association
www.iquest.net/ofma/
Organic Spot Market
www.aureus.com/spot
California Certified Organic Farmers
www.ccof.org
Organic Crop Improvement Association International
www.ocia.org
Hawaii Organic Farmers Association
www.ddidigital.net/~planethofa.html

Retail Markets In Hawaii
Most organic growers in Hawaii have a multi-level marketing program with the top-grade produce being sold to resorts and premium restaurants. Some volume is sold to health food stores or to local supermarket chains, while some sales are also made at farmers markets and to private fruit stands. Some growers are involved in consignment growing.

Oahu
Huckleberry Farms, 1613 Nuuanu Av., 524-7960

Kokua Market Natural Foods Co-op
2643 S. King, 941-1922

Celestial Natural Foods
66-443 Kamehameha Hwy., 637-6729

Mango's Market, 319 Hahani, Kailua, 263-6646

Down to Earth, 2525 S. King, 947-7678

Safeway: many stores in the state carry organic produce

Star Market: all Star Market stores carry organic produce

Foodland: The following Oahu stores carry organic produce: Beratania, Hawaii Kai, Pupukea, Stadium Sac'N'Save

Hawaii
Food Fantastic Natural Food
Mango Court, Kainaliu, 322-0739

Pahoa Natural Groceries, 965-8322

Supermarket chains such as KTA and Sure Save sell organic produce on the Big Island.

Maui
Down to Earth
Kahului; 305 Daisy Rd., 877-2661
Wailuku; 1910 Vineyard, 242-6821
Makawao; 1169 Makawo, 572-1488

Nature's Outlet Warehouse
330 Hoohana st., Kahului, 871-2001

Haiku Natural Foods, 810 Kokomo Rd., 575-2401

Hawaiian Moons Natural Foods
2411 S Kihei Rd., 875-4356

Mana Foods, 49 Baldwin Av., 579-8078

Foodland: The following Maui Stores carry organic produce: Kahului, Lahaina, Kihei, Pukalani

Kauai
Hanalei Natural Foods, 826-6990

Ambrose Kupuna Natural Foods
770 Kuhio Hwy, 822-7112

Papayas Natural Food Market and Cafe
Kapaa 4-831 Kuhio, 823-0190

Foodland: Kapaa, Princeville

Research Brief—
Effect of Seaweed Extract on Root Yield of Organically Produced Yam Bean *(Pachyrhizus erosus)*

Ted Radovich, Ted Goo and Hector Valenzuela

Yam bean *(Pachyrhizus erosus*), or jicama, is grown for its large, fleshy root that is used as both a cooked and fresh vegetable. Although native to tropical America (Larkom 1991), this member of the legume family is generally regarded as an Asian vegetable here in Hawaii. The root is valued for its crispness and mild, slightly sweet flavor. The mature seeds contain rotenone, a compound with insecticidal properties (Larcom 1991).

Seaweed extracts can contain plant growth regulators (especially cytokinins), plant nutrients, carbohydrates and antibiotics. Research on the effect of seaweed extract applications on crop yields have shown both positive or no effects on crop yields and quality (Csizinszky, 1996; Eris et. al. 1995; Reitz and Trumble, 1996). This trial was conducted to determine if yam bean tubers produced under organic conditions responded to applications of seaweed extract.

Methods

The experiment was conducted in a randomized complete block design with two treatments each replicated three times. Each treatment plot consisted of one 25-ft row. The treatments were chicken manure alone applied at a rate of 10 tons/a, and the same rate of chicken manure with two split-applications of SM6, a concentrated seaweed extract product. The soil drench applications were conducted at seeding and again 6 weeks after planting. Each application rate was 0.2 gallons of SM6 per acre. Seeds were directly planted 8 inches apart into raised beds spaced 4 ft apart. The crop was drip irrigated as needed. Five months after planting tubers were harvested, graded and weighed. Tubers which cracked naturally in the field were considered unmarketable.

Results and discussion

Preliminary data analysis indicates that the seaweed treatment had a significant effect on yield. Effects on root dimensions and size were not significant. Roots of plants that received seaweed extract were on average 4 oz (116 grams) heavier than those which did not receive the extract (Table 1). Nine percent of the total harvest was cracked and considered unmarketable. There was slightly less cracking in roots which received seaweed extract (Table 1). There were problems with the irrigation early in the experiment that resulted in sporadic and infrequent watering at the early plant growth stages. Reps 1 and 2 were particularly affected. Roots from these replications showed more cracking than those in rep 3 (Table 2), which was little affected by the irrigation problem. Uneven watering would be expected to increases the incidence of root cracks, which may explain for the observed difference here. In India, root cracking in yam bean was significantly reduced with applications of potash (K2O) at ~350 lb./acre (Mishra et.al. 1994). Thus an even irrigation and proper nutrition is necessary to minimize cracking incidence in jicama.

Conclusion

The results indicate that the application of seaweed extract may increase yam bean root yields under organic conditions. However additional trials are required to confirm these results. Future trials should include a range of seaweed extract application rates exceeding the rate used in this trial, and the number of split-applications should be increased to three. Because of the relatively high cost of organic amendments, a simple economic analysis comparing the benefit of any increase in yield with the additional cost of the amendment should be included.

Literature cited

Csizinszky, A.A., 1996. Foliar biostimulant, N and K rate, and cultivar effects on fresh market tomato, Soil and Crop Sci. Soc. Florida, 55:92-96

Table 1. The effect of seaweed extract soil drenches on the root yield of yam bean five months after planting.

Treatment	Total yield (grams/root)	Total yield (lb/100ft row)	Marketable yield (% by weight)	Cracked roots (% by weight)
Chicken manure	657 (1.4 lbs)	191	90%	10%
CM + SM6	773 (1.7 lbs)	224	92%	8%

Table 2. The incidence of cracked roots in each replication as percent by weight of total yields.

Treatment	Rep. 1	Rep. 2	Rep. 3
Chicken manure	17%	6%	3%
CM + SM6	15%	6%	3%

Note: CM= chicken manure applied at 10 MT/Ac; SM6= seaweed product (see description).

Eris, A., H.O. Sivritepe, N. Sivritepe. 1995. The effects of seaweed extract on yield and quality criteria in peppers. Acta Hroticulturae 412:185-192.

Larkom, Joy. 1994. Oriental vegetables: the complete guide for garden and kitchen. Kodansha, New York. 232 p.

Mishra, S., C.P. Singh, K.P. Singh, and U.P. Singh. 1994. Effect of levels and methods of potassium application on tuber yield and cracking behavior of yam bean. Journal of Potassium Research 10:271-273.

Reitz, S.R. and J.T. Trumble, 1996. Cytokining-containing seaweed extract does not reduce damage by an insect herbivore. HortScience 31:102-105

Product Description provided by distributor

SM6, Seaweed extract produced by a chemical-free aqueous process from a blend of seaweeds. Sold as a plant growth stimulant for increasing crop yields and quality. SM6 is highly concentrated, containing no less than 30% soluble seaweed solids. Analysis: Nitrogen 0.5%; P= 0.5%; K= 1%; Na= 1%; Ca= 200 ppm; Fe= 200 ppm; Mg= 200 ppm; Mn= 50 ppm; B= 60 ppm; Zn=40 ppm; Cu=40 ppm.

Contact: Scott Wallis Seeds Ltd., Chelmsford, Essex CM2 9SG, UK, tel. 01245-264211, fax. 01245-495887.

Additional Resources— Farmer References for Organic and Sustainable Agriculture

Dave Wall, New Mexico State Univ.

Disclaimer: 1) No commercial endorsements are implied, and 2) Effectiveness of biological or organic methods are sometimes unproven. Growers should realize that recommendations and projects are for the farmer to experiment with. The University of Hawaii does not endorse these references to be directly applicable in Hawaii, these references are useful to agricultural agents and farmers who want to learn more about alternative agricultural technologies.

Ordering Information:
Many of the publications listed can be obtained from the from the following two sources:
(1)Ag Access
P.O. Box 2008, Davis CA 95617-2008
1-800-540-0170, http://www.agaccess.com
(2) B.I.R.C. Bio-Integral Resources Center
P.O. Box 7414, Berkeley, CA 94707
510-524-2567

Weed Control

Steel in the Field: A Farmers Guide to Weed Management Tools (1997). E. Bowman editor. Sustainable Agriculture Network, 20705-2351 (order from SAN, $18) at Sust. Ag. Pubs., Hills Building, Room 10, Univ. of Vermont, Burlington, VT 05405-0082

Weed Biocontrol. (19 Page Booklet/$9.00) (Available from B.I.R.C)

Weeds: Control Without Poison. C. Walter (1991) 352 Pages. $19.95 (Available from Ag Access)

Bio-Integral Resource Center Weed Management Publications: A) Allelopathic Mulches [P8(4)], B) Flaming [P9(3)], C) Weed Management Using Animals [Q8(2)].

Weeds of the West. Whitson (Editor)(1991) 640 Pages. $35.00. (Excellent Field-Weed Identification Book - 900 Color photos, Available from Ag Access)

Pests, Insects, and Diseases

Common-sense Pest Control: Least-Toxic Solutions for your Home, Garden, Pets and Community. (1991) W. Olkowski et al. 715 p. $39.95. (Available from Ag Access)

Compendium of Plant Disease Series, from American Phyto Pathological Society: Available for Many Fruit, Vegetable and Field Crops, Including Tropical Fruits. (from Ag Access)

Enhancing-Biological Control: Habitat Management to Promote Natural Enemies of Agricultural pests. (1998) C. Pickett. 422 pp. Hardcover, $50.00. (Ag Access)

Future Harvest: Pesticide-Free Farming. J. Bender (1994) 360 pp. $26.00 (Ag Access)

Natural Enemies Handbook: The Illustrated Guide to Biological Pest Control (1998) 164 pp. (Ag Access)

Pests of the Garden and Small Farm: A Growers Guide to using Less Pesticide. M.L. Flynt (1990) 286 pp. $30.00 (Ag Access)

Soil Solarization: A non-pesticidal method for controlling diseases, nematodes and weeds (1997) 13 pp. $5.00 (Ag Access)

Vegetable diseases and their control. Chubb & Sherf (1986) 728 pp/hard cover $99.00. Emphasis on cul-

tural and physical disease control. (Ag Access)

Shepard's Purse: Organic Pest Control Handbook for Home and Garden. 1987. Pest Publications, The Book Publishing Co., Summer Town, TN 38483

Directory of Least-Toxic Pest Control Products (1998) $12.00 (Available from B.I.R.C.) Sources of Technology and Suppliers of Organic Pest Control Products

Reader on least-Toxic Pesticides. (Reviews and Applications for Organic and Low-Toxicity Pesticides) 88 pp. $14.50. (Available from B.I.R.C.)

Alternatives to Methyl-Bromide. 1998. 60 pp. $23.00. (B.I.R.C.)

Color Hand Book of Garden Insects. Rodale Press (1979) 256 pp. $16.95 (Available from Ag Access)

Complete Guide to Pest Control: With and Without Chemicals. G.W. Ware (1996) 388 Pages. $29.95 (Available from Ag Access)

The Gardener's Guide to Common Sense Pest Control. W. Olkowski, et al. 1998. 275 pp. $22.95 (Available from B.I.R.C.) - Abridged Section of Common Sense Pest Control Book for Home and Market Gardeners.

Identifying Diseases of Vegetables. Chubb & Sherf. 1983. 62 pp. $14.95 (Available from Ag Access)

Soil Fertility Management

Fertile Soil: Growers Guide to Organic and Inorganic Fertilizers. R. Parnes. 1990. 210 pp. $39.95. (Available from Ag Access)

Knott's Handbook for Vegetable Growers. 1997. 582 pp. $79.95. (Available from Ag Access, Reference Book for Vegetable Growers)

Producing Vegetable Crops. Swaider, et al. 1992. 611 pp. $53.25. (Available from Ag Access) (Reference for Vegetable Growers)

Farmers Fertilizer Handbook. Regenerative Agriculture Association, Rodale Research Center, Maxatawny, PA (610-683-1400: Ask for Reference Librarian) or cdcramer@clarityconnect.com or http://sunsite.unc.edu/farming-connection.

Managing Cover Crops Profitably. Sust. Ag. Network pubs. 212 pp. $19.00 Hard Cover. Hills Building, Room 10. University of VT, Burlington, VT 05405-0082.

Soil Science Simplified. Harpstead, et al. 1997. 210 pp. $36.95. (Non-Technical Summary of Soil Science. Available from Ag Access)

The Secret Life of Compost. M. Beck. 160 pp. $19.00. (composting guide, Available from Ag Access)

On-Farm Composting Handbook. 1992. N.E. Regional Ag Engineering Service. 607-255-7654 or nraes@cornell.edu

Organic Soil Amendments and Fertilizers. 1992. Sustainable Agriculture Research and Education Program. Univ. California. Division of Agriculture and Natural Resources. 6701 San Pablo Ave., Oakland, CA 94608-1239 (Publication 21505)(510-642-2431)

General References—Organic Farming and Sustainable Agriculture

Ag Access Catalog: Books for Farmers, Ranchers, and Market Gardeners. 1-800-540-0170. Fax: 530-298-2060. www.agaccess.com (Excellent Source of Practical Books on Alternative and conventional Agriculture)

Bio-Integral Resource Center (B.I.R.C). Publications Catalog. P.O. Box 7414, Berkeley, CA 94707. 510-524-2567. Fax: 510-524-1758 (B.I.R.C. is a non-profit organization providing education and research on integrated pest management, and least-toxic pesticides. B.I.R.C. also publishes the I.P.M. Practitioner Journal)

National Organic Directory Community Alliance with Family Farmers. 1-800-852-3832 (1999 Edition - $47.95) P.O. Box 363, Davis, CA 95617. (Excellent guide to the Organic Industry, with references for buyers, sellers, suppliers and distributors and farmers.)

You Can Farm: The Entrepreneur's Guide to Start and Succeed in a Farming Enterprise. 1998. J. Salatin. 480 Pages. $30.00 (Available from Ag Access)

The Small Commercial Garden: How to Make $10,000 a Year in your Backyard. D. Haakenson. 1998. 114 Pages. $19.95 (Available from Ag Access)

Farms of Tomorrow: Community Supported Farms, Farm Supported Communities. T.M. Grott. 1997. 312 Pages. $17.50. (Available from Ag Access)

Backyard Market Gardening: …Selling What you Grow. A.W. Lee. 1995. 230 Pages. $19.95 (Available from Ag Access)

Farming for the Future: Introduction to Low-Input Sustainable Agriculture. Reijntjes et al. 1992. 250 p. $29.95 (Focused on small-scale tropical agriculture using indigenous resources; available from Ag Access)

The New Organic Grower. E. Coleman. 1995. 339 Pages. $24.95 (Good Beginners Manuel for Organic Market-Farmers) (Available from Ag Access)

Rebirth of the Small Family Farm: A Handbook for Starting a Successful Organic Farm… B. Gregson. 1996. $8.65 (Available from Ag Access)

Successful Small-Scale Farming. S. Karl. 1991. 144 Pages. $12.95. (Practical Guide to Organic Farming) (Available from Ag Access)

Introduction to Permaculture. B. Mollison. 1997. 212 Pages. $16.95 (Available from Ag Access)

Permaculture: A Designer's Manuel. B. Mollison. 1997. 569 Pages. $45.00 (Hardcover) (Available from Ag Access)

Acknowledgements and Sources of Information

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