Industry in Transition


The Vegetable Crops Industry in Hawaii has experienced tremendous change over the past few years, and will continue to experience such turbulence at a similar or faster pace in the foreseeable future. At the macro level, production acreage has shifted from some areas in the state, to new opened lands for diversified ag. For example, acreage for vegetables more than doubled within a couple of years in Oahu, as new operations were established in former plantation lands. The increased acreage in central Oahu resulted in production acreage losses for some crops in other locations such as Molokai, Kamuela, and Kula. The consequences of these dramatic changes for the vegetable industry as a whole may have both potential positive and negative outcomes. The availability of former plantation lands for diversified crop production are providing a unique opportunity for entrepreneurs for the development of export industries, and also for the production of import-replacement crops. Policymakers thus have a keen eye on these developments as they try to promote economically viable stewardship of ag lands.

At the farm level the perspective is also two-fold, with both dire and positive consequences. On the negative side, a large number of small vegetable farms have gone under, almost in all islands, as they weren’t able to survive the increased competition in the marketplace. For those farms that have survived, lingering effects from the new picture include uncertainty of the future and economic losses due to increased costs of production and increased competition from both local and imported produce. A positive outlook exists for those few growers that have maintained a competitive edge in the marketplace. Progressive growers have maintained overhead costs down through careful management and improved production techniques. Others expanded production of specific crops, or focused on niche markets such as organic products, farmer’s markets, hotels and other direct-sale outlets, the growing gourmet market, or specialty ethnic products.

CTAHR also adapts and Reorganizes

The University of Hawaii itself, along with CTAHR, the UH College of Tropical Agriculture and Human Resources, have suffered serious staff and budget cutbacks in the past few years. These losses for CTAHR included a 50% reduction in operating funds and 20% reduction in personnel in the past five years. Continued cutbacks of at least 4% annually are expected for the next 3 years. To adapt to these changes CTAHR is currently undergoing through a ‘re-organization’ process that will likely result in leaner and more client-focused programs. Many other land grant universities in the continental US have undergone or are currently experiencing similar ‘re-organization’ programs.

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CTAHR Reorganization, cont. from pg. 1

Salient outcomes of this re-organization, in terms of benefits to the vegetable crops industry may include:

◊ More focused undergraduate and graduate instructional programs to train the future ag leaders in the state. Currently many farmers, farm managers, and other industry leaders are CTAHR alumni but the demand for trained professionals with experience in tropical ag is increasing.

◊ A more focused ‘swat-team-approach’ toward problem solving in such areas as pest control, fertilizer management, and crop production technologies.

◊ More focused technology-transfer programs through the use of the Internet, and other more traditional extension programs.

2 For example see: W.R. Gomes, Grass-roots effort sets priorities; Division creates a new budget process to meet them, California Agr. Oct. 1997, v. 51 n. 5. pg. 2.

The CTAHR Vegetable Crops Extension Team
The CTAHR Vegetable Crops Extension Team is developing both short-term and longer-term research and extension programs to better meet the needs of the vegetable industry. The vegetable team began to meet in 1991 to develop concerted statewide efforts in vegetable extension. Early results from this approach were improved communication within CTAHR resulting in a sharing of expertise among researchers and extension agents from the different islands. Some of the important statewide goals of the veg extension team included:

1) To synthesize/develop scientific-based local production systems which can be implemented by the industry for the production of target commodities;
2) To identify industry-wide issues needed to be addressed;
3) To identify/develop and promote sustainable agriculture practices that result in more efficient fertilizer applications, and in more effective pest control methods; and
4) To promote improved communication/organization within CTAHR and within the vegetable industry.

Vegetable CTAHR Staff Factoids
Personnel losses in CTAHR- vegetable programs
◊ One researcher in crop nutrition-resigned
◊ One crop breeder- retired
◊ About 40% extension-time loss in Oahu
◊ One senior-extension agent in Kamuela- retired
◊ Two home-garden extension agents (Kona & Oahu)- retired/position frozen
◊ Experiment stations, running at over 50% staff reduction, and with obsolete or non-existent farm machinery. Inadequate experiment station facilities prevent researchers and extension agents from conducting the necessary field research to develop new production techniques.

CTAHR Vegetable program 1998-2003

To comply with new federal initiatives (called GPRA) that promote increased government efficiency and responsiveness to client groups, the CTAHR Vegetable Team developed a tentative five-year plan. The goals are to consolidate efforts that have statewide relevance by pooling expertise from all CTAHR vegetable team members. Part of the process consists of developing benchmark data to compare final outcomes at the end of the five-year period, with conditions at the onset. Benchmark data will thus be collected through surveys, informal farm visitations, through DOA market statistics, and through grower evaluation forms collected after field days, workshops and other extension activities. It should be noted that the GPRA five-year plan is a “living” document that can and will be modified as new information is developed, and as required based on grower input and needs. Considerable flexibility and leeway is also required to allow for unexpected issues that will arise requiring both research and extension delivery programs, and also to allow for extension staff to focus on issues of relevance to individual production areas.

Thrust Programs of the 5-year CTAHR Vegetable Extension Team:

1) Industry Analysis: Industry organization, vegetable workshops/conference, grower survey to obtain benchmark data, grower meetings statewide.
2) Statewide project to improve spray application techniques.
3) Research and extension to improve onion production technologies-
   - Variety trials, alternative cultural management for control of pink root and other diseases, insecticide trials, nutrient and irrigation management, development of an onion extension publication, marketing programs.
4) Research and extension to improve taro production technologies- variety trials and alternative cultural management programs for control of important pests and diseases.
5) State-wide cultivar trials, beans, cucumbers, tomatoes, others
6) Information transfer: State-wide vegetable newsletter, Internet newsletters, Internet WEB site
7) Cost of production analysis for major vegetable crops
8) Re-training of former plantation workers.
Grower input is necessary for program success

It is often said that a research project is only as good as the data that goes into it. The same can be said of extension work. Thus farmer input and suggestions are critical for the success of University Cooperative Extension Programs. Farmer actions that on the long-term will benefit the industry as a whole include:

◊ Keep in touch with your extension agent, extension specialists, and with industry leaders. When a problem appears in the farm, these professionals will already be familiar with your production practices, and will be better prepared to make suggestions or recommendations.

◊ Take some time to canvass politicians and university administrators, and other ag leaders, on behalf of the Hawaii vegetable industry. Communicate with university administrators and policy makers to voice your ideas concerning the needs of vegetable growers in your area. Out-of state letters shall request that federal programs that target small farmers and rural areas also focus on your production area.

◊ Join industry groups, volunteer, and help create a statewide organization. By participating in grass-roots activities you will probably get more than what you give by learning timely information, polishing your communication skills, gain invaluable networking with colleagues and professionals, and by providing visibility to your industry. The statement is a worn-out cliche but nevertheless ‘Unity is Power.’

◊ Build up your knowledge base. Build-up your personal library of pertinent literature. Get a hold of as much information as you can, through trade magazines, seminars, or through the Internet. Improve your farm management and business/marketing skills.

◊ Share your knowledge with others and you will probably get more in return. It may be no coincidence that successful growers are often open to new ideas, and always willing to share information.

A major benefit of statewide extension programs is that experience and expertise don’t stay county-based but can be shared across islands. Also, several minds working together to tackle particular problems are more likely to come up with solutions, in a more timely fashion.

Vegetable Crops CTAHR Extension
Team Profile

Extension Agents

Alton Arakaki, CES Molokai
Tel. 808-567-6833; e-mail, ARAKAKIA@ctarm.hawaii.edu
Alton’s academic background is in agricultural economics. Alton, however, has a wide field experience in all aspects of commercial crop production. As such he is a strong promoter of whole-farm production systems, and believes in the need to develop sustainable agriculture systems. Alton’s programs in field research and extension have helped to develop the diversified agricultural industries in Molokai and Lanai. Crop expertise includes upland taro, sweet potato, tomato, bell pepper, cucumber, papaya, cover crops, and a host of other diversified crops.

Steven Fukuda, CES Wahiawa
Tel. 808-622-4185, e-mail: sfukuda@hawaii.edu
Steve’s academic background is in horticulture and field crop production. Steve has worked with local and ethnic growers for over 20 years to promote the vegetable and fruit industry in Leeward Oahu. His recent work has been intensified on over 1,500 Acres and over 150 new farmers have recently been established in Central and Leeward Oahu. To help his technology transfer program, Steve lead a project to create a series of over 25 extension VHS video presentations to help beginning farmers learn about the basics of vegetable crops production. Crop expertise include specialty Asian vegetables, daikon, green onion, eggplant, leafy lettuce, watercress, papaya, upland taro, yams, and sweet potato.

Robin Shimabuku, CES Maui
Tel. 808-244-3242; e-mail: shimabukur@ctarm.hawaii.edu
Robin has an academic background in plant pathology. He has an extensive extension experience with commercial vegetable and fruit production on Oahu, Kona, and on Maui. More recently, Robin has helped to organize vegetable growers in the Kula district to create new marketing and production programs. Crop expertise includes head cabbage, zucchini, lettuce, sweet onion, and upland taro.

Who is Who
Roy Yamakawa, CES Kauai
Tel. 808-274-3471; yamakawar@ctarm.hawaii.edu

Roy, a horticulturist, has major responsibilities with the ornamental crops industry in Kauai. However, he also has responsibilities with the taro and vegetable industry. His work with vegetables has involved information dissemination for the production of a host of vegetables, year-round troubleshooting, support of organic farmers, establishment of hydroponic greenhouses, value-added solar-drying, and support of wetland taro growers. Crop expertise (other than ornamentals) includes wet land taro and leafy lettuce for hydroponics production.

Specialists and Researchers

John Cho, UH Manoa, based in Kula.
Tel. 808-878-1213; e-mail: choj@hawaii.edu

Dr. Cho’s appointment is in research. Due to his close proximity to the vegetable growers in Kula his research directly addresses important pest and diseases that affect local vegetables in the state. His work in the past has dealt with management of spotted wilt virus in tomato and lettuce, the use of cross-protection for zucchini yellow mosaic virus management in zucchini, and with the management of taro diseases. Dr. Cho is currently involved with extension and research colleagues to develop alternative management practices for pink root control in onion. Crop expertise includes tomato, lettuce, bulb onion, zucchini, and head cabbage.

Bernie Kratky, UH Manoa- based in Hilo
Tel. 808-974-4015; e-mail: kratky@hawaii.edu

Dr. Kratky’s appointment is in research, but his line of work leads him to conduct considerable extra-curricular extension work statewide. Dr. Kratky’s non-circulating hydroponic system for the production of leafy and other veggies has been popularized statewide both for commercial and home-garden production. As a result Dr. Kratky is in demand to give several hydroponic talks a year in the different parts of the state. Proceedings of a one-day workshop held earlier this year on Hilo, have just been published. Dr. Kratky has also conducted considerable research in Hawaii, dealing with several cultural aspects (nutrition, irrigation, timing of harvest, herbicide injury) of field vegetable crops production. Crop expertise includes greenhouse and field tomato, bell pepper, cucumber, bulb onion, and lettuce, among others.

Ron Mau, UH Manoa
Tel. 808-956-2429; e-mail: maur@ctarm.hawaii.edu

Dr. Mau is the CTAHR Extension Entomology Specialist with statewide responsibilities for vegetable and fruit crops. Over the years his research and extension programs have resulted in Integrated Pest Management (IPM) CTAHR recommendations for the control of important pests in such crops as watercress, watermelon, head cabbage, eggplant, bulb onions, and leafy Asian vegetables. His area of work involves determination of pest threshold levels, selection of new insecticides and sticking agents, as well as pesticide coverage and timing of applications.

Stuart Nakamoto, UH Manoa
Tel. 808-956-8125; snakamo@hawaii.edu

Dr. Nakamoto is a CTAHR Marketing Extension Specialist. In his past work Dr. Nakamoto evaluated the marketing potential of several horticultural crops for Hawaii. Dr. Nakamoto also co-organized several marketing conferences dealing with value-added products, exports, statewide marketing and with regional marketing programs in Oahu. Currently he is working with colleagues and extension personnel to develop cost of production fact sheets for key vegetables in the state.

Jim Silva- UH Manoa
Tel. 808-956-6906; e-mail: jsilva@hawaii.edu

Dr. Silva’s appointment is also in research, working with fertilizer calibration studies. In his work around the state Dr. Silva has conducted fertilizer calibration work for such crops as upland taro, basil, bulb onions, head cabbage, and watermelon. His research indicates that farmers on Hawaii often over-fertilize their crops. As such he recommends periodical soil tests and that farmers then fertilize their crops according to CTAHR fertilizer recommendations.

Ray Uchida- UH Manoa
Tel. 808-956-6706 ; e-mail: ta_svcctr@ctarm.hawaii.edu

Ray is the head of the CTAHR Agricultural Diagnostic Service Laboratory (ADCS). The ADCS, at a nominal cost, conducts soil nutrient analysis, crop tissue nutrient analysis, water quality analysis, and diagnosis of crop insects, diseases, and nematodes. Ray also heads the CTAHR Seed laboratory. The Seed lab sells seed to the public of some popular UH-bred varieties (such as sweet corn, eggplant, green onions, soybean, pole beans, Chinese peas, home-garden tomatoes, and papaya).

Hector Valenzuela- UH Manoa
Tel. 808-956-7903; e-mail: hector@hawaii.edu

Dr. Valenzuela is the CTAHR Vegetable Crops Extension Specialist with statewide responsibilities. His work involves dissemination of current recommendations for the production of commercial vegetables, and to conduct applied research on cultural aspects relevant to local crop production. Valenzuela’s research activities involve variety trials, fertilizer and compost experiments, and the use of cover crops, no-till, and organic farming techniques in vegetable production.

Other Vegetable Researchers

Dr. Jim Brewbaker breeds sweet corn varieties adapted to low-elevations in the tropics; Dr. Janice Uchida develops diagnostic techniques and evaluates potential management practices for vegetable fungal diseases; Dr. Eduardo Trujillo works with diseases in taro and ginger; Dr. Brent Sipes researches nematode pest management alternatives in taro and other diversified crops; Dr. Mike Kawate conducts USDA pesticide registration trials. Dr. Joe DeFrank conducts work with cover crops and living mulches to minimize erosion and for weed control in vegetables.
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Manganese toxicity on Watermelon in former sugar cane lands

Randall Hamasaki (Tel. 808-247-0421), Peter Bunn, Steven Fukuda, N.V. Hue, R. Ogoshi, James Silva, Gordon Tsuji, Raymond Uchida, and Goro Uehara.

A “swat” team from CTAHR was convened in June 1997 to help solve manganese toxicity problems in large-scale watermelon plantings at an upper Haleiwa site. Members of the team included a chemical representative from Brewer Environmental Industries, extension agents, and fertilizer and soil scientists from CTAHR. On-farm experiments were designed to evaluate the rates and types of liming materials required to overcome the Manganese toxicity problems. The research would also determine the range of manganese tissue levels that result in toxicity symptoms. Excellent collaboration by the farmers and coordination by CTAHR research team leader Randall Hamasaki resulted in a successful set of preliminary research trials. The preliminary data indicates that soil pH in the Opaelua soils needs to be raised to 6.0, that soil-test Mn levels need to be below 450 ppm (as extracted by Mehlich3 solution), and that a Calcium to Mn (Weight:Weight) ratio above 20 needs to be maintained in greater yields than with bare-ground culture. Uniform lime incorporation to a depth of 8 inches or greater is recommended for best results. Also the acid soils tended to be deficient in potassium, calcium, magnesium, and zinc.

Overcoming taro disease and cultural problems

Alton Arakaki, Roy Yamakawa, Randall Hamasaki, Steven Fukuda, Robin Shimabuku, Dwight Sato, Eduardo Trujillo, Janice Uchida, Jim Silva, Ron Mau, Raymond Uchida, Susan Miyasaka, Hector Valenzuela, and Jim Hollyer.

Taro growers have faced several production challenges over the past 10 years. Important diseases included taro phytophthora leaf blight, and, more recently, taro pocket rot. The melon aphid is also a perennial pest in taro, especially for luau leaf production. Other cultural problems have included over fertilization of taro patches, especially with nitrogen. Nitrogen over fertilization may result in nutrient imbalances, may predispose the plant to pests and diseases, results in economic losses to the farm due to the purchase of unneeded fertilizer, and may cause environmental problems, by leaching nitrogen into fragile aquatic ecosystems. A CTAHR taro research team has been working for several years now to solve some of the most pressing cultural problems for taro production in Hawaii. Research activities included:

- Evaluation and maintenance of a large collection of native and exotic taro varieties by Alton Arakaki, Steven Fukuda, Randy Hamasaki, and Dale Sato on Molokai and on Oahu. This collection may serve as a source of resistance to particular pests in taro breeding programs, and specific varieties may fill specific market niches. Many of these varieties grown in wetland and upland conditions were evaluated on Molokai and on Oahu for their palatability when prepared as poi.
- Dr. Eduardo Trujillo collected taro germplasm from throughout the Pacific region, and identified Palau taro varieties with resistance to the important taro leaf blight disease. In cooperation with the vegetable extension agents, many of these varieties were evaluated in on-farm trials and in experiment stations throughout the state. Promising varieties were distributed to farmers.
- A research team headed by Roy Yamakawa was convened in 1997 to tackle the emerging problem with pocket rot in taro. CTAHR soil and fertilizer scientists as well as plant pathologists were convened to identify the causal organism/factor of this serious disease, and to propose possible remedial action and research avenues.
- Research conducted by Don Schmitt, Brent Sipes, Dwight Sato, and Alton Arakaki on Molokai and on Hilo revealed alternative nematode management practices through the application of pesticides or through the practice of crop rotation with non-host cover crop species.
- Research conducted by Lisa Ferentinos and Dwight Sato showed the potential of using cover crops to minimize erosion and weed problems in upland taro production. Further work by Joe DeFrank and Dwight Sato showed the potential of producing taro through no-till farming techniques using a no-till taro planter.
- Research conducted by Ron Mau, Randall Hamasaki, and Dwight Sato revealed possible management practices for the control of important pests in taro such as the melon aphid, and the taro root aphid.
- Nutrient calibration work and nutrient monitoring studies led by Dr. Jim Silva, in cooperation with several farmers on Hilo, Kauai, and Oahu, revealed nutrient management practices (dealing with liming, micronutrients, and nitrogen) to maximize taro yields and to minimize nutrient toxicity and imbalance problems. A team of researchers and extensionists is currently developing interim CTAHR fertilizer recommendations for wetland taro production. These recommendations are intended to assist commercial taro growers to improve fertilizer programs for wetland taro to increase yield, avoid excessive fertilizer applications and costs, limit disease severity resulting from N overfertilizing, and to reduce environmental pollution.
- CTAHR taro production recommendations were disseminated over the past few years through several conference proceedings. Doug Hamasaki, from the CTAHR Video Laboratory, also produced a video describing taro production practices in Hawaii and in the Pacific Region. A synthesis of current CTAHR knowledge for taro production was recently published in an extension publication developed by Jim Hollyer and colleagues. These guides provide production practices for dryland and wetland taro production, including pest management guides, the latest fertilizer recommendations, as well as marketing guides for taro production in the state.
- Taro was recently listed as one of the thrust activity areas for the UH College of Tropical Agriculture and Human Resources. The goals of the taro CTAHR research team that heads this thrust area is to develop updated recommendations for the production of taro, and because of its strong cultural value, to preserve the tradition of wetland taro production for future generations. In cooperation with several grass-root organizations Alton Arakaki and extension personnel colleagues have gotten together to better organize the taro industry state-wide to better direct research and marketing study efforts.
Promoting the bulb onion industry in the state.
Robin Shimabuku, Hector Valenzuela, John Cho, Robert Paull, Janice Uchida, Jim Silva, I.P. Wu, Randy Hamasaki, Mike Austin, and Marisa Wall (New Mexico State Univ.).
The following research activities were conducted to improve onion production practices in the state.

- In cooperation with the DOA and HARC onion variety trials were conducted by Robin Shimabuku, Mike Austin, and Hector Valenzuela to identify potential new sweet onion varieties for Kula, Maui.
- Research is being conducted by John Cho and colleagues to identify alternative management practices for the control of soil diseases in onion.
- Research by Ron Mau and Robin Shimabuku was conducted to identify insecticides for management of the pea leafminer in bulb onions.
- Nutrient calibration studies were conducted by Dr. Jim Silva and Robin Shimabuku to improve fertilizer application rates in Kula.
- Irrigation calibration studies were conducted by Dr. I.P. Wu and Robin Shimabuku to improve onion yields and water use efficiency in onion. On-farm trials conducted showed that improved irrigation practices resulted in increased bulb onion yields. Important results from these studies included: 1) The optimal evapotranspiration (ET) was 15 inches in a growth cycle of 99 days (after transplanting), the average ET was 0.152 inches per day. For a 133 day crop, the optimal ET was 17 inches, with an average ET of 0.127 inches; 2) Evaporation readings were determined to be useful for irrigation scheduling; 3) Yield reductions from under watering were equal to 1,500 lbs/Acre for each inch of water applied below the recommended levels. Similarly, yield reductions from over watering were 1,200 lbs/Acre for each inch of over watering; 4) Over watering resulted in nitrate leaching (6 lbs/Acre of N with a 10% deep seepage.
- Randy Hamasaki, Robin Shimabuku, and Hector Valenzuela obtained a grant to develop a publication with the latest recommendations to grow onions in Hawaii.

Hydroponic/Nutrition Experiments.
Bernie Kratky, Mike Nagao, and D.M. Sato.
Dr. Kratky and colleagues conducted several experiments to develop techniques for the hydroponic production of several crops.

- Ginger hydroponic trials to develop disease-free propagating material: Nine experiments were conducted at several experiment stations and 4 experiments were conducted in on-farm trials. Highest yields obtained in these trials reached about 80,000 lbs/Acre. Yields at the on-farm hydroponic trial were between 46 to 52,000 lbs/Acre.
- Tomato hydroponic trials: In four experiments tomatoes were pruned so that only 2, 4, or 8 clusters were harvested. Two-cluster ‘Vendor’ tomatoes yielded 49 and 73% more salable tomatoes per day than 8-cluster tomatoes. Also two-cluster ‘Lenor’ tomatoes yielded 47 to 92% more salable tomatoes per day than 8-cluster tomatoes. The data indicates that less pesticides were used per pound of harvested tomato with the 2-cluster harvest system.
- Lettuce hydroponic trials: Three experiments were conducted to evaluate the potential of a humidifier to reduce bolting and tip burn in hydroponically grown lettuce. The humidifan system reduced bolting and tipburn and resulted in greater yields. However, additional research is needed to further implement this system into commercial hydroponic production systems.
- Other crops and techniques evaluated for production under non-circulating hydroponics included: Conley Greenhouse: cucumbers grown in barrels, lettuce grown in suspended forestry tubes, and ginger grown in bags and trays; Metal conduit rainshelter: tomatoes grown in aluminum beverage cans; Kentucky Wooden Greenhouse: watercress grown in a floating system, strawberry grown in a Verti-Gro system and in soil beds, lettuce grown in foam, net pots, forestry tubes, and aluminum beverage cans, and onions. Other parts of the production system at the Experiment Station included a seedling greenhouse, a Criterion greenhouse, and a water catchment reservoir.

Variety Trials conducted
Hector Valenzuela, Ted Goo and Christine Crosby in collaboration with the vegetable county extension agents.
Variety trials were conducted with bush beans, pole beans, cucumbers, leafy cabbages, leafy lettuce, hydroponics leafy lettuce, cherry tomato, zucchini, bulb onion, and daikon. Results from these trials will be presented in upcoming issues of the Vegetable Crops Update Newsletter.

Nature Farming (organic farming) experiments
Hector Valenzuela and Randy Hamasaki
A long-term nature farming (organic farming) experiment was established in 1993 at the UH Waimanalo Experiment Station. This research is conducted in a 3 Acre plot were crops are grown without pesticides and synthetic fertilizers. These trials have been conducted for 5 years, and a follow-up research program has been initiated that will run until the year 2006. In the demonstration plots about 50 vegetables were evaluated for production under organic conditions. Also in those plots over 40 cover crops were evaluated for their potential use under organic growing conditions. Other demonstrations included the use of organic mulches for weed control, cover crop rotations, intercropping, N fixation, the use of floating covers for insect control, no-till farming, the use of insectary species, and evaluation of different composting techniques. In the plots where replicated trials are conducted, compost applications at 10 tons/Acre plus moderate amounts of a supplemental nitrogen source were shown to be effective for the production of lettuce, basil (2 experiments) and Filipino spinach (2 experiments). Periodical field days and annual workshops are held to disseminate this information to farmers.
### The Vegetable Industry in Hawaii: Recent Trends

#### Number of Vegetable Farms 1991 1996 Percent Increase

<table>
<thead>
<tr>
<th></th>
<th>1991</th>
<th>1996</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Statewide</td>
<td>490</td>
<td>950</td>
<td>93%</td>
</tr>
<tr>
<td>Taro</td>
<td>180</td>
<td>180</td>
<td>0%</td>
</tr>
<tr>
<td>Big Island</td>
<td>260</td>
<td>400</td>
<td>54%</td>
</tr>
<tr>
<td>Kauai</td>
<td>20</td>
<td>50</td>
<td>150%</td>
</tr>
<tr>
<td>Maui/Molokai</td>
<td>85</td>
<td>105</td>
<td>23%</td>
</tr>
<tr>
<td>Oahu</td>
<td>125</td>
<td>395</td>
<td>216%</td>
</tr>
</tbody>
</table>

#### Acreage in Vegetables 1991 1996 Percent Increase

<table>
<thead>
<tr>
<th></th>
<th>1991</th>
<th>1996</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Statewide</td>
<td>5,200 Acres</td>
<td>6,200 Acres</td>
<td>19%</td>
</tr>
<tr>
<td>Big Island</td>
<td>1,500</td>
<td>2,100</td>
<td>40%</td>
</tr>
<tr>
<td>Kauai</td>
<td>100</td>
<td>100</td>
<td>0%</td>
</tr>
<tr>
<td>Maui</td>
<td>2,700</td>
<td>1,500</td>
<td>-44%</td>
</tr>
<tr>
<td>Oahu</td>
<td>900</td>
<td>2,500</td>
<td>177%</td>
</tr>
</tbody>
</table>

#### Value of Crop Sales (farm-gate) 1991 1996 Percent Increase

<table>
<thead>
<tr>
<th></th>
<th>1991</th>
<th>1996</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>All Vegetables</td>
<td>$38.6 m</td>
<td>$40.6 m</td>
<td>5%</td>
</tr>
<tr>
<td>Taro</td>
<td>$3.0 m</td>
<td>$2.7</td>
<td>-10%</td>
</tr>
<tr>
<td>Big Island</td>
<td>$15.4</td>
<td>$16.1</td>
<td>4.5%</td>
</tr>
<tr>
<td>Kauai</td>
<td>$0.3 m</td>
<td>$0.3 m</td>
<td>0.0</td>
</tr>
<tr>
<td>Maui/Molokai</td>
<td>$15 m</td>
<td>$11.6</td>
<td>-22%</td>
</tr>
<tr>
<td>Oahu</td>
<td>$7.9 m</td>
<td>$12.5 m</td>
<td>58%</td>
</tr>
</tbody>
</table>

#### Ranking of Veg. Industry Among Diversified Crops in The State

<table>
<thead>
<tr>
<th></th>
<th>1991</th>
<th>1996</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 2 ($35 million)</td>
<td>No. 3 ($40 million)</td>
<td></td>
</tr>
</tbody>
</table>

Hawaii market share of vegetables consumed in the state (percent locally grown by volume)-

**Over 60% of the volume is locally grown.**

*The market is flooded for the traditional varieties found in the supermarket: Bittermelon, burdock, cabbages, cucumber, daikon, eggplant, ginger, green onion, American parsley, radish, Oriental squash, sweetpotato, watercress, and watermelon.*

**40-59% is grown locally.**

*Some potential for increased local production, but possible high price volatility. Potential exists to target market windows.*

Snap bean, sweet corn, dasheen, bell pepper, taro.

**Less than 40% is grown locally.**

*Higher potential to grow locally but questionable whether this can be done competitively in Hawaii, compared to the lower production costs in the mainland.*

Broccoli, cauliflower, carrot, celery, head lettuce, pungent onion, Chinese pea, pumpkin, romaine, zucchini, tomato, potato.

### Top Veggies, farm-gate value ($ millions) of production

<table>
<thead>
<tr>
<th></th>
<th>1991</th>
<th>1996</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese Cabbage</td>
<td>$1.8 m</td>
<td>$1.8 m</td>
<td>Maui (51% of total)</td>
</tr>
<tr>
<td>Head Cabbage</td>
<td>$2.9 m</td>
<td>$2.6 m</td>
<td>Maui (50% of total)</td>
</tr>
<tr>
<td>Cucumber</td>
<td>$1.7 m</td>
<td>$2.0 m</td>
<td>Molokai (47%)</td>
</tr>
<tr>
<td>Bulb Onion</td>
<td>$1.3 m</td>
<td>$2.3 m</td>
<td>Maui (99%)</td>
</tr>
<tr>
<td>Green Onion</td>
<td>$1.5 m</td>
<td>$1.3 m</td>
<td>Oahu (81%)</td>
</tr>
<tr>
<td>Bell Pepper</td>
<td>$1.2 m</td>
<td>$1.2 m</td>
<td>Oahu (93%)</td>
</tr>
<tr>
<td>Sweetpotato</td>
<td>$0.6 m</td>
<td>$1.3 m</td>
<td>Big Island (57%)</td>
</tr>
<tr>
<td>Taro</td>
<td>$3.0 m</td>
<td>$2.7 m</td>
<td>Kauai (54%)</td>
</tr>
<tr>
<td>Tomato</td>
<td>$3.1 m</td>
<td>$3.7 m</td>
<td>Molokai (74%)</td>
</tr>
<tr>
<td>Watermelon</td>
<td>$2.0 m</td>
<td>$2.8 m</td>
<td>Oahu (89%)</td>
</tr>
<tr>
<td>Watercress</td>
<td>$1.6 m</td>
<td>$1.1 m</td>
<td>Oahu (100%)</td>
</tr>
<tr>
<td>Herbs, all</td>
<td>$1.4 m</td>
<td>$2.7 m</td>
<td>NA</td>
</tr>
<tr>
<td>Ginger root</td>
<td>$7.5 m</td>
<td>$7.0 m</td>
<td>Big Island (100%)</td>
</tr>
</tbody>
</table>

*Other veggies with over $0.5 million in annual farm-gate value include: snap beans, sweet corn, daikon, eggplant, lettuce, romaine, burdock, and mustard cabbage.*
Vegetarian Shoppers
* Twenty million Americans have adopted a vegetarian diet.
* As a result Kroger Co., has developed a merchandising concept centered on vegetarian products. The vegetarian market section introduced in 39 stores included organic produce, soy-based hamburgers and hot dogs, rice-based cheese products, among other products. Kroger, the nation’s largest retail grocer, with stores in over 2,000 locations, has offered organic produce in many of its stores throughout the country (Brad Addington, The Packer, Aug. 25, 1997).
* Only about 2 million Americans are strict vegetarians, but millions more are ‘near vegetarians’. About 5% of Americans do not eat red meat. In addition to the growth of natural and vegetarian restaurants nation-wide, conventional supermarkets are also supplying natural and organic food produce. A survey conducted in 1994 showed that nearly 15% of the nation’s college students chose vegetarian options in the dinning halls (Larry Waterfield, The Packer, Sept. 8, 1997).

U.S. Industry factoids
* Americans throw out more than 27 million pounds of fruits and vegetables annually. (Packer, Aug. 11, 1997)
* The value of value-added produce in the US in 1996 was between $6-8 billion, or 10% of total produce sales. (Packer, Aug. 11, 1997)
* The top 75 retailers in the US had sales of $336 billion in 1996. The top 10 retailers accounted for half of the total. (Packer, Aug. 11, 1997)
* The number of fruit and vegetable items stocked in supermarket shelves doubled from 1992 to 1996, increasing from 276 to 552 stock-keeping units. (Packer, Aug. 11, 1997)
* Leaf lettuce acreage in California’s Monterey County in 1976 was 2,560, increasing to 9,928 by 1976, and to 33,004 by 1996. Per capita consumption of romaine/leaf lettuce in the US was 3.8 lbs/person in 1990, and increased to an estimated 6.6 lbs/person by 1997. Per capita consumption of head lettuce in 1990 was 27.8 lbs and decreased to an estimated 23 lbs/person by 1997. (David Swenson, The Packer, Sept. 1, 1997).
* The value of US exports to Hong Kong in 1996 was $101 million, a 14% increase over the previous year. The major items were canned sweet corn, frozen French fries, lettuce, celery, potato chips, and ketchup (Packer, Sept. 1, 1997).
* Items provided by newly formed Bird Eye Farm Fresh product, based in Green Bay, Wisconsin include: 8- and 16-ounce broccoli florets; 8- and 16-ounce baby carrots; 16-ounce broccoli and cauliflower florets mix; 16-ounce vegetable medley with broccoli florets, cauliflower florets and baby carrots; and 16-ounce stir-fry with broccoli, celery, baby carrots, and sugar snap peas. (Chuck Harvey, The Packer, May 19, 1997).
DISCLAIMER

Reference to a company or product name does not imply approval or recommendation of the product by the Cooperative Extension Service, College of Tropical Agriculture and Human Resources, the University of Hawaii and its employees, or the United States Department of Agriculture, to the exclusion of others which may be suitable.

The pesticide information provided here should be used only as a guide. This is not a recommendation; consult an expert. Before purchasing a pesticide, the user should carefully read the entire label to determine if the pesticide is appropriate (legal) for the particular use. Labels frequently change without notice.