



Department
of Agriculture
STATE OF HAWAII

An Economic Assessment

of the

Former Kekaha Sugar Company Land and Infrastructure: Its Current and Potential Economic Capability

FINAL REPORT

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By

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Disclaimer

All views and opinions expressed herein do not necessarily represent those of, nor endorsed by the Hawaii Department of Agriculture (HDOA).

Executive Summary

Given the existing infrastructure left by the former Kekaha Sugar Company (KSC) and a favorable climate, the Kekaha agricultural land has considerable potential for generating income and employment for the people of Hawaii.

The combined output potential of all farms, excluding Ceatech's shrimp farm and Wines of Kauai, increased as a result of land acquisition by some existing tenants, from \$19.5 million in 2002 to \$34.9 million in 2004 (Table 3). The actual output value in aggregate has also increased moderately, from a range of \$14.7-\$15.6 million in 2002 to a range of \$16.4-\$19.9 million in 2004. Due to rapid capacity expansion, the combined actual output value as percent of its potential declined from a range of 75-80% in 2002 to 47-57% in 2004. Farm employment declined slightly over this brief period with the phasing out of the remaining sugar plantation, from 387 to 375 full- and part-time positions. In 2004, there were 100 full-time (19 managerial and professional positions, 38 skilled technical positions, and 43 hourly-paid laborers) and 275 part-time and seasonal workers.

Based on the land area existing tenants intend to hold, by 2010, the potential farm output in aggregate could grow to approximately \$38.4 million, providing 60 full-time and 345 part-time and seasonal jobs. However, actual output could be in the range of 60-70% of its potential (in the 2010a scenario). With the multiplier effects, farm activities originated in Kekaha's former sugar land as described could contribute approximately \$71 million in total to Hawaii's Gross State Product (GSP) and provide about 834 full-time and part-time jobs. If the most productive cropland, approximately 58% of the entire 12,592 acres complex, were fully utilized (in the 2010b scenario), the aggregate farm gate value of output could rise to approximately \$50.8 million, providing about 73 full-time and 440 part-time and seasonal jobs. With the multiplier effects, the Kekaha former sugar land could contribute about \$95 million in total to the GSP and provide about 1,056 full-time and part-time jobs.

Major advantages for farm operations in Kekaha include relatively long annual production period, relatively low rent, abundant and inexpensive water supply and hydroelectricity power generated using hydraulic power from the irrigation system. Disadvantages include a limited local market, relatively high input costs, and scarce skilled farm workers. The extra costs for shipping in the many necessary inputs and shipping out the products are major constraints for farming in Kauai. However, the supper ferry, which is expected to begin operation in 2007 will help to offset some of these costs.

The major challenge for the managing agency is to maximize the potential of this agricultural production asset to generate income and employment for Hawaii's residents. Managing the number and type of tenants in the Kekaha agricultural land may prove to be the most challenging point for the managing agency. A minimum land size requirement that is too large for leasing, designed to keep the number of tenants small, could result in much of the land being left idle while small farmers who need farm land the size less than the existing minimum requirement of 300 acres would be left out. On the other hand, too many small, independent farms producing diversified products in a given region could create logistical problems associated with pest control, which could affect crop yields in the whole area as well as food safety.

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1 Introduction

Approximately 12,592 acres were assigned to the Agribusiness Development Corporation (ADC) in October 2001, for management. This is a portion of the 27,720 state-owned land located in Kekaha, Kauai County, where the Kekaha Sugar Company operated sugarcane plantation for about a century until November 2001, when the mother company Amfac officially announced the closure. This portion of the land is the focus of this study. The study's main objective is to assess the current and potential economic capability of this agricultural asset.

Hawaii's agricultural development trend is one of increasing product diversification, necessitated by the changing market forces that resulted in a decline of sugar and pineapple plantations, which have dominated state's agricultural landscape for more than a century. Diversified agriculture has been widely accepted as a way to assure the state's agricultural needs. Thus the assessment of economic potential of this particular agricultural production asset is consistent with this on-going agricultural trend and accepted view. As ADC is the managing agent of the Kekaha former sugar land in question, including infrastructure in place, since the plantation closure, the assessment ultimately is an assessment of ADC's contribution to the county's and state's economy.

Section 2 provides a brief historical background and description of the property, with a review of changes in production and employment that have taken place within the property. Section 3 examines Kauai's competitive products. Section 4 analyzes the economic potential of the property, its direct (farm) and total contribution to Gross State Product (GSP) and jobs. Section 5 discusses challenges and constraints faced by farmers in Kekaha. Finally, Section 6 concludes the study.

2 Historical Background and Description of the Land

The former sugar land in Kekaha is located on the northwest portion of the Kauai Island. The state-owned land was under the management of the Department of Land and Natural Resources (DLNR) since the sugar plantation time until October 2001, when the Board of Land and Natural Resources (BLNR) handed a master lease to ADC.

The land has a relatively long history in commercial agriculture. The land and infrastructure designed specifically for sugarcane plantation were developed by the Kekaha Sugar Company, which was formed in 1898. Thus, sugar was the single dominant crop in the entire region until recently, when Kekaha Sugar Company (owned by AMFAC) closed down in February 2001. It was a single major crop for which the economy and livelihood of the people in Kekaha depended on for about a century. In fact, Kekaha is a town started by the sugar plantation workers where, in 2000, 3,178 people lived, about 5.4% of Kauai's total population. An average Kekaha resident earned \$17,117 in 2000, about 80% of state's average.¹

¹ Income is stated in 1999 dollar. Census 2000, U.S. Census Bureau.

The land is extensively irrigated, as average annual rainfalls range from 20 inches in the coastal area to 40 inches on the ridges while sugar plantation requires approximately 90 inches of rain. Originally, three main ditches (Kekaha Ditch, Kokee Ditch, Waimea Ditch) formed the irrigation network that diverts water to the sugarcane field, with approximately 2,668 acres in the highland area and 5,090 acres in the coastal Kekaha-Mana plain.

The Kekaha Ditch, 27 miles long, was built in 1907. The ditch carries water from an altitude of about 500 feet from the Waimea River to Kekaha. The Kekaha Ditch provides water to users beyond the subject land, including Kikiola Land Co. and Knudsen Land Co. The Kokee Ditch, approximately 21 miles long, diverts water from Mohili Stream and the headwater of the Waimea River in the Alakai Swamp at an altitude of 3,400 feet. The Waimea Ditch was abandoned about 14 years ago due to a landslide.

The Kekaha plain was once mostly marshland. The drainage system, with two pumps at the Kawaiele and Nohili pumping stations constantly running to lower the groundwater table, which made possible for sugarcane cultivation. Today, these pumping stations must continue running to keep the groundwater table from rising too high, which could result in root rots and hence low crop yields. During storm season, with five inches of rain in one day would result in flooding. These pumping stations help shorten the time required for the water table to return to its normal level.

The pumping stations are run with hydroelectricity generated within the subject land, which also provides relatively inexpensive electricity for other uses for farm operations. The hydroelectricity is generated using hydraulic power provided by the irrigation system. Three generating plants were originally constructed, including Kekaha power plant, Waiawa Hydro, and Mauka Hydro. The Kekaha plant has been shutdown together with the sugar mill, leaving the other two plants in operation to provide electricity to the existing tenants.

Changes in Employment and Crops Since the Plantation Closure

Other crops besides sugar were grown in the subject land before the plantation closure. Since the closure of the Kekaha Sugar Company in 2001, the Kekaha agricultural lands have supported besides sugar cane, the production of seed corn, sweet corn, melons, tropical fruits and various vegetable crops. Some of the agricultural activities have proven successful, while others are still in their trial period.

Seed crops, of which corn seeds make up more than 90% in sales value at farm gate price, have been grown in the area since the late 1960s. They have proven to be profitable agricultural products in Kekaha, in place of sugarcane. Shrimp farming has also been attempted, but failed. After years of struggle over finance, an outbreak of the white spot syndrome virus prompted the shrimp farm company Ceatech USA Inc. to destroy its entire shrimp population in the farm, shutting down operations in 2004, and filing for Chapter 11 bankruptcy protection in early 2005. Vegetables (cucumber, cabbage, kaichoi, daikon), melons (seedless and water melon) and fruits (grapes and mangoes) are also being grown on the former sugar land.

In 1997, the Kekaha Sugar Company's operation provided 465 jobs.² After the plantation closure, the six legitimate farm tenants together, which occupied approximately 40% of the 12,592 acres, provided 432 jobs in total, including 157 full time jobs and 275 part-time and seasonal jobs for a relatively short period of time.³ The closure of Ceatech shrimp farm operations in 2004 eliminated 33 jobs and the phasing out of the remaining sugarcane plantation under Gay & Robinson will result in a total loss of between 60 and 70 full time jobs.

Gay & Robinson, which initially occupied 3,500 acres after the plantation closure, has reduced the size of its land holding to 1,750 acres by April 2005. The acreage will continue to decline throughout the year as harvest progresses. The company will retain 400 acres for sugar seed crop, according to the company's Director of Finance & Property Management.

3 Kauai's Competitive Products

To assess the economic potential of the Kekaha agricultural land, it is useful to first identify products that are currently thriving in Kauai. The level of competitiveness of a product depends on its per unit production cost. Although data on production costs are unavailable, competitiveness of a given agricultural product produced in Kauai can be assessed by inferring from its per acre yield in dollar value relative to the same products produced elsewhere. In addition, the product's marketing information can also provide its "revealed" competitiveness. The reason is simply that, if a product is not competitive, it will not last in the market over a long period of time. For this, the Honolulu market supply data (inter-island inshipment to Honolulu plus Honolulu's own supply and inshipment from the Mainland) for fresh produces are utilized.

Competitiveness Based on Yield

For the purpose at hand, yield per *acreage used* (or allocated) for a given crop, which includes fallow land, is the most desirable unit measure as it reflects the total cost of land. However, in [Table 1](#), due to data availability yield per *acreage harvested* is reported for most crops. Yields for seed crops, pineapple and taro are reported with different acreage definitions, causing inconsistency. In HAS's statistical reports, land information for certain crops contain only "acreage harvested," others contain only "acreage used for crop" or "acreage in crop" with acreage harvested. Acreage harvested accounts for only part of the total land a farmer must pay. Whether or not part of the land within a given farm allocated for a specific crop is left fallow, for any reason, there is a cost to it. Cultural practices differ for different crops and, often, across farms growing the same crops. Different crops have different time requirements for maturity and for land rotation. Thus, fallow land left for rotation purpose and acreage not harvested as a proportion of the total acreage varies across crops and farms. Therefore, even if yield is measured as the output value per acreage harvested for all crops used for productivity (with respect to land) comparison, inconsistency remains.

² The figure is reported in an article titled "Kekaha Sugar's Demise Leaves West Kauai Water System in Limbo," Vol. 11, No. 8, February 2001, Environmental Hawaii, Inc., www.environment-hawaii.org/201cov.htm.

³ Part-time farm laborers, according to the interviews, generally worked between 30 and 35 hours per week throughout the year. Seasonal workers also worked more than 30 hours per week, 2.5 to eight months, depending on which farm they employed at.

Table 1 shows some commodities that have been grown in the state and in Kauai with per acre yield in term of dollar value above \$5,000.⁴ The value for each commodity is the average across farms and over a specified time period as indicated in the parenthesis following the name of each commodity. Only four of Kauai's high value yield commodities are compared with statewide averages, as data for Kauai's other commodities are not available.⁵

Starfruits, rambutan and longan are still in their early phase of commercial production in Hawaii, as they have just appeared in the market and are not widely visible. The relatively small amount of total supply in the Honolulu market, revealed in Table 2, indicates that these products either have a limited market or still in their early stage of marketing. Thus their existing per pound dollar value may still be unstable. That is, per unit dollar value sold in the market may be too high. The cases of longan and rambutan, their prices in the market, as of April 2005, are most likely too high to be used for profitability calculation in making an investment decision.

Table 1 Hawaii's Crops with High Dollar Value Yield

Selected Crops, valued at farm gate prices

Commodities	Acre Specification	Statewide Average		Kauai Average	
		lbs/acre	\$/acre	lbs/acre	\$/acre
1. Ginger Root (00-04) ^a	Acre Harvested	44,500	25,899	na ^b	na
2. Tomatoes (99-03)	Acre Harvested	32,500	17,245	na	na
3. Seed Crops (99-03)	Total Acre ^c	1,593 ^d	12,880	na	na
4. Pineapples (00-04)	Acre Used	34,016	10,453	na	na
5. Papayas (99-03)	Acre Harvested	27,241	8,105	26,413	10,358 ^e
6. Taro (00-04)	Acre In Crop	14,850	7,951	16,534	8,750
7. Vegetables & Melons (99-03)	Acre Harvested	14,864	7,302	6,508	6,482
8. Cucumbers (99-03) ^f	Acre Harvested	13,775	6,201	18,058	8,320
9. Starfruit (99-03)	Acre Harvested	1,882	5,482	na	na
10. Rambutan (99-03)	Acre Harvested	5,358	5,045	na	na
11. Longan (00-03)	Acre Harvested	1,473	5,009	na	na

Data Source: Calculated from data reported in "Statistics of Hawaii Agriculture 2002" and other commodity annual summary reports, HAS. Notes: For those values that are reported by measures other than per acre harvested are due to the lack of data. ^a Numbers in each parenthesis indicate a period for which the average is calculated. For example, (00-04) indicates that the statewide and Kauai averages are for the 2000-2004 period. ^b There is no report for Kauai, see footnote 5. ^c Total acre refers to the total acre owned and leased by seed crop farms. ^d This is outshipment volume only; part of the output is normally retained for research activity. ^e Value is combined with Maui. ^f Figures for cucumber are Kauai and Hawaii combined.

Figure 1 shows Kauai's farm productivity, in dollar term, relative to state's average for selected commodities, with some not included in Table 1.⁶ On a per acre dollar value basis, yield for some products (papayas, cucumbers, sweet potatoes, green beans, sweet corn, watermelons) shown as Kauai's are combined with other counties. Although the values for these products do

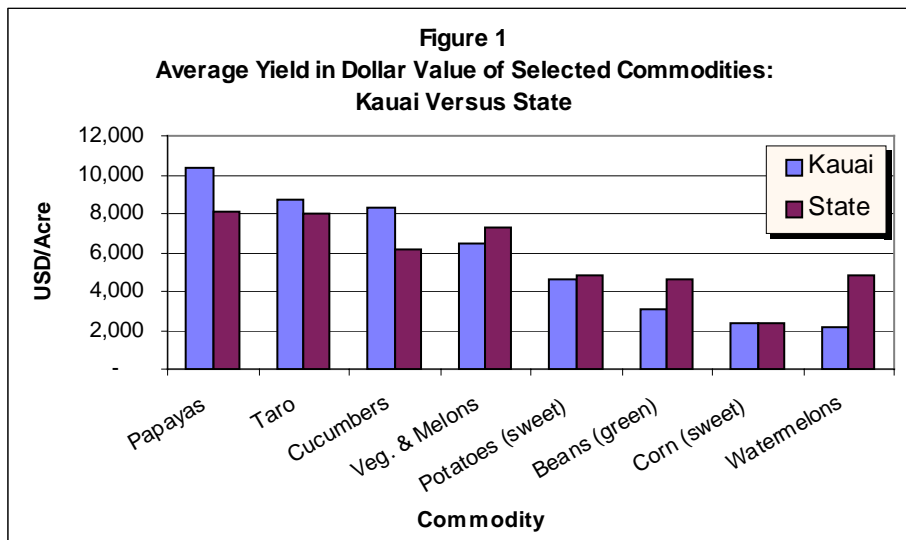
⁴ The list in the table is by no mean exhaustive. There may be other, relatively new products that produced above this dollar value yield, but are not included in the Hawaii's agricultural statistics.

⁵ In some cases, HAS refrains from reporting county data in order to avoid disclosure of specific operations. This usually applies to a case in which there are few operations in any given county.

⁶ Selection is based on data availability.

not represent Kauai’s competitiveness, they are still useful for assessing Kauai’s competitiveness. For instance, Kauai’s yield for watermelon is combined with Hawaii and Maui. Since Honolulu is the only county remaining, the higher state’s average yield must be due to Honolulu. Thus, a farmer can be cautioned about whether he should grow watermelon in Kekaha and hope to sell his product in Honolulu. A similar precaution can be made for green bean.

Other products that may thrive in the market if they are fertile in the Kekaha agricultural land can be inferred from the Honolulu market supply data collected by the Market News Section, ADD, HDOA. Commodities that have been shipped from Kauai to supply the Honolulu market are shown in Table 2. Kauai, where 4.8% of Hawaii’s 1.2 million residents lived in 2000 and 10.6% of approximately 60.1 million total state’s visitor days spent in 2002, has relatively small share in the total intrastate inshipment to Honolulu market in 2004 for all products familiar to the Honolulu consumers, except for wet land taro for poi processing, which had 92.8% market share. Other products that Kauai has relatively large share in Honolulu market include longan (47.7%), rambutan (27.8%), starfruit (81.8%), and caimito (100%). These latter products are relatively new to the Honolulu consumers, and the market demand for them in 2004, as indicated in the far right column in Table 2, was relatively limited.



Data Source: Calculated from data reported in “Statistics of Hawaii Agriculture 2002” and other commodity annual summary reports, HAS. **Notes:** Papayas: Averaging over 1999-03; Kauai and Maui combined. Taro (fresh and processed): Averaging over 2000-04. Cucumbers: Averaging over 1999-03; Kauai and Hawaii combined. Vegetables and Melons: Averaging over 1999-03. Sweet Potatoes: Averaging over 1998-02; Kauai, Hawaii and Honolulu combined. Beans (green): Averaging over 1998-02; Kauai and Hawaii combined. Corn (sweet): Averaging over 1998-02; Kauai and Hawaii combined. Watermelon: Averaging over 1998-02; Kauai, Maui and Hawaii combined.

Revealed Competitiveness

Kauai’s share of the total in-state supply in the Honolulu market in 2004 for processed lettuce (28.7%) was relatively large, but its share in the Honolulu total market supply of 6.06 million pounds, which includes imports from the Mainland, was a tiny fraction 0.1% (Table 2). The relatively high share in the in-state supply reveals that Kauai is competitive in producing

processed lettuce relative to other counties, while its' very low share in Honolulu's total market supply indicates that there is an opportunity for import substitution of processed lettuce in the Honolulu market. Table 2 also indicates that Kauai has revealed competitive advantage in sweet corn and seedless melon, as well as room for producers in Kauai to compete with the Mainland imports in the Honolulu market.

It is noticeable that the only product for which Kauai clearly has a competitive advantage over other counties is taro, which Kauai has higher per acre yield than state's average in both output and dollar value (indicated in Table 1). For taro, Kauai has a substantially large share in the Honolulu total market supply in 2004, 92.8%. For cucumber, which Kauai seems to have higher per acre yield than other counties in both output and dollar value, Kauai's share in the in-state supply and total supply in the Honolulu market was only 0.8% and 0.7%, respectively. In 2004, 76.5% of the 2.5 million pounds of cucumber in the Honolulu market came from Maui County. Specifically, 74.8% of the 2.5 million pounds came from Molokai, part of Maui County.

Table 2 Kauai's Share in Honolulu Market: 2004
(Volume)

Commodities	% of State's Supply	% of Total Market Supply	Total Market Supply in Honolulu (1,000 lbs)
1 Avocados	8.8	2.6	1,845.2
2 Guava (processed)	0.01	0.0	1,619.6
3 Longan	47.7	21.2	15.7
4 Lychee	0.3	0.0	93.5
5 Papayas	0.2	0.2	14,597.6
6 Pineapples	0.05	0.0	17,268.8
7 Rambutan	27.8	27.4	18.7
8 Starfruit	81.8	16.6	15.8
9 Tangelo	0.4	0.0	138.2
10 Beans (green)	0.02	0.0	596.7
11 Cabbage (Chinese)	na	na	5,611.7
12 Cabbage (head)	na	na	8,681.6
13 Cabbage (Pak Choi)	0.2	0.1	356.2
14 Caimito	100.0	100.0	0.01
15 Corn (sweet)	17.1	1.4	1,315.1
16 Cucumbers	0.8	0.7	2,472.7
17 Ginger Root	1.1	0.9	1,102.7
18 Lettuce (head and semi-head)	na	na	7,290.4
19 Lettuce (processed)	28.7	0.1	6,062.7
20 Lettuce (specialty)	2.1	0.1	667.1
21 Luau Leaf	0.1	0.1	83.7
22 Melon (seedless)	100.0	21.5	1,946.3
23 Melon (watermelon)	0.7	0.6	5,990.9
24 Potato (sweet)	0.1	0.1	3,040.6
25 Taro (processed, poi,)	92.8	92.8	2,799.6
26 Tomatoes	0.01	0.0	8,415.8
27 Unspecified	14.1	0.1	21,438.8

Data Source: Market News Section, ADD, HDOA

4 Economic Potential of the Kekaha Former Sugar Land

Given the existing infrastructure (irrigation system, hydroelectricity power stations, road ways and other support structures) left by the former Kekaha Sugar Company and a favorable climate for crop production, the Kekaha agricultural land has considerable potential to generate income and employment for the people of Hawaii. The question is not whether it will make a positive net contribution to the state's economy. Rather, it is by how much could the Kekaha agricultural land contribute to the county's and state's economy. The answer lies upon how the land is used and for what commodities it is used to produce.

Hawaii's agricultural trend is one of increasing product diversification, necessitated by the changing market forces that resulted in a decline of sugar and pineapple plantations, which have dominated state's agricultural landscape for more than a century. Diversified agriculture has been a force of growth in Hawaii's agriculture for more than a decade and is widely accepted as a way of assuring state's agricultural needs. Thus, this paper examines the economic potential of the Kekaha agricultural land in question consistent with on-going agricultural trend in Hawaii. Because the term "diversified agriculture" can be interpreted slightly differently by individuals of different occupation and professional background, to avoid misunderstanding, the meaning of the term "diversified agriculture" in this report is clarified.

Diversified agriculture is generally understood as agriculture that is characterized by multiple product varieties. In Hawaii, it is viewed as agriculture comprising of a variety of profitable agricultural products that are replacing sugarcane and pineapple plantations, which have become increasingly less profitable. There is a difference in perspective regarding diversified agriculture between a farmer, region, and state. For a particular farmer, diversified agriculture means producing a variety of crops and, in some cases, including crop rotation. Thus, a farmer producing a single crop on a sizeable agricultural land is not diversifying his business. If it happens that this farmer is the only one in an agricultural region of any county, then the region is not diversifying its agriculture. Nonetheless, given such a scenario, state would still be diversifying agriculture as long as there are many other farmers producing many other products in other agricultural regions in the state. Thus, even if there were only a single type of crop being grown in the entire Kekaha agricultural land by a single producer, as long as it is not sugarcane and pineapple, Hawaii's agriculture is being diversified while Kekaha's agriculture is not.

However, Kekaha former sugar land has actually been diversified. As of April 2005, six legitimate farm tenants, with five active, producing more than five crop varieties commercially, occupied most of the more productive 7,758 acres former sugar land. However, approximately 46% of that would become unutilized as the phasing out of Gay & Robinson's sugarcane cultivation approaches completion by the end of 2005. Although part of the remaining land within the 12,592 acres, after subtracting 7,758 acres, has not been cultivated by the Kekaha Sugar Company, it may be productive for certain crops and other agricultural products.

Estimation Method

While both actual and potential production capacities are important information, for several reasons, the estimation emphasizes *potential* economic contributions of the land. First, while an estimation of the actual production would be useful for evaluating resource utilization, or for establishing a basis for tax, or for GSP estimation purpose, they are not the purposes of this study. Nonetheless, the estimations of actual farm production value for 2002 and 2004 are attempted and summarized in [Table 3](#) for comparison with the corresponding potential values. Second, this study takes the economic asset management perspective. As Kekaha former sugar land is in transition, an objective analysis of its potential will be useful for decision making by policy makers and the management agency, ADC, for management planning and execution.

Two levels of potential economic contributions of the former sugar land are estimated: direct contributions and total contributions. **Direct contributions** include farm output value and farm employment. **Total contributions** to the economy by farm operations in the Kekaha former sugar land include farm output value plus economic value produced through the linkages effects, to be explained further later, and farm and non-farm employment.

Estimates for potential direct economic contributions of the Kekaha former sugar land are based on land area, Kauai and state average yield and price for each crop. Each farmer is assumed to be able to achieve an average yield for each crop by using common farm practices, management and technology that are common to farmers in Kauai and elsewhere in State of Hawaii and sell output at an average price specific to Kauai or State of Hawaii. The area of land used in the estimation is for the 7,758 acres, which are considered to be among the most productive land within the 12,592 acres complex under ADC's control. Land productivity is assumed to be identical for each acre. Estimates for potential total economic contributions of farm operations originated in the Kekaha former sugar land are based on the estimates of direct economic contributions and multiplier coefficients produced by DBEDT and adjusted for Kekaha's agricultural production context.

To minimize the effects of annual yield and price fluctuations, both the average yields and average prices used for estimation are the averages of annual averages across farms over a five-year period. For sugarcane and vegetables and melons, yield and price averages are Kauai-specific; for seed crops, due to the lack of Kauai-specific data, they are statewide averages.⁷

Readers should be aware that although HAS's data are used to calculate the averages used for estimation, the estimated results for any given commodity and year in this study are differ from those of HAS, for three reasons. First, the average yield used in this study is the average of HAS's average yield in each year over five years. Second, the average yield used in this study is the output volume per acre of "area in crop" or "area use" based on leasehold, not on output volume per acre of "area harvest." To account for the opportunity cost of agricultural land, farm output is estimated based on the "total acreage holding or use" rather than on the "total acreage harvest" or "total acreage farm." HAS output per acre is based on harvested or bearing acres. Depending on individual farm practices, land area under the lease that is not farmed may serve

⁷ Per acre yield in output for crops used in the estimation are derived from HAS's annual reports, calculated in terms of yield per "acre in crop" and "acre use," not in terms of per acre harvest as commonly reported by HAS.

various functions for the area that is farmed, such as roadway, buffer zone (to prevent cross-breeding), wind blocker, etc. Whether or not all acres under the lease are used for any purpose, once the land is taken by one farmer it is no longer available for others. Third, the estimation in this study emphasizes the potential economic value of an agricultural production asset while HAS's estimates are for actual output of the past.

Interviews of existing farm tenants were made in mid-April 2005 as part of the overall assessment of production and employment possibilities of the farmland and its infrastructure. Complementing the interviews used for the analysis are published and unpublished data from various units within the HDOA and published data from the National Agriculture Statistics Service.

Direct Potential Economic Contributions

[Table 3](#) provides a picture of economic potential of the Kekaha agricultural land in terms of farm output value—farm output measured at average farm gate prices—and employment creation. All farm potential output values are estimated based on land holding (row 9), crop types (row 10), and average yields and prices as explained earlier.

In 2002, with approximately 5,000 acres allocated for sugarcane, seed crops, vegetables and melons, the aggregate potential farm output value is estimated at \$19.5 million (row 1). Actual output value in aggregate is estimated to be in the range of 75-80% of the potential value (row 2). All together, farm operations in 2002 employed approximately 387 jobs, with 112 full-time, and 275 part-time and seasonal jobs. Although shrimp and other crops were already grown there, they are not included in the estimate due to inadequate data. Sugarcane operation is phasing out, thus its output value estimated in [Table 3](#) is declining in each year and approaching zero by the end of 2005. The company will retain 400 acres for sugar seed crop.

In 2004, six farm entities occupied 7,122 acres of the former sugar plantation, with 6,689 acres under the lease for crop production and 433 acres for aquaculture. The assessment is made for cropland area held by four companies only. They include Gay & Robinson (sugar), Pioneer (seed crop), Syngenta (seed crop), and Wally Johnson (seed crop, fruits, vegetables & melons). Ceatech (shrimp farm) and Wines of Kauai are excluded from the estimation due to inadequate data.⁸ Given the total leasehold, average yields and prices as explained earlier, the combined potential output by the four farms in 2004 is estimated at \$34.9 million ([Table 3](#)).⁹ Crops grown by the four farms used in the estimation include sugar, seed crops, and vegetables & melons. The actual production value in 2004 is estimated to be in the range of 47-57% of the potential value. Although actual production as a percent of land potential capacity declined between 2002 and 2004, because of some existing tenants acquired more land faster than they could farm, the actual value of production increased moderately over this period. Farm operations by the four companies employed 375 workers in total in 2004, including 100 full-time, 275 part-time and

⁸ Nature of operation, cost and market constraints for shrimp farms are different from crop farms. The Wines of Kauai project is in its infancy and grape wine production is uncommon for Kauai, and data for grape wine production and price in Hawaii are not available.

⁹ Both yields and prices used for estimation are the averages over time (1999-2003) of the annual averages across farms.

seasonal workers. The number of employment declined due to the phasing out of sugar plantation. Among the full-time jobs, 19 were managerial and professional positions, 38 skilled technical positions, and 43 hourly-paid laborers. Part-time workers worked between 30 and 35 hours per week throughout the year. Seasonal workers worked between two and a half and six months, depending on which farm they employed at.

By 2010, aggregate potential farm output value could grow to between \$38.4 million (2010a) and \$50.8 million (2010b), and farm jobs, between 405 (2010a) and 513 (2010b), depending on land use and types of crop grown. Crop types used in the estimation are based on existing crops being grown there and have proven commercially successful and the existing tenants' future investment plans. In both 2010a and 2010b cases, 3,150 acres are assumed used for seed crops. While only 350 acres are assumed used productively for vegetables and melons in the 2010a scenario, in the 2010b scenario, 4,175 acres are assumed used for vegetables and melons. Land leased by Ceatech is excluded from the estimation. The remaining land (of the 12,592 acres) is assumed left idled, although it may be productive for certain crops and agricultural activities.

The smaller two of the four companies experienced actual output growth of approximately 30% and 67% each between 2002 and 2004. Each of the two companies plans to double or tripple production in Kekaha in the next five years. If these tenants could achieve their growth target as planned, the aggregate actual output would be in the neighborhood of 60-70% of the potential output value in column 2010a.

**Table 3 Economic Potential of the Former Kekaha Sugar Land:
 Direct and Total Contributions to Hawaii's Economy**

	Direct Contribution (Farm output and jobs)				Total Contribution	
	2002	2004	2010a	2010b	2010a	2010b
1. Potential Output Value (\$ million)	19.5	34.9	38.4	50.8	71	95
2. Actual Output Value (% of Potential)	75-80%	47-57%	60-70% ^a	na	na	na
3. Total Number of Jobs (actual & potential): ^b	387	375	405	513	834	1,056
4. Full-Time	112	100	60	73	na	na
5. Part-Time and Seasonal	275	275	345	440	na	na
6. Managerial/Professional (all Full-Time)	na	19	na	na	na	na
7. Skilled Technical (all Full-Time)	na	38	na	na	na	na
8. Laborer (Full- and Part-Time and Seasonal)	na	318	na	na	na	na
9. Total Acreage of Cropland Held by Tenants ^c	5,000	6,172	3,500	7,325	3,500	7,325
10. Types of Crop Grown	Sugarcane Seed crops Vegetables & Melons	Sugarcane Seed crops Vegetables & Melons	Seed crops Fruits Vegetables & Melons	Seed crops Fruits Vegetables & Melons	Seed crops Fruits Vegetables & Melons	Seed crops Fruits Vegetables & Melons

Notes: ^a This is an expected actual output value in aggregate based on existing tenants' growth plan. ^b Number of jobs for 2002 and 2004 are estimates of actual farm employment. For 2010, they are estimates of potential job creation. ^c Total acreages for 2002 and 2004 are based on leasehold of the four farms used in the estimation; for 2010a, the total acreage is based on business plans of the existing tenants; and for 2010b, it is the total acreage of the readily arable and most productive cropland of the 12,592 acres, with a hypothetical land allocation. Farm yields and prices of crops used for estimation are Kauai's averages, except for seed crops, which are statewide averages.

The estimated potential farm output values are based on a set of assumptions regarding land, productivity, farm practice and technology, and price as described earlier. However, whether the

potential farm output values will be realized will depend on various constraints including market limitations, pests that may arise as production expands, and the required skilled labors. Vegetables and melons as a group is used in the estimation because it's already being grown in Kekaha, proven profitable in Kauai, widely consumed by Hawaii residents, and is exportable. Expanding the production of existing products, as long as there is more room in the market for them, is a safer route than trying something unfamiliar to neither producers nor consumers. Data in section 3 offer a preliminary indication that there may be more room in the market for certain vegetables, melons and fruits to grow. However, a detailed market study for each crop is required before any conclusion can be made regarding market constraints. In addition, it should not be interpreted that this study recommends vegetables and melons for Kekaha, nor does it provides any indication that vegetables and melons will take half of the Kekaha agricultural landscape in the next 5-10 years. Ornamental plants, including flowers and potted plants, and other crops may thrive in Kekaha. For a number of reasons, such as changes in the market conditions, technology and input costs, crops that are profitable today may become unprofitable in the future. For the same reasons, crops that are not in the market today may be popular in the future.

Total Potential Economic Contribution

Beyond its direct contribution to the state's economy in the form of farm income and farm jobs, farm activities also create demand for various types of farm inputs including tools, machinery, equipment, fertilizers, pesticides, materials, and services. Farm products are also used by manufacturers and eatery and tour-related businesses. In addition, the farm itself is used for tourism. Incomes earned by farm workers and all others whose job either supplying farm inputs or using farm outputs will be spent and further induced growth in income and employment elsewhere. These phenomena are called the *multiplier* or *linkage* effects. In order to assess the total potential contribution of the Kekaha former sugar land, these linkages effects must be accounted for.

For this purpose, output and job multipliers for vegetables and other agricultural products, estimated by DBEDT, are employed.¹⁰ Take the weighted average of the two multipliers according to their estimated shares in the Kekaha agricultural land yields output and job multipliers for Kekaha's farm production. Applying these multipliers, which have been adjusted for Kekaha, the total potential contributions of the Kekaha former sugar land to state's economy are derived and summarized in the far right columns in [Table 3](#).¹¹ With the linkages effects, farm production originated in the Kekaha former sugar land could contribute to the GSP between \$71 million and \$95 million and to state's employment between 834 and 1,056 farm and non-farm jobs.

5 Constraints and Challenges

Kekaha former sugar land is an ideal place for agricultural production. The relative dryness of the region together with isolation is a natural pest control condition. Yet the irrigation system that is in place, which was designed specifically for the sugarcane plantation that uses

¹⁰ Only type 2 multipliers, as defined by DBEDT, are considered.

¹¹ The (Type 2) output and job multipliers for 2010a are respectively 1.84 and 2.06, and for 2010b, 1.89 and 2.06.

water approximately three times the amount the average tropical farm products need, allows farm operators to have a better control of the amount of water in the field. This condition allows farmer to have better control of the farm environment. However, farmers in Kauai in general face relatively high input costs, a limited local market, and an extra cost for transporting goods to the markets outside the island.

Advantages and Disadvantages for Farm Operations in Kekaha: There are advantages as well as disadvantages for farm operations in Kekaha, and in Kauai in general. The existing land rental rates, which are determined by size and type of crop to be grown, administered by ADC are low relative to other agricultural lease land both in Kauai and elsewhere in Hawaii. The extensive irrigation system and natural climate in the region allow farmers to have better control of the farm environment. Relatively low-cost irrigation water and hydroelectricity available within the property are both exceptional advantages farm tenants have.

Major advantages and disadvantages associated with farm operations in the subject Kekaha land can be summarized as follows:

Advantages:

- Good climate and soil condition allowing longer production period within a year
- Abundant water supply through the irrigation network
- Availability of relatively low-cost hydroelectricity
- Relatively low rent
- Isolation –natural pest control

Disadvantages:

- Limited supply of farm workers
- Extra transportation cost to major markets, but should diminish with the supper ferry in operation beginning in 2007
- Relatively high input cost
- Relatively small local market

Diversification Constraint: Crop diversification, if properly practiced, could be useful for controlling pests and diseases, maintaining soil quality, and for mitigating the negative impact of market disturbances. However, careless crop diversification in a given region could also complicate pest and disease problems, hampering productivity. An introduction of a new crop or growing an existing crop of certain type at a certain time of the year could complicate pest control for the existing crops nearby. Such potential problem can be prevented through a cooperative effort among farmers in the same region by refraining from growing certain crops completely or at a certain time of the year, among others. For instance, seed crop farmers in Kekaha today control pests by limiting the amount of soybeans grown, and reserving the months of August and September as a corn-free period. Even if chemical pest control method is applied, cooperation among farmers in the same region is required for effectiveness in many cases. Without cooperation, there is room for pests to develop resistance to chemical by hopping across farms.

Because, in a diversified agricultural context, effective pest control requires cooperation among farmers, an increase in the number of either farmers that compete for the same market or farmers that produce different variety of crops would likely increase difficulties and costs associated with maintaining cooperation.

Cost Constraint: Based on the 2002 *Census of Agriculture*, Kauai had lower farm operation expenses per acre of cropland, as well as per acre of harvested cropland, than any other island counties (Table 4). These statistics seem to contradict the general perception about Kauai’s production costs, as prices of goods, including gasoline, are generally higher than elsewhere in the state.

Kauai’s relatively low total operation expenses per acre of cropland, on average, was a result of the county’s lower per acre expenses on seeds, livestock, feed, utilities, contract labor, depreciation, and “other expenses” (details in Appendix 3). This may be attributed to low utilization of purchased inputs, to the type of farm operations, possibly to cultural practices, and not to efficiency. Despite the county’s lower per acre operation expenditures, Kauai was the only county with a negative net cash income of farm operation (\$30 per acre of cropland) in 2002. In contrast, Honolulu, which had the highest expenses per acre of cropland, also had the highest net cash income of operation per acre of cropland (Table 4).

**Table 4 State of Hawaii's Agricultural Status 2002:
 Cross-County Competitiveness Comparison**

	State	Hawaii	Honolulu	Kauai	Maui
Farm operation expenses per acre of harvested cropland (\$)	4,120	2,907	9,430	3,921	4,000
Farm operation expenses per acre of cropland (\$)	2,136	1,778	4,458	1,513	1,871
Operation Expenses-Product Value Ratio*	0.85	0.86	0.72	1.10	0.91
Net cash income of operation per acre of cropland	465	379	1,799	(30)	203
Government payment as %share of total operation expenses	0.002	0.002	0.000	0.004	0.002
Irrigated land as % of cropland	32.8	10.0	47.1	64.2	44.2
Number of farms with 180 acres and above as %share of the total number of farms within own jurisdiction	5.82	5.66	4.28	8.50	6.08

*Total farm operation expenses divided by total value of products sold. Data Source: Calculated from data reported in the 2002 *Census of Agriculture, Hawaii State and County Data*, NASS.

An explanation to Kauai’s negative net cash income is the county’s high total expenses per dollar worth of output sold, at \$1.10 (Table 4). This is attributed to a combination of relatively low yields and high expenses on fertilizers, lime and soil conditioners; gasoline fuel and oil; supplies, repairs, and maintenance; machinery and equipment rental; property taxes (see Appendix 3). As a percent share in county’s own total operation expenses, Kauai’s expenses on these items were higher than those of any other county. With more than 64% of total cropland irrigated, Kauai is also most extensively irrigated than any other county in Hawaii (Table 4). Maintaining the irrigation system is costly.

Market Constraint: Kauai’s small population is a natural barrier to commercial farming on the island. In 2003, with about 60,747 residents, Kauai’s population made up only 4.8% of Hawaii’s total population (DBEDT). In 2003, the island hosted 11.07% of state’s 58.78 million total visitor days. Visitors’ share in state’s total consumption of fresh produces in 2003 is 11.35%.¹² With such a limited local market, farmers in Kauai must rely on export markets (defined as any market beyond the island county).

¹² Southichack, August 2005.

Diversifying agriculture means searching for new products that are profitable, and it usually requires a new idea, which may require new farmers. Certain products that are known to be fertile in Hawaii soil and climate already have established markets and others do not. If there were an abundant supply of products that are already established in the market, new farmers would have to come up with new products, which must pass through experimentation on both production and marketing in order to achieve a relatively stable supply and consistent quality. Under such a situation, new farmers would cautiously start farm operations with relatively small initial investment and land area. Given the relatively high input and transportation costs between the farm and the market destinations beyond the island of Kauai, the variety of agricultural products that can be profitably grown in Kekaha is limited. Large investment requires large and ready markets for the products to be produced. Thus, given the island's unique situations (as well as Hawaii as a whole), if the minimum land lease size is designed for large investment projects to keep down cost associated with management and monitoring, much agricultural land may be sat unutilized over a long period of time. This poses a challenge for the land management agency, ADC.

ADC's Challenge: The number of farmers occupying the land could have a significant implication on the cost and effectiveness of management. Property management and monitoring cost tends to be lower, the smaller the number of tenants. However, both advantages and disadvantages exist whether the number of tenants is large or small. While it is less costly for the ADC to deal with a few large mono-cropping tenants, a business downturn resulting in bankruptcy and departure of a large tenant could be costly in terms of lost rent revenue and cost associated with finding a new tenant. On the other hand, with a relative large number of small tenants, management and monitoring costs would be higher than with a few large tenants. However, the departure of a small tenant would have a relatively small impact on the land manager's rent revenue. Considering food safety and environmental impact of farm operations (i.e., from the application of pesticides), the larger the number of farmers tends to raise costs associated with monitoring and control. Although these costs will be mostly absorbed by the farmers themselves and the HDOA, part of the cost could be transferred to ADC if some historically good (paying) tenants decided to leave due to problems associated with pest control and contamination.

The Sunshine Markets (Farmers Markets), as they are called in Kauai, although will probably never become the ultimate outlets where diversified agricultural products are sold at a level that sustain Hawaii's agriculture economy, they are useful for both new farms with new products and established products. Sunshine markets are useful outlets in the initial stage of marketing experimentation for certain new products. They are also good marketing tools for all of Hawaii agricultural products, as they are known to be tourist attraction, especially for Kauai. Based on the surveys of four markets, conducted in mid-April 2005, Sunshine markets are frequented by locals, island visitors and vacationers who have kitchen facilities.¹³ Prices were highly varied. Certain fruits (mangoes, pineapples, longans) were sold at much higher prices than in the supermarket. Each market was small, but the buying traffic (turnover) was rapid in each market visited. Based on 15-minute counts of the number of buyers leaving the market with goods

¹³ Surveys were conducted on Saturday, April 16, 2005. Three private-run and one county-run Sunshine Markets were visited (Kekaha—County-run, Wailua, Hanalei, and Kilauea).

bought, roughly, the total value of goods sold per minute in each market could be anywhere between \$50 and \$200. Some vendors were seen to have moved from one market to another in the same day, as each market lasted two to three hours. Total sales value in 2004 from the county-run Sunshine Markets alone was reported at \$405,000. Although the reported figure is small, which the County's official in charge of the market operation admittedly to be much underreported, it grew 157% between 1990 and 2004.¹⁴

The University of Hawaii's College of Tropical Agriculture and Human Resources (UH-CTAHR) has proposed an incubator facility in Kekaha in cooperation with ADC, which could occupy between 100 and 500 acres. The incubator facility is to allow the university to provide technical and infrastructure assistances to start-up farmers. The program has the potential to promote growth in diversified agriculture and complementary industries (e.g. processing, tourism) and may put a vast area of fallow lands in Hawaii State back into productive use and increase greenery in Hawaii's landscape. However, the program is not costless. A number of factors must be taken into consideration in deciding where the incubator program is to be located. The state of Hawaii owns vast areas of fallowed land, left by the demise of sugar plantations at different locations. If there were enough paying-tenants to occupy all the farmable acreage in the Kekaha agricultural land in question, it may be in the best interest of the state to consider the possibility of locating the program elsewhere. By its definition and purpose, if it requires public funding, the establishment of an incubator program would be justified only if there is a vast excess agricultural land left unutilized. The program should not crowd out the private sector. In determining its location, the opportunity cost of land in which it would occupy must be considered in addition to other parts of the cost.

Potential Water Shortages and Floods: Water shortages occurred for sugar plantation in some years during the dry season. However, existing farmers that are growing seed crops and other diversified products there have never experienced water shortage and, according to the interviews, in fact there has been more water available than needed. Flooding, nonetheless, could become a problem especially during the storm season if the drainage system is not properly maintained. Currently, excess water must be pumped out 24 hours with two pumping stations using hydroelectric power generated within the subject land to keep down the groundwater table to prevent possible root rots. During storm season, with five inches of rain in one day would result in flooding. These pumping stations help shorten the time required for the water table to return to its normal level. Although there is a good drainage system in place, a heavy storm similar to the Iniki that hit the island in the early 1990s could result in serious damages.

The Unexpected: A shrimp farm has experienced the so-called white spot syndrome virus, which forced the farm operator to destroy its two million shrimps and close down its operation in 2004. However, the farm has been officially declared clean and a new investor is set to renew operations in 2006.

¹⁴ An interview was made on April 15, 2005 with an Economic Development Specialist of the Kauai County's Office of Economic Development, C. W. "Bill" Spitz, who also supplied official data.

6 Conclusion

Given the existing infrastructure left by the former Kekaha Sugar Company (KSC) and a favorable climate, the Kekaha agricultural land has considerable potential in generating income and employment for the people of Hawaii. The actual contribution of Kekaha agricultural land to the county's and state's economy would ultimately depend upon land use and types of crop grown.

Since the KSC officially closed down its plantation operations in 2001, seed crops, with corn comprising of more than 90% of the total, melons, mangoes, and vegetables have been grown successfully there. Shrimp farming has been attempted, but the operation continues to face challenges such as the need for capital infusion and white spot syndrome virus. The Wines of Kauai project is at its infancy. The remaining sugarcane operations under Gay and Robinson are phasing out and will finally complete by the end of 2005. The company will retain 400 acres for sugar seed crop. The future of Kekaha's former sugar land tends toward seed crops and other diversified products.

The combined output potential of all farms, excluding shrimp farm and Wines of Kauai, increased as a result of land acquisition by some existing tenants, from \$19.5 million in 2002 to \$34.9 million in 2004 (Table 3), valued at average farm gate prices. The actual output value in aggregate has also increased moderately, from a range of \$14.7-\$15.6 million in 2002 to a range of \$16.4-\$19.9 million in 2004. Due to rapid capacity expansion, based on leases, the combined actual output value as percent of its potential declined from a range of 75-80% in 2002 to 47-57% in 2004. Farm employment, however, declined slightly over this brief period due to the phasing out of the remaining sugar plantation, from 387 to 375 full- and part-time positions. In 2004, there were 100 full-time and 275 part-time and seasonal workers. Among the full-time jobs, 19 were managerial and professional positions, 38 skilled technical positions, and 43 hourly-paid laborers. Part-time workers worked between 30 and 35 hours per week throughout the year. Seasonal workers worked between two and a half and six months, depending on which farm they employed at.

Based on the land area existing tenants intend to hold, by 2010, the potential farm output could in aggregate grow to approximately \$38.4 million, providing 405 farm jobs in total, with 60 full-time and 345 part-time and seasonal jobs. However, based on the estimated actual output in 2004 combining with existing farms' expansion plans, actual output could be in the range of 60-70% of its potential in the 2010a scenario. With the multiplier effects, farm activities originated in Kekaha's former sugar land could contribute approximately \$71 million in total to Hawaii's GSP and provide about 834 full-time and part-time jobs. If 7,325 acres that are considered most productive and readily arable cropland of the 12,592 acres were fully utilized, the farm gate value of output in aggregate could rise to approximately \$50.8 million, providing about 73 full-time and 440 part-time and seasonal jobs. With the multiplier effects, the Kekaha former sugar land could contribute about \$95 million in total to the GSP and provide about 1,056 full-time and part-time jobs.

Products used in the estimation are neither by any mean what this study recommends, nor does this study provides any indication that vegetables and melons will take half of the Kekaha agricultural landscape in the next 5-10 years. They are used for the estimation because they are already being grown there and have proven commercially successful in Hawaii. For many reasons, such as changes in the market conditions, technology and input costs, crops that are profitable today may become unprofitable in the future. For the same reason, crops that are not in the market today may be popular in the future.

Major advantages for farm operations in Kekaha include relatively long annual production period, relatively low rent, abundant and inexpensive water supply and hydroelectricity power generated from the irrigation system. Disadvantages include a limited local market, relatively high input costs, and scarce skilled farm workers. The extra costs for shipping in the many necessary inputs and shipping out the products are major constraints for farming in Kauai.

The major challenge for ADC, as a managing agent, is to find ways to maximize the potential of the land as agricultural production asset to generate income and employment for Hawaii's residents. Currently, all tenants have revocable permits, which is renewable annually. The long-term lease ADC is considering to issue is an important step to encourage investment. Given Hawaii's unique situations, which includes both constraints and advantages, together with farm practices and complexities involved in product quality control and pest management that farmers must deal with, managing the number and type of tenants in the Kekaha agricultural land may prove to be the most challenging point for ADC. A minimum land size requirement that is too large for leasing, designed to keep the number of tenants small, could result in much of the land being left idle while small farmers who need farm land the size less than the existing minimum requirement of 300 acres would be left out. On the other hand, too many small, independent farms producing diversified products in a given region could create logistical problems associated with pest control, which could affect crop yields in the whole area, as well as food safety.

Interviews:

Mr. Alfredo Lee, Executive Director, Agribusiness Development Corporation, State of Hawaii.

Mr. C. W. "Bill" Spitz, Economic Development Specialist, Office of Economic Development, Kauai County.

Mr. Charles Okamoto, Director of Finance & Property Management, Gay & Robinson.

Mr. Kenny Chicoine of Syngenta Seeds, Inc.

Mr. Maurice Munechika, Wines of Kauai.

Mr. Steven Kai, Plant Manager, Parent Seed-Kekaha, Pioneer Supply Management, Poineer.

Mr. Wally Johnson of Far West Ag.

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Appendix 1 Kauai's Agricultural Production and Yield in Comparison with State's Average Yield for Selected Commodities

Commodities	Kauai					State of Hawaii			
	Farm Production Value in Latest Year (\$1,000)	% Share in State's Total Farm Production Value in Latest Year	Average Farm Price Over a Specified Period (\$/lb)	Average Yield Over a Specified Period (lbs/acre)	Average Yield Over a Specified Period (\$/acre)	Average Farm Price Over a Specified Period (\$/lb)	Average Yield Over a Specified Period (lbs/acre)	Average Yield Over a Specified Period (\$/acre)	
1. Floriculture & Nursery (2003)	3,203	3.3	na	na	na	na	na	na	1.
2. Cut flowers [1]	268	1.9	na	na	na	na	na	na	2.
3. Orchids [2]	459	1.9	na	na	na	na	na	na	3.
4. Potted flowering plants	148	2.6	na	na	na	na	na	na	4.
5. Other nursery products [3]	2,198	7.0	na	na	na	na	na	na	5.
6. Fruits (2003, including pineapple)	1,739	1.3	na	na	na	na	na	na	6.
7. Avocados (99-03)	na	na	na	na	na	0.6	2,680	1,570	7.
8. Guava (proc., 99-03)	na	na	na	na	na	0.1	19,433	2,635	8.
9. Longan (00-03)	na	na	na	na	na	3.4	1,473	5,009	9.
10. Lychee (99, 02-03)	na	na	na	na	na	2.8	1,095	3,027	10.
11. Papayas (98-02)	482	4.0	0.4	23,840	8,969	0.3	25,720	8,354	11.
12. Pineapples (00-04)	na	na	na	na	na	0.3	34,016	10,453	12.
13. Rambutan (99-03)	na	na	na	na	na	2.9	1,882	5,499	13.
14. Starfruit (99-03)	na	na	na	na	na	1.1	5,358	5,830	14.
15. Seed Crops (99-03)	na	na	na	na	na	8.1	1,593	12,880	15.
16. Vegetables and Melons (99-03)	1,558	3.0	1.0	6,508	6,482	0.5	14,864	7,302	16.
17. Beans (Green, 98-02, HAKA)	147	16.7	0.9	3,400	3,044	0.9	5,080	4,623	17.
18. Cabbages (Chinese, 98-02, HOKAMA)	528	32.4	na	na	na	0.2	21,596	3,824	18.
19. Cabbages (Head, 98-02, HAHOKA)	1,844	67.5	na	na	na	0.2	25,467	4,169	19.
20. Corn (sweet, 98-02, HAKA)	513	39.6	0.5	4,740	2,381	0.6	4,060	2,339	20.
21. Cucumbers (98-02, HAKA)	289	11.6	0.4	17,240	7,337	0.4	13,440	5,887	21.
22. Ginger Root (00-04)	na	na	na	na	na	0.6	44,500	25,899	22.
23. Lettuce (head and semi-head, 98-03)	na	na	na	na	na	0.5	9,350	4,862	23.
24. Melons (watermelons, 98-02, HAMAKA) [5]	100	3.4	0.2	8,740	2,176	0.2	20,640	4,830	24.
25. Potato (sweet, 98-02, HAHOKA)	657	66.4	0.5	8,740	4,657	0.5	8,800	4,787	25.
26. Taro (processed, poi, 00-04) [6]	2,079	74.0	0.5	16,534	8,753	0.5	13,944	7,491	26.
27. Tomatoes (98-02)	na	na	na	na	na	0.5	33,480	17,544	27.

Notes: [1] Cut flowers refer to all cut flowers except for orchid, which is included in "Orchids." [2] Excludes orchids used for lei flowers. [3] Includes bedding plants, plant rental, sod, trees, and any other nursery products. [4] Shredded lettuce for salad. [5] In 1998 Kauai combined with only Hawaii. [6] Taro prepared for making poi. The capital letters in the parentheses in each row indicate county combined data. For example, HAHOKA - Hawaii, Honolulu, and Kauai combined. HA - Hawaii County, HO - Honolulu County (Oahu), KA - Kauai County, and MA - Maui County.

Data Sources: Production and farm prices are from Statistics of Hawaii Agriculture 2002 and various issues of annual summary reports for specific products, HAS. Honolulu market supply and Kauai's shares in Honolulu market are calculated from inshipment data of fresh produces, Market News Section, Agricultural Development Division, HDOA.

Appendix 2 Commodity Briefs

Floriculture and nursery products: Kauai's floriculture and nursery production sale value (grower sale value) has been growing consistently in recent years, from \$1.3 million in 2000 to \$3.2 million in 2003 (Hawaii Flowers & Nursery Products Annual Summary, June 4, 2004, HAS). Kauai's floriculture and nursery production value in 2003 accounted for approximately 3% of state's \$97.7 million industry. Hawaii County is the largest producer (52%), followed by Honolulu (33%) and Maui (12%) counties.

Fruits and nuts: Kauai's fruit sale value declined consistently since 2001, from \$3.8 million in 2000 to \$1.7 million in 2003, and the county's share in state's total production also declined from 2.6% in 1999 to 1.3% in 2003. Included in the sale value are guava, tropical specialty fruits, bananas, papayas, avocados and citrus fruits. Tropical fruits are referring to longan, lychee, mango, rambutan, starfruit, among others. Kauai's papaya production increased more than double between 1998 and 1999, growing from 2.06 to 4.76 million pounds. However, the county's production declined by 57 percent between 2000 and 2001, from 3.94 to 1.69 million pounds, and dropped again in 2002 by more than 34 percent.

Seed crops: Production of seed crops grew steadily since 1999. Total land use in production statewide expanded from 2,450 acres in 1999 to 4,080 acres in 2003. Total outshipment of seed increased from 3.5 million pounds in 1999 to 6.4 million pounds in 2003. Total sales value (based on gross operational budget) increased from \$30.5 million in 1999 to \$50.5 million. The majority of seed crops produced commercially is seed corn, which made up 98 percent of total production sale value in 2003.

Vegetables and melons: Kauai's total production value of vegetables and melons grew from \$0.80 million in 1999 to \$1.56 million by 2003. Kauai share in state's total production value of vegetables and melons also grew, from 1.86% in 1999 to approximately 3% by 2003. Although on a five-year average (1999-2003) Kauai's per pound farm value of vegetables and melons is more than twice that of state's average, \$1 versus \$0.49, the county's per acre yield in dollar terms is only approximately 90 percent of state's average. The explanation lies with low per acre physical output of vegetables and melons grown in Kauai. On a five year average (1999-2003) Kauai's per acre yield is 6,508 lbs while statewide average per acre yield is 14,864 lbs.

Sweet potatoes: State's total production of sweet potatoes declined steadily since after 1999, when aggregate farm output value was \$1.83 million. In 2002 state's total output was estimated at less than a million.

Taro: State's total taro production fluctuated downward since 1953. Oahu and Maui together was once the major taro producers. However, urbanization and the changing relative demand in the market had bidden away land and water resources from taro production in Hawaii, Oahu and Maui, making Kauai a leading taro producer in the state. In 2004, Kauai accounted for 74% of state's total production. Kauai is also a major supplying base for Honolulu market. In 2004, Honolulu received 93% of all taro prepared for poi and chips from Kauai alone. Kauai's taro production declined 19.6% in 2003, from \$2.18 million in 2002, but regained 15.3% in 2004, while price remained roughly constant on an average over this period. Kauai's competitive edge is in its higher yield (pounds of output per acre). If production cost for Kauai's taro producers is roughly the same as for producers in other counties, Kauai will remain competitive relative to other counties. Threats: Since mid-1990's to the present pests are the major problems for taro farmers. Apple snails and Taro Pocket Rot—a fungal disease caused by a species of *Phytophthora*—for wet taro; root aphids for dry land taro growers; and theft (reported) for all farmers.

Cultured shrimp: Aquaculture in Hawaii has continued to grow in the past five years. Most growth took place in Hawaii County, which accounts for 71% of state's total production of approximately \$27.7 million in 2003. Honolulu, with approximately 17% share in state's total output value in 2003, is state's second largest aquaculture producer. Given a growing world's cultured shrimp market, with the U.S. taking the lead as importer which purchased 48% of the \$3.2 billion culture shrimp traded internationally, and with the existing infrastructure for cultured shrimp in place, Kekaha has the potential for commercial shrimp farming. However, given domination by the relatively low-cost S.E. Asian, Central and South American countries in the world major markets (U.S., Japan, and EU), the profitability of commercial shrimp culture in Kekaha is unclear.

Appendix 3

**County Comparison:
Farm Characteristics, Expenses and Income in 2002**

	State Total	Hawaii	Honolulu	Kauai	Maui
Number of farms	5,398	3,216	794	565	823
Land in farm (acres)	1,300,499	821,276	70,705	151,828	256,690
Total cropland	211,120	90,778	29,103	30,510	60,729
Harvested cropland	109,461	55,529	13,757	11,771	28,404
Irrigated land	69,194	9,041	13,703	19,595	26,855
Average farm size	241	255	89	269	312
Irrigated land as % of cropland	32.8	10.0	47.1	64.2	44.2
Market value of agricultural products sold (\$1,000)	533,423	187,736	179,321	41,855	124,511
Government payment (\$1,000)	886	397	60	165	264
Income from farm-related sources (\$1,000)	19,237	7,625	5,433	2,834	3,345
Total farm production expenses (\$1,000)	450,946	161,441	129,730	46,151	113,624
Net cash income of operation (\$1,000)	98,145	34,408	52,347	(914)	12,303
Farm sizes (acres)					
1-9	3,440	2,009	574	352	505
10-49	1,309	818	152	127	212
50-179	335	207	34	38	56
180-499	146	90	15	21	20
500-999	61	38	5	11	7
1000 or more	107	54	14	16	23
Expenses (\$1,000)					
Total farm production expenses	450,946	161,441	129,730	46,151	113,624
Fertilizer, lime, and soil conditioners	17,791	5,738	5,009	2,329	4,714
Chemicals	16,134	4,310	4,572	1,715	5,538
Seeds, plants, vines, and trees	11,188	4,613	3,686	520	2,368
Livestock and poultry	6,025	3,293	2,032	155	545
Feed	27,997	11,993	11,148	2,282	2,575
Gasoline fuel and oil	14,458	4,964	3,668	1,964	3,862
Utilities	19,474	5,725	5,398	1,057	7,294
Supplies, repairs, and maintenance	50,411	17,354	9,377	7,207	16,472
Hired farm labor	177,692	47,453	59,615	18,082	52,452
Contract labor	7,159	5,156	940	96	967
Custom work and custom hauling	9,232	6,795	989	1,177	272
Cash rent for land, building and grazing land	19,723	6,866	7,471	1,938	3,448
Rent and lease expenses for machinery, equipment and farm share of vehicles	3,066	1,128	678	608	653
Interest expenses	8,633	5,372	1,202	1,372	688
Property taxes	6,463	3,071	1,300	1,086	1,006
All other production expenses	55,499	27,609	12,646	4,563	10,682
Depreciation expenses claimed	34,498	16,031	5,823	2,352	10,292

Data Source: 2002 Census of Agriculture, USDA, National Agricultural Statistics Service.

Appendix 4

Technical Notes on Estimation Method:

The aggregate potential farm output value is estimated using the following equation:

$$Y = \sum_j^4 \sum_i^n a_{ij} H_j y_i p_i,$$

The variable a_{ij} represents farm j 's fraction of the land area (in acreage) allocated for producing commodity i , for $0 < a_{ij} \leq 1$, and $a_{11} + a_{21} + \dots + a_{n1} = 1$. H_j is farm j 's total land area. Thus, $a_{ij}H_j$ is the total land area farm j allocated for producing commodity i . The variables y_i and p_i respectively represent commodity i 's five-year average output per acre of land use and five-year average farm gate price. Output per acre and prices are averaged over five years period to minimize the effects of annual yield and price fluctuations, which could cause either over or under estimation. For commodities that have Kauai-specific data (sugarcane and vegetables and melons), the averages of output per acre and prices are Kauai-specific. Otherwise, they are statewide averages.

Each farmer is assumed to be able to achieve an average yield for each crop by using common farm practices, management and technology that are common to farmers in Kauai and elsewhere in State of Hawaii and sell output at an average price specific to Kauai or State of Hawaii. The area of land used in the estimation is for the 7,758 acres, which are considered to be among the most productive land within the 12,592 acres complex under ADC's control. Land productivity is assumed to be identical for each acre.