Hawaii's Seed Crop Industry:

Current and Potential Economic and Fiscal Contributions

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EXECUTIVE SUMMARY

The research objective of this study is to update the 2009 study of the Hawaii seed crop industry's economic and fiscal contributions to the State of Hawaii. To this end we have provided:

- Background information about the technology used by the industry locally and internationally,
- Details of Hawaii's seed crop industry with comparisons to other Hawaii sectors and subsectors,
- The economic contributions of the seed crop industry.

Our primary research conclusion is that Hawaii's seed crop industry makes significant ever increasing economic and fiscal contributions to the state's economy generally, and most particularly to the agriculture, life sciences and high technology subsectors. These contributions are most significant in rural Hawaii relative to other economic subsectors. Seed crop industry economic contributions to the state should continue to increase, albeit at a slower rate than historically.

Background Information

The Hawaii seed crop industry arrived in Hawaii 50 years ago when several seed crop companies first located here. Hawaii offered and continues to offer a unique factor set, including:

- Year-round growing conditions allowing up to four crop cycles per year
- Availability of a highly skilled agricultural workforce
- Availability of land and water
- A stable political and economic environment.

This factor combination gives Hawaii a competitive advantage over U.S. mainland and international locations for a seed crop industry. Currently, 45 companies comprise the industry, some of which are international leaders in the advancements of agricultural science. Seed crop farms are located on Oahu, Maui, Kauai and Molokai. These farms use both conventional as well as biotech plant breeding methods to grow seed crops. The primary seed crop grown in Hawaii is corn, all of which is exported to both North and South America for further development and ultimate worldwide distribution. In the complex system of worldwide food production, the objective of the stop in Hawaii is improved and increased crop production.

The seed crop industry uses conventional plant breeding techniques to a significant extent. Because of limitations of this method the industry also uses genetic engineering technology. This technology allows the transferability of specific traits to plants with the simultaneous exclusion of undesirable traits. Because of their preciseness, genetic engineering plant breeding practices can be regarded as a significant technological advancement over conventional plant breeding practices. Traits most commonly engineered into plant varieties in Hawaii include increased insect and disease resistance, resistance to common agricultural herbicides and increased yields.

The Hawaii Seed Crop Industry

Figure 1 charts the value of Hawaii seed industry since its inception.

Figure 1: Hawaii Seed Industry Value [28]

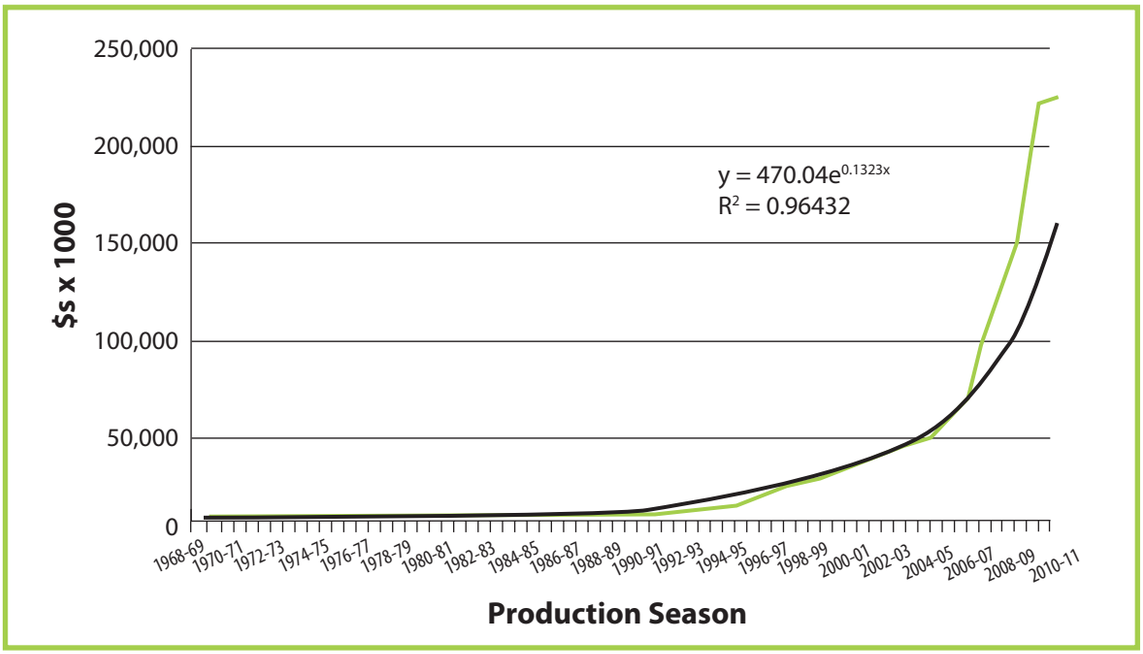

Chart Note: The vertical axis measures seed industry annual Hawaii expenditures and the horizontal axis the production year of the expenditure. The bold line represents the (exponential) trend of the reported industry value shown by the non-smoothed line.

Industry Growth

The seed crop industry in Hawaii currently consists of 10 farms that cultivate seed corn, soybean, wheat, sunflower, and other seed crops. Seed corn comprised 95.6% of the value of the seed crop industry in 2011. Hawaii's seed crop industry has grown dramatically. Since its inception, the Hawaii seed crop industry grew almost 54,000% at an average annual rate of 15.4%. Since 2000 the industry grew 548% at an average annual rate of 18.5%. The authors are not aware of any other Hawaii economic sector or sub-sector exhibiting such growth.

It is noteworthy that our seed crop industry forecast growth in 2009 of 65.4% from 2008 to 2012 was exceeded by actual industry growth of 72.2%. While seed crop industry growth has been stellar historically, it appears to be slowing as this industry matures and possibly due to the worldwide economic slowdown since 2008. Growth will continue given continued operating expenditures at a current level of $243 million and anticipated capital investment in Hawaii averaging $25 million over the next 10-years.

Hawaii's seed crop industry average annual value growth since 1968 (15.4%) greatly exceeds Hawaii's general economic growth as measured by GSP (7.1%). This growth rate difference is even more dramatic since 2000 when seed crop industry growth equaled 18.5% versus GSP growth of 4.5%. More significant is the seed crop industry's contribution to Hawaii's agricultural sector. At current farm value levels, the Hawaii seed crop industry's value contribution to the agricultural sector makes it:

- The largest agricultural commodity with a value contribution that exceeds the contribution of sugar, the second largest commodity, by more than 200%.
- The fastest growing agricultural commodity.
- An agricultural subsector providing almost 34% of the total value of all Hawaii agricultural crops, 39% of total Hawaii crop value and 44% of total Hawaii diversified agriculture.

The seed crop industry's average annual growth rate since 2000 of 18.5% and rank as the No. 1 agricultural and diversified agricultural crop in Hawaii stands in marked contrast to growth rate comparisons.

- Major Hawaii agricultural subsector average annual growth rates (crop rank) are:
  - Total Hawaii agriculture 3.2%
  - Sugar 2.1% (2) per year
  - Pineapple -3.6% (3) per year (last reporting year was 2007)
- Major Hawaii diversified agricultural subsector crop annual growth rates (diversified agriculture rank) are:
  - Diversified agricultural total 4.0% per year
  - Nursery 1.0% (2) per year
  - Coffee 4.6% (6) per year
  - Macadamia nuts 2.4% (5).

A footnote to the existence and growth of the Hawaii seed crop industry and its contribution to the agricultural sector is that this industry receives no governmental support in the form of subsidies, targeted tax credits, tax breaks, etc. to operate in Hawaii. The contribution to the Hawaii seed crop industry is solely due to Hawaii's natural resource competitive advantage.

Jobs

Job Number and Distribution: As of its most recent reporting, the Hawaii seed industry employs 1,397 individuals. Relative to Hawaii comparatives the seed crop industry:

- Has a significantly higher proportion of agricultural-related jobs (81.6% industry-wide, 80.0% for Oahu and 82.9% for the neighbor islands) than Hawaii comparatives (1.2% statewide, 0.4% for Oahu and 3.4% for the neighbor islands);
- Has a significantly higher proportion of professional-related jobs (15.9% industry-wide, 19.3% for Oahu and 13.1% for the neighbor islands) than Hawaii comparatives (12.5% statewide, 13.7% for Oahu and 9.2% for the neighbor islands).

Job Growth: Seed crop industry job growth since the authors' 2006 study has been significant, especially when contrasted with statewide employment changes. However, since our 2009 study, seed industry job growth has declined.

- Seed crop industry
  - Total job growth 2006-2012 = 29.7%
  - Total job growth 2009-2012 = -9.4%
- Hawaii State
  - Total job growth
- 2006-2012 = -5.12%
- 2009-2012 = -7.1%
  - Ag sector job growth
- 2006-2012 = -6.2%
- 2009-2012 = 20.0%

The seed crop industry job increases have occurred in a Hawaii employment environment that has at best been lackluster since 2005, although the downward trend in statewide agricultural appears to be reversing. In contrast, seed crop industry for recent years shows a leveling of its historic upward trend.

At current employment levels, the seed crop industry percentage of all agricultural jobs equals:

- 20.2% of statewide agriculture jobs
- 27.8% of Oahu agricultural jobs
- 12.4% of Neighbor island agricultural jobs

Employee Compensation

Earnings: Overall average earnings for the seed crop industry are 11.1% greater than the statewide average. The seed crop industry pays a higher than average wage scale to its workers in all occupations than one would expect based on statewide and per island averages except business & financial occupations and office & administrative, which make up an insignificant percentage of total industry jobs. The percentage by which seed crop industry pay exceeds statewide average is:

- 34.2% for management and professional jobs
- 35.9% for farm labor jobs

The seed crop industry's high relative wage scales contribute to economic diversification, which is greater for the neighbor islands than Oahu given the relatively higher neighbor island wage scales for management & professional workers.

Benefits: In spite of paying a higher wage, overall the seed crop industry provides a benefits package the value of which well comports with benchmarks in percentage terms. In dollar terms, seed crop benefits packages are higher than benchmarks because the benefits percentage is multiplied by a higher wage.

In sum, seed crop industry compensation packages are more generous than Hawaii benchmark comparisons.

Economic Contributions of Hawaii Seed Industry

Direct Contributions

Table 1: Seed Industry Direct Economic Contributions to Hawaii[1]

Items	Amounts
Total Annual Expenditures	**$264,430,000**
Annual Operating Expenses	$239,375,000
Expected CAPEX	$25,055,000
Capital Expenditure Budget	
Last 10-years	$423,170,517
Next 10-years	$250,550,000
Total Labor Income	**$76,439,636**
from Annual Operating Expenses	$69,244,274
from Annual CAPEX	$7,195,362
Total Jobs	**1,493**
Employment from Operating Expense	1,397
Direct Jobs from CAPEX	96

The total economic impacts (i.e. annual from operating expenditures and CAPEX) of the Hawaii seed industry to the state economy are the following.

- Seed crop industry direct annual contributions to the Hawaii economy from annual expenses equals $239.4 million. This is 33.3% of total direct annual contributions to Hawaii's economy from all Hawaii agriculture.
- Seed crop industry labor income equals to $69.2 million. This is 28.1% of the total labor income of Hawaii's agricultural sector.
- Total Hawaii employment attributable to direct expenditures of the seed industry equals 1,397, which is 16.5% of the total jobs in agriculture.
- Industry CAPEX over the next 10 years is estimated to be 37.7% less than the previous 10 years. Nonetheless, it is yet estimated to be $25 million per year 65.3% of which is estimated to occur on the neighbor islands. This direct seed crop industry expenditure generates $7.1 million in labor income and 96 jobs.

Note: The "Labor Income Portion" is a categorization of annual operating expenses to highlight this particular expenditure given its significance to policymakers. Data are for the most recent fiscal year.

- On a sub-regional basis (i.e. Molokai or West Kauai) seed company expenditures and jobs as a percentage of local totals ha e a much larger economic impact than occurs relative to the comparisons made herein. This is even more significant when discussing the agricultural sector, which generally comprises a much larger percentage of total economic activity and employment in Hawaii rural areas.

Indirect and Induced Impacts and Total Economic Impacts

Table 2: Total Direct and Indirect Economic Impact of the Hawaii Seed Industry

Items	Direct Contributions	Indirect/Induced Impacts	TOTAL
Total Output (Sales)	**$264,430,000**	**$286,511,518**	**$550,941,518**
Annual Operating Expenses	$239,375,000	$262,465,793	$501,840,793
from CAPEX	$25,055,000	$24,045,725	$49,100,725
Total Labor Income	**$76,439,636**	**$186,505,127**	**$262,944,763**
from Operating Expenses	$69,244,274	$181,728,573	$250,972,847
from CAPEX	$7,195,362	$4,776,554	$11,971,916
Total Employment	**1,493**	**1,034**	**2,527**
from Operating Expenses	1,397	924	2,321
from CAPEX	96	110	206

Besides the direct impact, the Hawaii seed industry (direct) operating and capital expenditures create ripple (i.e. multiplier) effects in the economy by generating revenues, jobs, salaries and taxes in the form of indirect and induced impacts. The seed crop industry's direct annual contributions from annual expenditures result in indirect/induced impacts and total impacts of:

- $286.5 million indirect/induced output with total annual output attributable to the Hawaii seed crop industry from annual expenses of $550.1 million, which is 30.9% of the total annual output of the Hawaii agricultural sector;
- $186.5 million indirect/induced labor income with total annual labor income attributable to the Hawaii seed crop industry from annual expenses of $262.9 million, which is 28.1% of the total annual labor income generated by the Hawaii agricultural sector;
- 1,034 indirect/induced jobs with total annual jobs attributable to the Hawaii seed crop industry from annual expenses of 2,527, which is 21.6% of total Hawaii agricultural sector jobs.
- The economic impact of the seed crop industry we measure is conservative given the high likelihood of the industry contributions not measured in our study in the form of an increased knowledge base for Hawaii's life sciences sector stimulating more local investment in research & technology, economic activity, related labor income and job creation, and an increased tax base.

Tax Revenue Contributions

On an annual basis, the Hawaii seed industry activities currently generate $29.4 million tax revenues to the State. This represents an increase of over 100% seed crop industry tax contributions measured in 2009.

Table 3: Fiscal Impact of the Hawaii Seed Industry

Tax	Annual Operating	CAPEX	TOTAL
GET	$12,645,889	$1,159,080	$13,804,970
Income Taxes	$8,152,563	$747,237	$8,899,800
All Other	$6,107,695	$559,811	$6,667,507
TOTAL	$26,906,147	$2,466,128	$29,372,276

Seed Crop Industry Contribution To State Public Policy Objectives

By its mere existence the seed crop industry contributes to generally-stated Hawaii public policy objectives which includes the following:

- Economic diversification not only statewide but in particular on the neighbor islands where economic diversification is less than on Oahu;
- Creating jobs in a green industry, agriculture;
- Maintaining prime agricultural lands in agricultural use with little if any incentive to convert these lands to alternative uses due to their profitable use by the seed crop industry;
- Creating high-tech jobs.

Slightly more than 20 years ago Hawaii's agricultural sector contributed 2% of Hawaii's GSP. This percentage currently and in our 2009 study is less than 1%. This declining trend shows no sign of abating in any significant way. The Hawaii seed industry has mitigated the downward trend of agricultural as a contributor to Hawaii economic activity maintaining this source of statewide as well as per county economic diversification. While seed crop industry growth and job creation may be leveling as the industry matures, it yet remains the most significant contributor as an individual crop to the agricultural sector of Hawaii. Without the seed crop industry, Hawaii's agricultural sector would be dramatically different than currently. Specifically,

- Without the seed crop industry the Hawaii's diversified agricultural sector would decrease by 45%;
- Without the seed crop industry the Hawaii's farm sector would decrease by more than one third;
- Neighbor island decreases in the diversified agricultural sector and overall for all farms would be much more significant than statewide averages.

It merits re-acknowledgement that the seed crop industry contributions to achieve public policy goals are at no cost to the State. Rather this contribution is a natural response by market participants to put to profitable and productive use Hawaii natural resources that otherwise could become idle, thereby making no economic, public policy or other contribution to the State.

ENDNOTE

This study was commissioned by the Hawaii Farm Bureau Federation with funding provided by the Hawaii Crop Improvement Association (HCIA). The Hawaii Field Office Management Team of the U.S. Department of Agriculture's National Agriculture Statistics Service (USDA-NASS) led by Director Mark Hudson collected Hawaii seed industry data. This approach assured non-disclosure of firm-specific, proprietary data and removed any data biases. Seed company data reported in the study represents industry totals with no firm or island-specific data disclosed, a detail confirmed by USDA-NASS personnel previous to public release of this study.

The authors wish to thank the organizations and individuals noted for their assistance and contribution to this study.

References

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The **Hawaii Crop Improvement Association (HCIA)** is a nonprofit trade association representing the agricultural seed industry in Hawaii. Producing the state's largest agricultural commodity, the seed industry contributes to the economic health and diversity of the islands by providing high quality jobs in rural communities, keeping important agricultural lands in agricultural use, and serving as responsible stewards of Hawaii's natural resources.

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HCIA Member Companies

BASF Plant Science – a BASF group company – is one of the world's leading companies providing innovative plant biotechnology solutions for agriculture. Today, about 840 employees are helping farmers meet the growing demand for improved agricultural productivity and healthier nutrition. BASF Plant Science has developed an unparalleled gene discovery platform focusing on yield and quality traits in crops such as corn, soybean and rice. Jointly with leading partners in the seed industry BASF Plant Science is commercializing its products. Current projects include higher yielding row crops or higher content of specific Omega-3's (EPA / DHA) in oil crops for preventing cardiovascular diseases. Further information on BASF Plant Science is available on the Internet at www.basf.com/plantscience.

Dow AgroSciences is a U.S. based company specializing in crop protection, pest and vegetation management, and seed trait development to serve the food, feed and fiber needs of the world's growing population. For decades, island farmers have used Dow AgroSciences' crop protection products on pineapple, sugar cane, and diversified agricultural crops, as well as its urban pest products for termite control.

Monsanto Company is a leading global provider of technology-based solutions and agricultural products that improve farm productivity and food quality. The company's farm stations in Hawaii assist in the development of better-quality seeds to help farmers grow crops sustainably so the farmers can be successful; produce healthier foods, better animal feeds and more fiber; and help reduce agriculture's impact on our environment.

Dupont Pioneer is the world's leading source of customized solutions for farmers, livestock producers and grain and oilseed processors. Research and product development carried out by Pioneer in Hawaii allows the company to develop corn hybrids, sunflower hybrids and new soybean varieties. The goal of the company's plant breeding and seed production programs in Hawaii is to develop hybrids and varieties that are more productive on the same or fewer acres of land.

Syngenta Hawaii LLC conducts research and parent seed operations on Oahu and Kauai. The Syngenta Hawaii facilities play a critical role in harnessing the power ofplants to meet global challenges for food, feed and fuel. Syngenta helps growers increase overall crop productivity with innovative seeds and products designed to deliver more yield potential from existing agricultural land.