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Panel: Financing Innovation: Case Studies on Structuring & Paying for Test-Bed Projects in Hawai'i

Pongamia: A "New Economy" Tree Crop

Pongamia is a legume tree that grows well in poor soils, fixes nitrogen, and produces an oilseed crop that is usable for bio-based products.

Seed pods

Harvester

Seeds

Oil

Pongamia Overview

About Pongamia	• Nitrogen-fixing tree native to South Asia • Well adapted to hot, arid and semi-arid regions of the world • Very hardy with deep tap root
History	• Pongamia is already established in Florida and Hawaii -- planted in local parks as an ornamental tree. • In arid regions in Australia and elsewhere, Pongamia is commercially farmed for the production of biodiesel. • The oil is refined into a high grade biodiesel and the residual seedcake is used as fertilizer or further processed into animal feed. Nothing is wasted.

Planting Dynamics

Trees Per Acre:	▪ Goal is to allow for maximum production and efficient mechanical harvesting ▪ Currently planting 145 trees per acre (15' X 20') ▪ May revise to 100-120 trees per acre, based on higher-than-expected growth to date
Pongamia Canopy:	▪ Window for livestock grazing: month 9 to month 36 ▪ Intercropping possible, but may require more intensive management for soil moisture and nutrients
Annual Maintenance:	▪ Pruning, weed spraying ▪ Drip irrigation system (as applicable)
Harvesting:	▪ Harvesting will occur via commonly-available automated shakers used for other nut crops (e.g., almonds, pistachios, etc.)

Current Trends In Agriculture and Pongamia's Significance

Agriculture Trends

- A period of growth and transition
  - Need for increased production of food
  - Sustainable cultivation
  - Shifting conditions (e.g., crop-specific diseases, unpredictable droughts)
- New consumer demands = new products
  - Biochemicals, biopesticides, organic fertilizers, animal feeds, bioenergy
  - For bio-based products, non-edible crops viewed as favorable to food crops

Pongamia's Significance

- Highly profitable crop diversification
  - Better utility of underproductive land
  - Disruptive economics compared to alternatives
  - Drop-in crop: use of existing assets in farming and processing
- Unique fit for downstream markets
  - Oil and seed cake similar to soy
  - Physiology as a tree means low cultivation costs, long productive life, and good carbon footprint

Pongamia Crop Yields and Applications

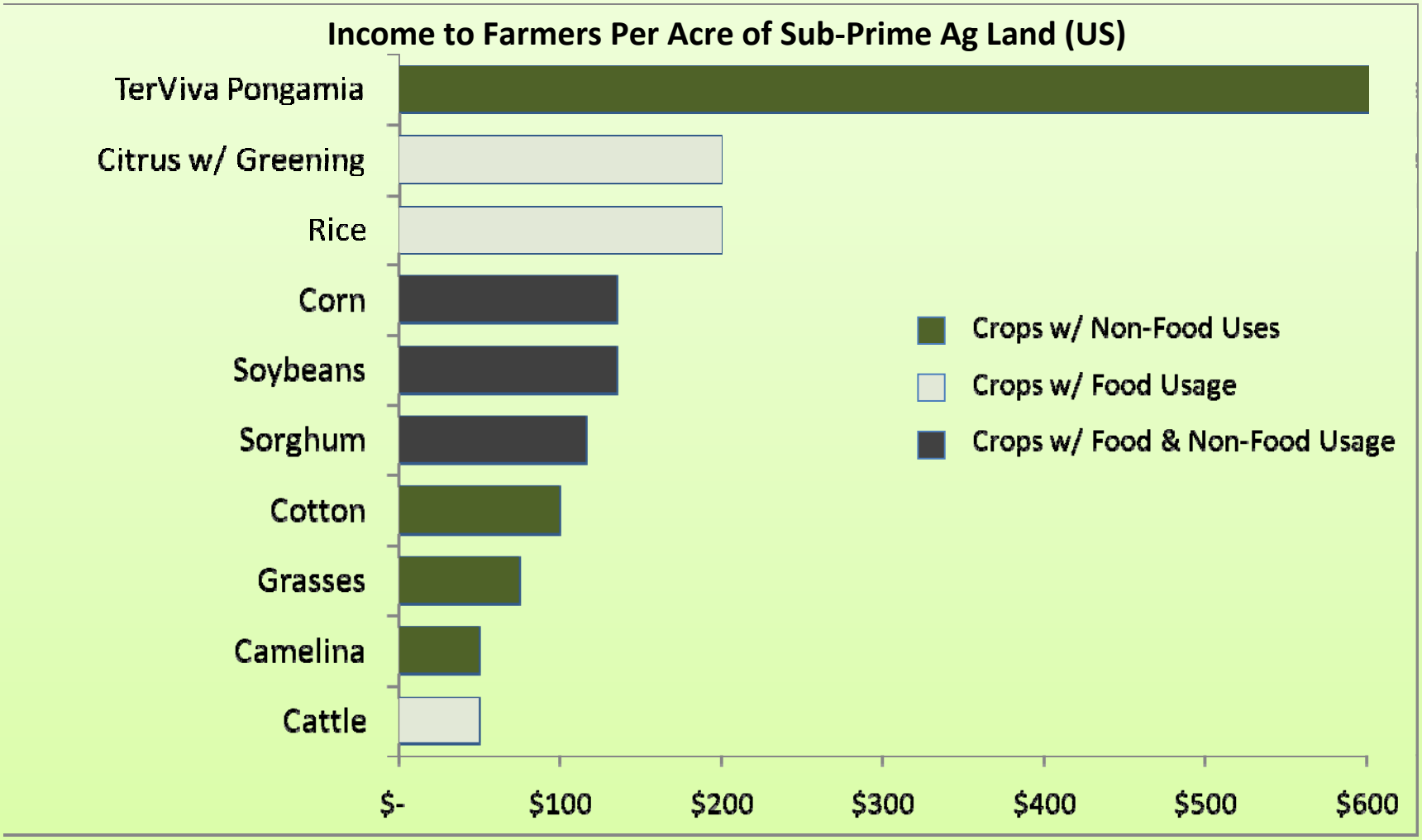
Revenue potential from the three major outputs – oil, seedcake and shells – could be as high as $2,900 per acre at current market prices.

Major Outputs*	Amount Per Acre	Applications	Comments	TerViva Progress to Date	$ / Acre
Oil	400 gal.	Chemicals / Pharma	50-70% oleic acid Anti-inflammatory	Early-stage analyses	**$1400 - $1800**
		Biofuel	Oil structure good for fuel	Production of biodiesel, syngas. Offtake: Pac Biodiesel, HI Gas Co., Valero (in prog.)	
		Edible oil	Upgrading required	Early-stage analyses	
Seed cake	2.25 tons	Animal feed	28% protein	Feeding tests w/ Texas A&M and Oceanic Institute	**$225-$800**
		Fertilizer	5% nitrogen	Early-stage analyses	
		Biogas	2x CH4 vs. manure	Early-stage analyses	
Shells	3.5 tons	Biopower	High lignin	Early-stage analyses	**$175-$300**
		Biochar	Good surface area	Early-stage analyses	

*Investigating possibility of voluntary-market carbon credits

Income Advantage Compared to Other Crops

At the lower end of the revenue spectrum ($2,000/acre), the economics per acre are disruptive to the norm. See appendix for further details.



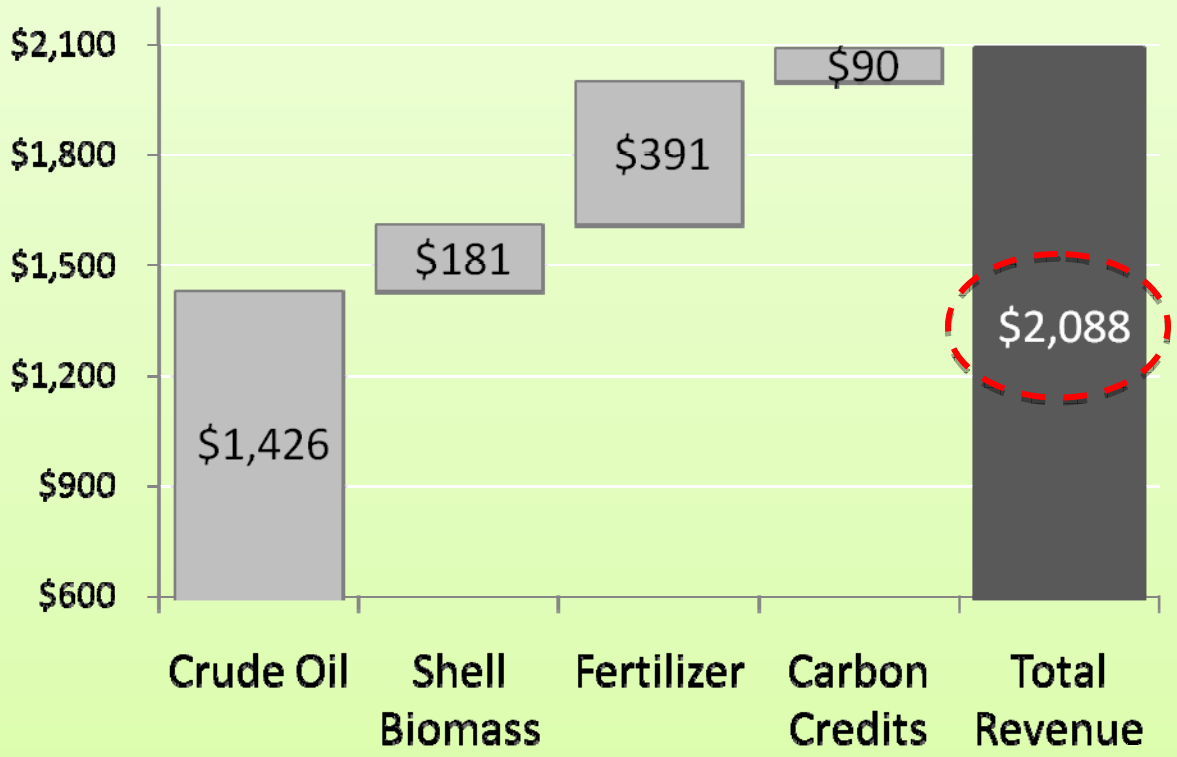
Indicative Landowner Economics

- Revenues are based on selling the pongamia oil at a 15% discount to current soybean oil price, although pongamia oil is a substitute of equal quality.

Revenue Drivers

Crude Oil	▪ 400 gals (10 bbls) / ac ▪ $3.57/gal
Shell Biomass	▪ 3.6 tons/ac ▪ $50/ton
Feed/ Fertilizer	▪ 2.2 tons/ac ▪ $175/ton
Carbon Credits	▪ 9 tons/ac ▪ $10/ton

Financials per Acre



Business Model

- **TerViva provides tree & service packages to landowners**
  - Proprietary pongamia genetics, propagated by our nursery partners
  - Support on cultivation and processing
  - Access to downstream channels for sale of oil and seed cake
  - Target US states: AZ, CA, FL, HI, TX
- **Landowner provides upfront fee per acre and royalty to TerViva**
  - $1,000 to $1,500 per acre, depending on scale
  - 10-20% royalty on revenue from oil/cake sales
  - Landowner IRR > 30%, exclusive of land value
- **Example current landowner customers include Evans Properties, Johnson Utilities, and US Sugar Corporation**

Management Team

- Joe Andrew, Founder & Chairman: Ag. entrepreneur; Chairman, SNR Denton
- Naveen Sikka, Founder & CEO: Biofuel markets and technologies
- Maggie Kavalaris, Founder & VP: Entrepreneur & new venture attorney
- Sudhir Rani, CFO: Investment banking, cleantech private equity
- Dr. Claire Kinlaw, Product Dev.: USDA tree geneticist & biochemist
- Tom Schenk, Business Dev.: Ag. economics and real estate
- Dr. David Harry, R&D: USDA tree breeder & geneticist
- Eduardo Martinez, Operations: Texas Dept. of Agriculture, energy project dev.
- Heather Richman, Gov't. Affairs: Capitol Hill; Stanford Univ. Gov't. Relations
- Matt Willis, International Markets Clean Energy - IFC & Clinton Foundation

2012-2014 Advisory Board

- Nora Mead Brownell: FERC Commissioner (2001-2006); TerViva angel investor
- Richard Celeste: Former Governor of Ohio, US Ambassador to India, Director of the Peace Corps, and President of Colorado College
- Todd Kimmel: Co-Founder of Coskata, VC at Mayfield Fund, TerViva angel investor
- Bill McCollum: Former FL Attorney General, 2007-2011, and former member of the US House of Representatives, representing FL's 8th District from 1981-2001
- Rolando Pablos: Current Texas Public Utility Commissioner
- Marc Stuart: Founder, EcoSecurities (acquired by JPMorgan), Vice Chair, Verified Carbon Standard, TerViva angel investor

Summary

In a world with increasing demand for renewable energy and food…

And decreasing availability of arable land….

We are developing the world's next great crop.

Mahalo!

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