Crop Diversification: Cost Considerations When Adding Taro Crop into Existing Farm Production

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Principles of Sustainable Farming

One of the key principles in sustainable farming is the concept of diversity. Diversity on a farm begins with the idea that more than 1 crop is produced in the field. Some farmers achieve diversity by growing selected cover crops in addition to their market crops. It is recommended that the crops selected for growing during the same period is different from each other to promote and create a diverse biological environment and habitat in the field. One of the guide farmers use in their crop selecting process is to select crops from different botanical Families, such as from Cucurbitaceae (melon Family) and Cruciferae (broccoli,cabbage Family). The goal of creating a diverse biological field environment is develop a balance between population of beneficial and harmful biological species in the field, including populations of insects, vegetation and micro-organisms above and below the soil surface. Studies have shown when there is balance between beneficial and harmful biological species in the same area, less management interventions are required to control harmful species; less dependency of external inputs such as plant nutrition, insecticides, fungicides, nematicides are applied; and it can contribute to lowering the cost of production for the crop.

Another key principle in sustainable farming is the need for the farm to maintain its economic competitiveness and profitability while applying and practicing sustainable principles and production methods. Growing diversity of crops on the farm captures one of the strategies promoted by many financial advisors that advocate the concept of maintaining a diversified financial portfolio to achieving economic security. Growing more than one crop will lead to creating diverse revenue stream for the farm, and avoid the risk of putting "all your eggs in one basket". When selecting crops growers need to understand all biological and business aspects of growing the crop to make a determination whether or not they can be competitive in the market. Each crop, while they might benefit from the symbiotic biological environment they create together, need to be independently profitable.

Project Introduction

The Hawaiian islands, 2390 miles from California to the east and 3850 miles from Japan to the west, are the most isolated land area and civilization on earth. The population of 1.3 million people produces only 5% of their nutritional needs and imports the rest from global food suppliers. In 2008 it was estimated that Hawaii has about an inventory of 1-week of stored food supply. In a recent survey of farm supplies, 98% of the crop production supplies and inputs are imported. When suppliers were asked about transportation cost, they responded that import transportation adds about $5.00 to a 50lb bag of fertilizer. Farmers on Moloka'i tend to produce crops within their "comfort zone", including crops they've developed historic knowledge, skills and experiences in growing and marketing the crop. They fortify this comfort zone from potential competitors by capitalizing on expensive and specialized equipment such as mechanical equipment and farm implements that contribute to reducing per unit cost of production. As they increase their expertise and capitalization in their crop, they increasingly become trapped in this "comfort zone" and in their mono-cropping production system. As a result, their production system becomes a production system that produces 'a lot of a few crops', similar to the now declining Hawaiian sugar and pineapple industries. Economy of scale, knowledge and experience become their competitive advantage.

In order to increase Hawaii's food supply, growers need to move away from being mono-croppers and diversify the crops they produce on their farm. Crop diversification will also improve economic stability and promote biological diversity of the farm. The project seeked to diversify the crops produced on participating mono-cropping farms on Moloka'i. The project utilized on-farm hand-on and experiential teaching and learning methods to train participants to produce another crop on their farm. The project provided opportunities for project leaders to work closely with farmers to help hedge against production risks that come with steep learning curve of growing a new crop. The project required participants to select and produce another crop on their farm to create a diverse biological environment and increase the revenue streams on their farm. In the process they to learned new skills, acquired new knowledge and developed experiences that eventually will lead to an efficient and competitive production system that produce a diversity of crops.

Economic Considerations When Ramping Up

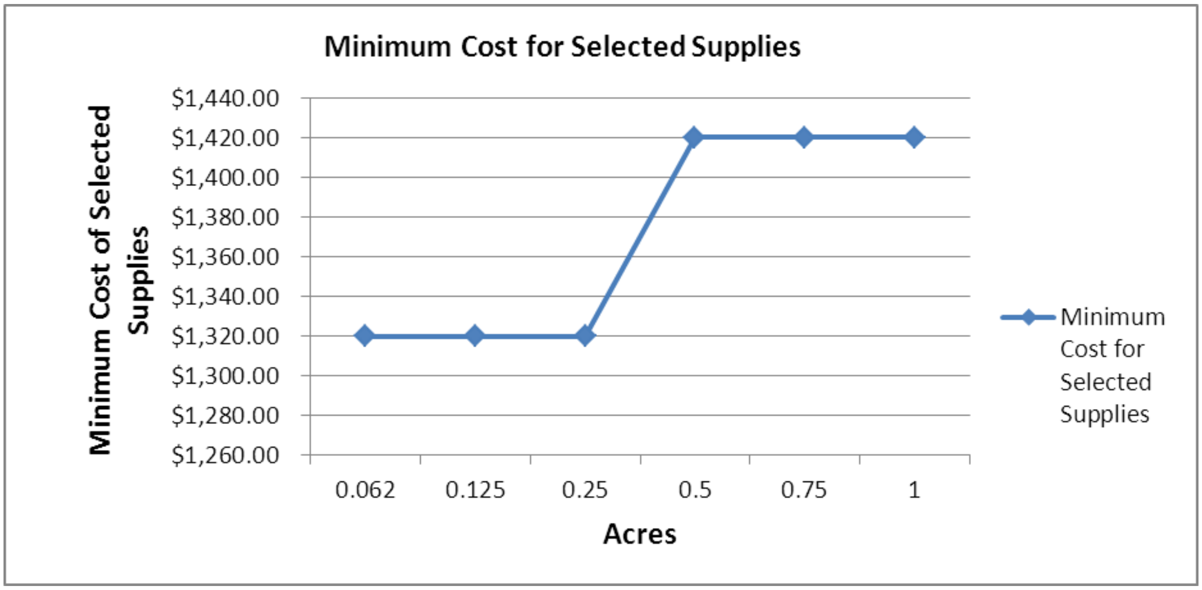
This report examines some economic factors that need to be considered during transition, when participants move away from their comfort zone of growing a single crop, and begin to establish another crop into their production system. 4 participants selected production of upland taro as one of their additional crop for their farm. At start 2 participants grew papayas, 1 participant grew sweet potato and 1 grew watermelons as their primary crops. Taro offers several products that can be marketed. The most common product you see in the market is the corm. Other products include the younger leaves that are consume as a cooked vegetable and value-added products such as po'i and kulolo, a pudding-like dessert. Each participant expanded their taro production at their own speed, and largely depended on the availability of vegetative propagation materials, huli, of taro. Each participant started small, 1/8th of an acre and gradually increased their production at a rate they were comfortable with to begin integrating taro into the production of their primary crop. The report looks at some of the cost and efficiencies of ramping up production of the taro.

Cost of Selected Materials and Supplies

Farmers usually start small when he begins to grow a new crop. Starting small and eventually ramping up is a good and recommended strategy to hedge against the risk of not having enough knowledge and experience in growing the crop. In this project participants started small, some starting less than 1/8th of an acre and eventually expanding production to over an acre. While it is a good strategy to start small, there is a minimum amount acres to start production to minimize the effects of the minimum size and amounts of supplies sold to farmer.

There are minimum amounts of selected production supplies farmers are required to purchase to begin production. The minimum amounts that farmers are required to purchase, like

7,500 feet in a roll drip tube and 2400 feet in a roll plastic mulch, may exceed what is required for the initial planting of taro. If expansion doesn't occur soon, farmers are required to inventory the excess supplies and tie-up working capital for at least 9 months, the period taro take to



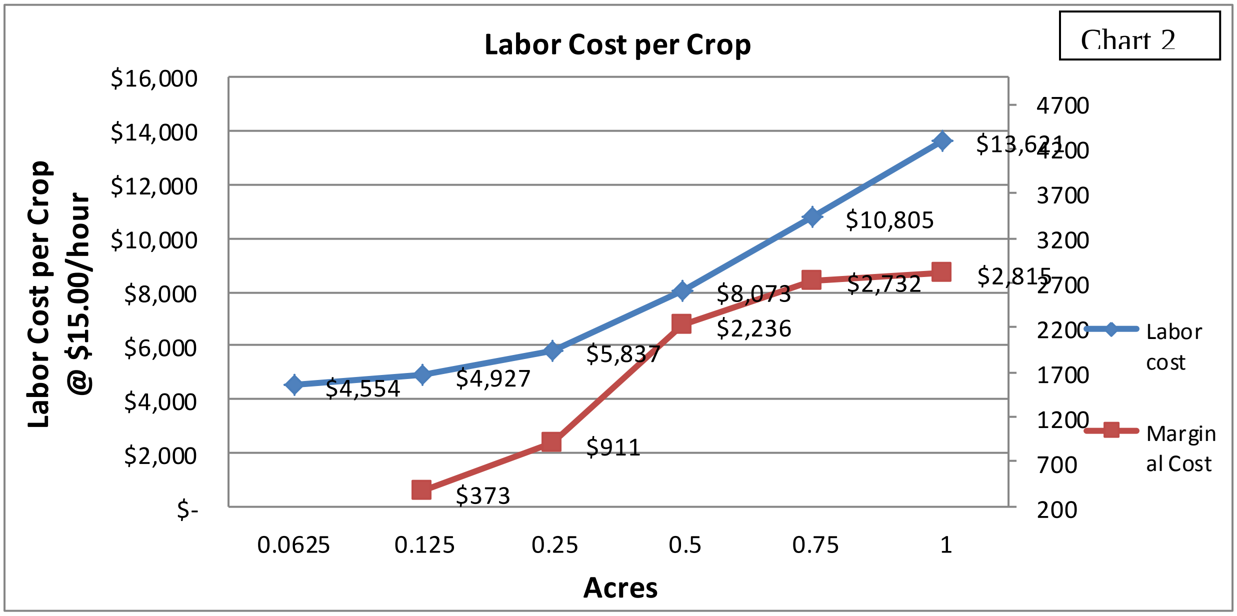
mature,. From the Chart 1 below, the cost reflects the cost selected supplies that require minimum purchase. The selected supplies include drip irrigation tube, plastic mulch, organic fertilizer "Fish Bone Meal", pest management supplies and hiring equipment service.

Chart 1

Cost data from the project indicates that a farmer is required to bulk purchase a minimum of $1,320 of selected supplies to start his taro project. At that cost amount he will purchase enough supplies for at least .25 acres of production. Growing fewer acres will result in needing to store excess supplies and tie up working capital. If a farmer started at .062 acres, he will be tying up as much as $1003 until he plants another increment of taro. Thus farmers would be wise to plant a minimum of .25 acres to expand to 1 acre as soon as possible, where the cost of selected supplies and equipment service will be the same as .75 acres of taro production.

Labor Cost

After using equipment for initial land preparation, broadcasting plant nutrition and soil amendments, laying drip tube and plastic mulch, all the work required in the taro field are conducted by human labor for 9 months. Labor is the highest cost of production input in taro production. For the project, participants started small and gradually expanded the area of production. As they expanded their production total labor cost increased. However there is indication that when expansion reaches .5 acres, labor become increasing efficient as marginal cost curve begins to bend and flatten as more production area is added. To take advantage of this efficiency in labor, starting point should be greater than .5 acres. It is project that labor efficiencies is occurring during preparation and ending work activities where the same amount of time is expended whether preparation is for 1 or 5 acres, such as the time expended for preparing and ending fertilizer injection activity. In addition work motion in the field may be decreasing as

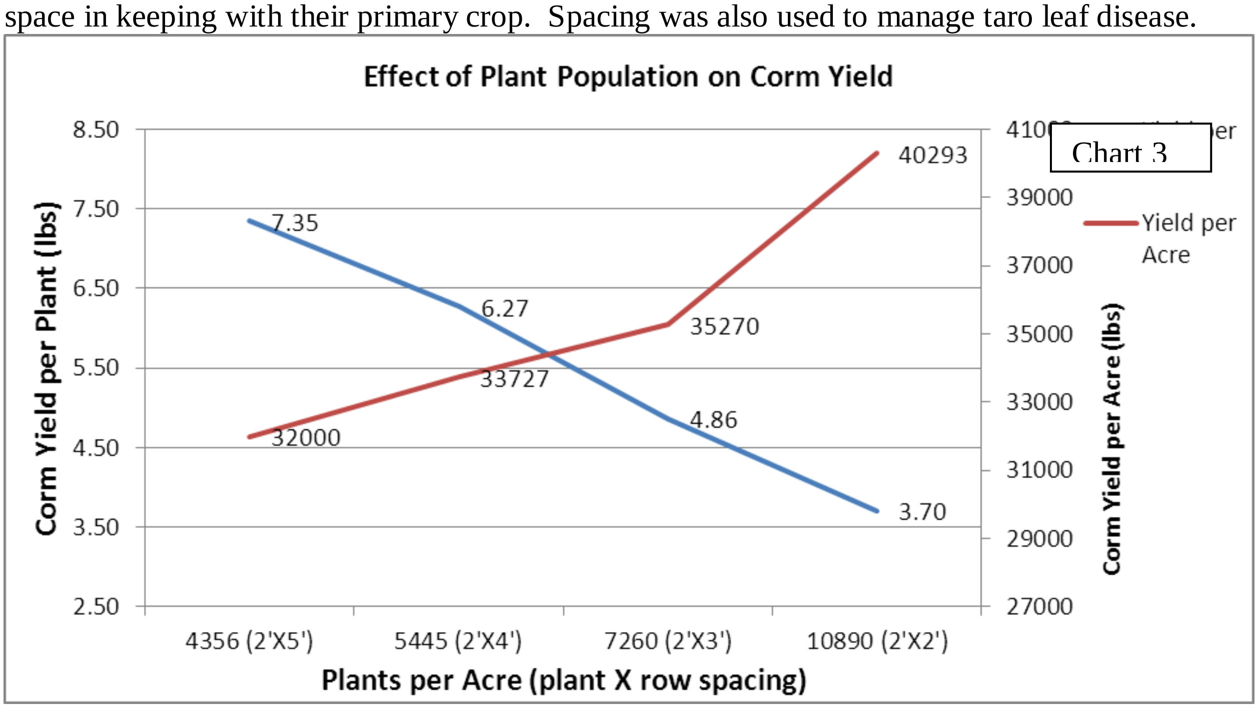


labor become more efficient in the repetitive motion to complete work, such as using weed-eater equipment in the field for weed management.

The Labor Cost, Chart 2 indicates that the marginal cost curve for labor begins to bend and flatten as production expansion exceeds .5 acres of production. A participant farmer indicated that when another person helps him with weeding it requires less total number of hours to complete the work than when he does the work himself, thus indicating that efficiency of hand labor can be achieve even in relatively small acres of production.

Taro Corm Yields

Four participants selected taro as one of the crop to grow to diversify the crops on their farm. Each used their own plant spacing or plant density, depending on what they attempted to achieve. High density spacing, 2 feet X 2 feet was used in nursery setting to increase taro propagation material and other wider spacing to fit tractor wheel spacing or maintaining plant space in keeping with their primary crop. Spacing was also used to manage taro leaf disease.



Wider spacing and less plant density help increase air flow between plants and field. Increasing air flow, especially in the mornings helps evaporate dew on taro leaf and reduces condition favorable for the establishment of taro leaf blight, Phytophthora. Growers also use plant density to shade ground and reduce understory weed germination. The participants grew anywhere for 2 to 4 varieties of taro. The 4 varieties produced by the participating farmers included Lehua Maoli, Eleele Naioea, Eleele Makoko, Piko Ulaula and Maui Lehua. The corm yields of these varieties are represented in the aggregate yield data. While the yield data don't represent data generated from normal crop yield trial where the crop variety is a constant, the taro corm yield pattern is very similar to other yield/planting density studies, such as *Sato, D., Silva, J., Preliminary Results of Dryland Taro Spacing and Fertilizer Timing.* The individual corm weight decreases as planting density increases and the total yield per acre increases as the planting density increases.

Cost of Production and Breakeven Price

Besides incurring fixed minimum cost of start-up describe in previous section, $1,420 per acre, participants incurred other expenses for equipment, and expendable production supplies. An additional $6,590 per acre were expended for irrigation pipes, irrigation water, soil amendment, planting materials, hand tools, fuel, packing materials and equipment. Estimated labor cost was $13,621 per acre. Production cost totaling $21,631 of which 37% was expended for materials, supplies and equipment and 63% for labor.

The breakeven prices for planting density of 4356, 5445, 7260 and 10,890 plants per acre is $ .68, $ .64, $ .61 and $ .54 per pound respectively. Table 1 describes the estimated revenue at various planting densities and selling prices per pound of corm.

Table 1: Estimated Revenue at Various Planting Densities and Selling Prices per Pound

		Prices per Pound									
Number of Plant per Acre	Corm Yield per Acre (lbs)	$0.52	$0.54	$ 0.56	$ 0.58	$ 0.60	$0.62	$0.64	$0.66	$ 0.68	$0.70
4356 (2'X5')	32000	$16,640	$17,280	$17,920	$18,560	$19,200	$19,840	$20,480	$21,120	$21,760	$22,400
5445 (2'X4')	33727	$17,538	$18,212	$18,887	$19,562	$20,236	$20,911	$21,585	$22,260	$22,934	$23,609
7260 (2'X3')	35270	$18,340	$19,046	$19,751	$20,456	$21,162	$21,867	$22,573	$ 3,278	$23,983	$24,689
10890 (2'X2')	40293	$20,952	$21,758	$22,564	$23,370	$24,176	$24,982	$25,788	$26,593	$27,399	$28,205

Conclusion

Promoting a diverse biological field environment is one of the key principles in sustainable farming. Farmers create a diverse biological field environment by including and producing several market and cover crops in the field, and move away from mono-cropping. The goal of creating a diverse field environment is to develop a balanced population of insects, plants and microorganisms above and below the soil surface. Studies have shown that a balanced population of beneficial and harmful biological species in the field can lower the application of production inputs and while at the same time maintain a profit margin.

Producing and growing more than 1 crop requires a higher level of knowledge and skills. When first starting to develop crop diversity, farmers are usually advised to start small and expand to hedge against their lack of knowledge in growing the crop and management experience to integrate and synchronize production activities into the already activities of the existing primary crop. However “starting small” is a relative term that doesn’t define a unit.

The information collected from this project looked at some cost factors to consider when determining the appropriate size to begin the production of additional crop, taro for this project. The cost of minimum sizes and amounts of supplies and materials sold to farmers and cost of labor were looked at to determine the optimum start up size for taro. Evaluation of the cost of minimum purchase sizes indicates that the starting point should be at least .25 acre of taro. At this size the minimum amounts of bulk purchase of selected supplies would be expended to generate cash flow for the farm and supply inventory that tie up working capital is minimized. After initial land preparation and application of soil amendment activities, most of the field work is conducted with hand labor. Labor cost contributes 63% to the cost of producing dryland taro. Evaluation of labor cost indicates that the marginal cost of labor begin to flatten after .5 acres of production. Therefore from a cost perspective the project suggest that minimum size to start a crop of taro is .25 acres to maximize the use of the minimum bulk amounts of supplies sold to farmers and expansion should take place to .5 acres or more to capture the efficiency of labor.

While it is a wise strategy to “start small” then expand when introducing a new crop that you have little knowledge and experience with, into a production system, there is a minimum size you need to consider in order minimize the impact of startup cost and maximize the effects of production efficiency.

This project was partially funded by the Western Sustainable Agriculture Research and Education Program; SW09-502