COMPOSTED ALMOND WASTE BLENDED WITH COMMERCIAL FERTILIZERS FEASIBILITY

Presented to the

Faculty of the Agribusiness department

California Polytechnic State University

In Partial Fulfillment

of the Requirements for the Degree

Bachelor of Science

By

Jordan Jay Marchy

March 2013

Approval Page

Title: Composted Almond Waste Blended With Commercial Fertilizers Feasibility

Author: Jordan Marchy

Date Submitted: March 2013

Dr. Wayne Howard ______________

Senior Project Advisor

____

Signature

Abstract

Composting is becoming more and more pressured into today's agricultural industry. With this comes a business idea that has the potential to be economically viable. This business consists of taking the waste produced from almond hullers in the Central Valley, which consists of foliage, dirt, and twigs, composting it, mixing it with some sort of synthetic fertilizer to create a blend, and selling the product to farmers in the area. The problem is that agriculturalists don't know for sure if it can be profitable. This study takes a closer look at the costs and revenues associated with such a business to determine whether it is economically viable.

The tools used to gauge whether or not a business of such kind would work are, the amount of compost that could theoretically be produced, which is an indirect reading of the demand for the product in the area, the net present value (NPV) of the business over a ten year span, and the internal rate of return (IRR) of the business while it produces this amount of compost over the ten years

It was found that the average composter size in the Central Valley produces 68,000 cubic yards of compost per year. Because of the space available to the known location and learning curve faults this number was dropped to 50,000 cubic yards. Producing these 50,000 cubic yards of compost creates a NPV of $228,228.41 and an IRR of 31%. Analyzing these numbers, a business such as this and located in the Central Valley, is in fact economically viable.

Table of Contents

List of Tables

Chapter 1

INTRODUCTION

Production agriculture is faced with the pressure of becoming more sustainable in day-to-day operations because of long run cost considerations, diminishing land fertility and popular and legal environmental pressures. A majority of farmers in San Joaquin Valley use commercial synthetic fertilizers to keep land fertile for bearing crops. The use of such fertilizers has been on the rise since they were introduced in 1940. Over application of these synthetic fertilizers can have a negative impact of the longevity of the soils, and therefore a negative impact on the future fertility of the world's arable land (Nelson 1972).

Composting agricultural wastes is a plausible way to reverse this trend, and create healthier soils for the future; but transitioning to a 100% compost regimen instead of commercial fertilizer usage is not in the short run interest of farmers. It can take years for compost materials to create healthier soils, as the materials have to break down more so than commercial fertilizers to generate plant available nutrients. Mixing commercial fertilizer with composted waste gives one the best of both worlds; this creates sustainable soils that complement both long and short run fertility. This mixing procedure is known as blending.

Almonds are a leading crop in California, but their promotion results in substantial amounts of waste, consisting of foliage and foreign matter, that sits aimlessly in the yards of hullers and shellers. So much, that almond farmers are paying to have such field waste shipped away (Cotton, et al 2010). This creates a business opportunity to generate revenue waste input and also from the compost you have created as your output.

Problem Statement

Is composting almond huller waste, creating mixed individualized blends, and selling it to farmers in the Central Valley a feasible business idea?

Is there enough demand to where the business can produce enough to be profitable?

Hypotheses

There will be enough demand for the blended product based on the amount of compost produced and sold in the Central Valley region of California and the number of composter in the area.

This business idea will be economically viable; the internal rate of return (IRR) should exceed 15% and a positive net present value should be obtained for a project life of 10 years.

Objectives of the Study

1. To estimate compost production by looking at the survey done by the California Department of Resources Recycling and Recovery.

2. To develop enterprise budgets to find: break even prices, variable costs, fixed costs, and estimated overall profit of the business idea.

3. Estimate the IRR of the business through the first 10 years, based on profit and average production of the product in California's Central Valley.

Significance of the study

This study was motivated by conversations with family members and business partners. Tom Marchy is an almond farmer in Waterford, CA looking to diversify his operations and this was an idea he conceived. He asked if this would work, and what the numbers would actually look like. Besides being on a small business scale, a study such as this can set an example for others, and possibly start a trend that will take agriculture by storm, as commercial fertilizers have now. If composted materials are used in unison with commercial fertilizers, farmers will create long term and short term health of their soil and decrease costs when applying them as a mixture every season.

The amount of compost produced and sold to the agricultural sector in the Central Valley was 1.9 million cubic yards with only 29 composting businesses in the Central Valley, giving a rough value of production at about 50,000 cubic yards per year. These numbers portray an opportunity to provided Central Valley farmers with exceptional compost/fertilizer blends, and create a profit while doing so.

Chapter 2

REVIEW OF THE LITERATURE

Chemical fertilizers

Over the years, many farmers have phased out the use of compost and replaced it with mineral fertilizers (Termorshuizen, *et al*, 2004). This began because unfertilized soils could no longer provide sufficient amounts of nutrients to feed the growing plants. The United States Department of Agriculture states that this increase in fertilizer use in the United States has accounted for over 50% of the increase in food production per acre since 1940 (Nelson 1972). Some of the most common synthetic fertilizer ingredients include: urea, ammonia, ammonium nitrate, and ammonium sulfate. These fertilizers listed, carry, and are used for, adding nitrogen to soils. Fertilizers such as potash and phosphoric acid contain phosphorus, while fertilizers such as potassium chloride and potassium sulfate contain potassium, which are described by their chemical names. All can be applied through: soil injections four to six inches deep, banding, applying to the surface through a liquid spray or pellets, and by introducing them into the water source before irrigating (Nelson 1972).

Over the years, fertilizers, even when they account for over 50% of the food increase per acre from 1940 (as stated above), have had a negative use connotation. When working vegetable stands at farmers markets, the overall consensus is that most people react negatively to the addition of many chemicals (i.e., pesticides, herbicides, and fertilizers). Nelson (1972) stressed that there has been a lack of sound data correlating fertilizers to the increased amounts of nitrogen (N) and phosphorus (P) in ground water. However, it is possible that misuse, or over application of fertilizer in areas known for their vulnerability to run-off, leaching, and erosion, may result in chemicals entering the ground water.

Edmeades (2003) looked at the long-term effects of manures and fertilizers on soil productivity and quality. His main reason for gathering such data was partly because of the world-wide concern of modern farming practices and their impacts on soil and water quality. Biodynamic and organic management systems are being promoted on their enhancement of soil and water quality, and their environmentally friendly aspects. His study consisted of 14 trail fields located in 5 different countries that compared fertilizer and manure treatments side by side. Characteristics such as: crop yields, microbiological activity, soil bulk density, and amount of organic matter were used to compare the two soil amendments. Edmeades (2003) found fertilizers and manures both had large effects of long-term soil productivity and health in contrast to applying no nutrients. The application of manure had a greater effect on soil organic matter levels, and thus creates more biological activity than when synthetic fertilizer was added. The down side to this is that agriculturalists have to add more manure to fulfill a crop's nitrogen requirement because of its low nitrogen content. When adding this much manure, large deposits of phosphorus accumulate in the soil. With more phosphorus in the soil, greater amounts of phosphorus leaches into the groundwater; resulting in manures more likely to contribute to poor water quality by the addition of materials with a high chemical oxygen demand.

Nelson (1972) found fertilizers essential in providing needed quantities of food at high quality and low cost. If fertilizers are found to adversely affect the environment, the solution is to not ban them, but develop products and practices that protect and help the environment and farmers alike.

Compost

Composting organic wastes creates a product that can be stored for long periods of time, easily handled, and uniformly applied to land as a low-analysis fertilizer (Sikora 1996). Studies from around the world are concluding that compost can be beneficial. A Dutch study showed that adding compost to a field with an incline of 8% resulted in 67% reduced erosion, 60% less water run-off, and 8% higher bulk density (Termorshuizen, *et al*., 2004). Another study conducted in the United States in 1994 found increased yields when crop residues were applied to the surfaces of soil in the form of mulch (Marr and Facey 1995). Compost has numerous benefits, and one of those is solving environmental and managerial problems by combining the two beneficial amendments together, compost and fertilizer, and applying to soils as one nutrient supply.

Blending

Blending is the addition of fertilizer (preferably a nitrogen base) to a composted material, creating a mix or "blend" (Ross, et al. 2006). These blends are found to have the same, if not more, beneficial characteristics than ordinary chemical fertilizers. Not only are the characteristics seemingly more beneficial, but they use composted residues at lower rates, allowing for less passes across fields. It also reduces the amount of inorganic chemical fertilizer applied to soils, and the accumulation of non-nutrient ingredients, such as phosphorus and magnesium, which come from over applying compost (Sikora 1996).

Ros, et al, (2006) looked at the effects of compost amendments on soil functionality, structure, and microbial activity. They used 40 randomly disbursed plots in a field near Linz, Austria. Each plot received different treatment each spring over a 4 year time span in the following order: no treatment (control), compost amendment (green waste, cattle manure and sewage sludge, compost plus Nitrogen, and mineral fertilizers. The scientists found that the application of compost plus nitrogen, a blend, had the most pronounced effects on the soils. Crop yields were higher, and soil protection against disease was greater. Biodiversity, bulk density, and water retention all were greater, relative to the application of just compost or just fertilizer. The authors described it as a synergy between compost and mineral fertilizer. The compost part of the blend adds organic matter to the soil which allows for more nutrient uptake by the plants roots, while fertilizers provide nitrogen in the form of Nitrate and ammonium. When used in unison, the plant is able to enhance its nutrient uptake.

Creating Blends

The first step in creating compost/fertilizer blends is composting. In the case of the study, the material being used in the composting process is almond orchard debris. This debris ranges anywhere from sticks, twigs and foliage (which will be minced into fine pieces for faster decomposition), to dirt and rocks (which will have to be separated). After material particle size has been decreased, composters have to choose their composting system. There are two types of composting systems, open systems and in-vessel systems. In-vessel systems are more for smaller garden-like circumstances, and won't be paid much attention to. There are 3 different methods associated with open systems; static pile method, agitated windrow system, and aerated static pile system (Goulin 1998).

The static pile method is the least time consuming and least expensive out of all the options. It requires the to-be-composted material to be placed in windrows and maximizes the use of convention currents. Downsides to this method are: non-uniform composting, which is caused from the lack of agitation, and timeliness, in that it takes about two years for a completed compost to be produced (Goulin 1998).

Agitated windrow system is the static pile method incorporating frequent turning of windrows instead of piles. Turning the windrows accelerates the process and allows for a more uniform compost. This method requires more space, as the piles are constantly moving and being merged together to conserve the already finite space (Goulin 1998). A business such as the one laid out in this study would choose this method because of its minimal cost and expedited process.

Aerated static pile method is the most expensive method mentioned because of the construction needed to make the method possible. This method requires the piles of material to be positioned right over vented airways. These airways allow ventilation in the center of the piles, which create uniform compost. Although less time consuming, the time and money of construction would be detrimental to a newcomer in the industry (Goulin 1998)

Once the method of composting is chosen, creating the right environment is critical in producing superb, nutrient rich compost. Rao, Grethlein, and Reddy (1995) looked at the carbon to nitrogen ration and moisture content, two main determinants of a good compost pile environment, in poplar wood compost piles to see which levels created the most uniform compost in the timeliest manner. They created nine compost piles which all used an in-vessel aeration system. Moisture contents used were 30%, 50%, and 70% moisture, and carbon to nitrogen ratios used were 10:1, 30:1, and 50:1. Experimenters added water to obtain the moisture contents listed; to achieve the various carbon to nitrogen ratios, they added urea until satisfied with the readings. They measured the rate of decomposition by measuring the amount of carbon dioxide gas leaving the test piles. Conclusions were that a moisture content of 70% and a carbon to nitrogen ratio of 30:1 or 50:1 (both were close to identical) were ideal. These conclusions resonate based on the fact that they were composting material identical to that of almond orchard debris.

Killing any weed seeds and parasites is another thing composters have to accomplish. The way in which to do this is to reach a certain temperature, 160 degrees Fahrenheit. This temperature is hot enough to kill parasites and weed seeds, but yet low enough to not allow ammonia to volatize, or vaporize (Radabaugh 1980).

Once the composting process is complete, the blending takes place. Different farmers have different needs based on the land that they farm. So creating the perfect blend is dependent on communication with the farmer. It is as easy as mixing the fertilizer and compost together, and shipping it out for application.

Compost Industry Policy

In 2007, California passed Assembly Bill 939. Among other things, this bill has "Strategic Directive 6.1," which sought an additional 50% of organic wastes diverted away from landfills by 2020. The California Department of Resources Recycling and Recovery (CDRRR) estimates that meeting this directive means 50 to 100 organic processing or composting facilities have to open up (Cotton, et al 2010).

Cotton, *et al.,* (2010) conducted a survey in 2008 funded by CDRRR. They were looking to find the amount of composters and processors in California, how much they produce, where they produce, and what they produce. The survey was sent out to 1046 related businesses and 230 responded. Seemingly, an endless amount of data was collected that described the composting/processing industry's size and make-up.

A majority of composters surveyed stated that the agricultural sector was a significant market segment for their business. Some of the major crops that the compost was used on included: almonds, rice, corn, strawberries, and much more. Services provided by composters spanned from blending, to spreading, to even bagging the compost for clients. The amount of compost produced and sold to the agricultural sector in the Central Valley was 1.9 million cubic yards with only 29 composting businesses in the Central Valley (Cotton, et al. 2010)

These facts, coupled with Assembly Bill 939, indicate that there is a market for blended product in Stanislaus County. The survey tells us that in the 1990's and 2000's, California held demonstration projects and workshops dedicated to teaching California farmers how composted material interacts with the soil and how beneficial it could be. Now all they need is businesses to supply them with consistent quality product at low rates (Cotton, et al. 2010

Chapter 3

METHODOLOGY

Procedures for data collection

The goal of production is to ship, and sell 50,000 cubic yards of compost/fertilizer blends. The survey funded by CDRRR will be used to calculate this figure. Variables needed are: the amount of compost sold in the Central Valley, and the number of composters located in the same specified region.

Enterprise budgets will be created for the new composting sector of the business to calculate how profitable it will be. Variables portrayed in the enterprise budget are: income from compost sales which are generated from the amount of compost produced and the price of the compost, variable costs associated with the production of compost, and fixed costs related to the production period of the compost. Variable costs consist of labor, fuel and lubrication, repair costs, and compost amendments. Fixed costs consist: of rent or property tax, interest on loan, depreciation on investments, shelter for equipment, taxes on equipment, insurance for equipment, and interest on equipment.

Table 1. List of Almond Waste Compost Enterprise Budget Variables

Variable Cost Per Year	Fixed Costs Per Year
Labor	Property rent
Fuel	Interest on equipment
Lubrication	Depreciation on equipment
Repair	Shelter for equipment
Compost amendments	Taxes on equipment
	Insurance on equipment
	Licensing and permit fees
	Loan payment

Dollar prices of the composted material on a cubic yard basis and the amount of material sold (cubic yards) will be needed. Almond farmers and hullers are paying people to take wastes off of their hands. Since the composters get paid for inputs, profit margins can be greater than normal while still allowing the price of the product to be relatively low. The price is dependent on the total costs which will come from the enterprise budget, divided by the amount produced which will be calculated using the CDRRR survey. The profit margin will be added on after this calculation.

Variable costs are those that change with the amount of compost being produced (Rouse, Rothenberger, and Zurbrügg 2008). Variable costs, as stated above, include: Labor, fuel and lubrication, repair costs, compost amendments (water, nitrogen based materials, and other amendments needed to create the perfect composting environment).

Labor will be estimated by using the USDA’s 2007 Census of Agriculture survey. Hired farm labor as a percentage of total production costs are given by county. San Joaquin County falls into the 15%-19% range.

Fuel, lubrication, and repair costs of the equipment being used will be estimated using the formulas set forth by the American Society of Agricultural Engineers. These formulas are presented in the textbook, Machinery Management: How to Select Machinery to Fit the Real Needs of Farmers, published by Deere and Company in 2008. Variables that are needed are: size (PTO HP) and price of tractor purchased, which will come from the dealers specifications on the equipment, price of mulch churner and chipper, which again will come from specifications given by the local dealer, hours used per batch of compost, and cost of diesel. Hours used per batch of compost is dependent on the amount of compost being produced which stems from the CDRRR survey. Cost of diesel will be determined using the California state website's energy almanac. This site provides average fuel prices per year, of which we will take the average from the previous five years to use throughout the study.

Compost amendments vary from chemical fertilizers and manure, which supply nitrogen to reach the optimal carbon to nitrogen ratio, or water to keep the compost moist and obtain the proper moisture content. The cost will be gathered from the local fertilizer dealer with the best price. A fee of five extra dollars a ton will be charged if farmer wants a personal blend of compost and fertilizer.

Fixed costs are incurred whether or not compost is being produced (Rouse, Rothenberger, and Zurbrügg 2008). Fixed costs taken into account are: rent or property tax, interest on loan, depreciation on investments, shelter for equipment, taxes on equipment, insurance for equipment, and interest on equipment.

Rent on property will be acquired and calculated based on the owners past records. Interest on the loan will also be based on the financial standing of the owner of the company.

The loan acquired is for the equipment needed to produce compost. Equipment such as a tractor and churner are needed, along with chippers and trucks to haul compost to customers.

Depreciation, shelter, taxes, insurance, and interest on equipment will all be calculated based on equations set forth by the American Society of Agricultural Engineers, and again, are found in the textbook, Machinery Management: How to Select Machinery to Fit the Real Needs of Farmers. All these costs are associated with the purchase price of the equipment which will be found by local dealer prices of the equipment, as stated before.

Procedure for Data Analysis

Once acquired for the CDRRR study amount of compost produced will be divided by the number of composters in the area; this will give us the estimated cubic yards sold per composter.

$$\text{Estimated cubic yards sold/composter} = \frac{\text{Total amount of compost produced in the region}}{\text{Number of composters in the Central Valley}}$$

Revenues, variable costs, and fixed costs will all go into the making of the enterprise budget. The budget will separate the variable costs, fixed costs and revenues and allow us to estimate the profit when selling one cubic yard of compost.

Price of the final product has to be equal to the total cost, which will come from the enterprise budgets created, divided by how much compost was produced (cubic yards), which will be based upon the market demand which comes from the CDRRR survey, plus the profit margin the company sets (Rouse, Rothenberger, and Zurbrügg 2008). The reason farmers set the price of their product is because every composted product is different, depending on what they used as the compost medium, and what type of fertilizer was used to create the blend.

$$\text{Price/cubic yard} = \frac{\text{Total costs}}{\text{Compost production}} + \text{Profit margin}$$

Variable cost equations for Fuel, lubrication, and repair:

Fuel costs = .044 * Power take-off Horsepower (PTO HP) * Hours used * fuel cost per gallon

Lubrication costs = fuel costs * 10%

Repair costs = (Purchase price) * Repair factor one * (total hours/1000)^(Repair factor 2)

*Size and price of tractor, chipper, and mulch churner will be provided by local dealer

Only one enterprise budget will be made, which will estimate revenues and cost for all ten years. Fuel, lubrication, labor, and amendment costs will stay constant throughout the ten years of production because the same amount of compost will be produced each year. Depreciation and repair costs change throughout the projects life because the equipment gets older as time goes on. Because of this, the Repair at the sixth year will be used in the enterprise budget. Using the same logic, the depreciation expense at year six will also be used in the enterprise budget. A table will be made using the formulas from Machinery Management: How to Select Machinery to Fit the Real Needs of Farmers, which displays all costs associated with owning and operating machinery.

Fixed cost equations rely on the depreciation equation since shelter, taxes, insurance, and interest are all percentages of the equipments value at the beginning of each year. The depreciation equation that is being used is called the remaining value equation. This equation was chosen because it most resembles the value of equipment over time. It depreciation the most is the first two to three year relative to the latter years.

Remaining value = (purchase price) * (0.67)*(.094^n-1)

*This gives the remaining value after years used where (n) is the number of years owned.

Shelter, taxes, insurance, and interest on the equipment are just percentages based on the remaining value at the beginning of each year, which was calculated with the depreciation. All percentages for shelter, taxes, insurance, and interest are available in the textbook Management: How to Select Machinery to Fit the Real Needs of Farmers Completing the budget will allow us to conduct break-even analyses which calculate the price needed to break even given a certain yield and vice versa.

Break-even price = Total costs/yield (cubic yard)

To find the short run break-even analyses, use only the variable costs given in the enterprise budget, and to find the long-run break even prices use variable and fixed costs.

The calculated profit per cubic yard of product, coupled with the estimated production from the CDRRR survey, will gives us a pretty accurate estimate of future cash flows once depreciation is added back in because it is a non-cash expense. Using these cash flows, extrapolated to ten years, and the interest rate granted to the owner of the operation for the discount rate, the net present value and internal rate of return can be found for this business venture; thus Giving the company a good reading on whether compost/fertilizer blending will be economical or not.

$$\text{Net Present Value (NPV)} = -Cf(0) + \frac{Cf(1)}{(1+R)^1} + \frac{Cf(2)}{(1+R)^2} + \ldots..$$

Where Cf equals the cash flows for the respective years, and R is the cost of capital. This is an example of the first two years; the equation for this study will extend out to eight years.

The internal rate of return can be calculated using the same equation except making the NPV equal 0, and solving for the rate (R).

Different circumstances, other than the perfect ones laid out by the author, cause for a change in the cash flows or profitability in the enterprise. A sensitivity analysis will be conducted to determine the peaks and troughs of the profitability.

Assumptions

It is assumed that:

- The company will be the size of an average composting business in the Central Valley.
- The company will be of adequate size, to produce the amount of compost/fertilizer blends stated.
- The company is in compliance with regulations and standards set forth by the state of California.
- No natural disasters or industry ending laws will be past for the next eight to ten years.
- Equipment follows the depreciation and repair cost schedule set forth.

Limitations

The study does not account for inflation, and is in terms of today's dollars. Amount of product being produced is based off of the average size of composters in the Central Valley;

when in reality it will probably be substantially smaller in size. Information on this industry is rare due to the fact that it is a fairly new; therefore, production numbers are only rough estimates.

Chapter 4

DEVELOPMENT OF THE STUDY

Finding out the amount to produce comes from the study done by the CDRRR. In the report they have a series of tables specifying all different things relating to recycling. In the tables, which are broken up into regions, one can find the amount of composters and the amount of compost produced for agricultural purposes for the Central Valley region of California.

Table 2. Number of Composters in The Central Valley

Comparison of Participating Composters by region			
	2000	2003	2008
Southern	25	19	38
Central Valley	32	35	29
Central Coast	15	20	21
Bay Area	20	18	15
Northern	12	9	12

Source: Cotton, Matthew, Stuart Buckner, Niel Edgar, Mark Grover, John Gundlach, and Jerry Lawrie 2010. "Third Assessment of California's Compost and Mulch-Producing Infastructure; Management Practices and Market Conditions." *California Department of Resources Recycling and Recovery*. Sacramento. Publication #DRRR-2010-007. August.

Table 3. Amount of Compost Sold in the Central Valley (In Cubic Yards per Year)

Distribution of Products Sold by Region (Composters) (Cubic Yards Per Year)									
	Agricultural	Landscape	Nursery	Caltrans	ADC	Biomass Fuel	Municipal	Beneficial Reuse at Landfills	Other
Southern	468,669	361,031	79,335	0	5,435	5,435	0	5,435	25,110
Central Valley	406,661	103,511	2,313	6,200	36,163	36,163	6,334	0	727
Central Coast	1,990,061	355,316	88,071	21,560	243,492	243,492	6,337	0	62,550
Bay Area	60,900	38,295	1,350	0	17,556	17,556	1,000	228	0
Northern	93,575	462,704	114,060	9,978	20,519	20,519	8,300	65,715	3,200
TOTAL	3,019,866	1,320,857	285,129	37,738	323,165	323,165	21,971	71,378	91,587

Source: Cotton, Matthew, Stuart Buckner, Niel Edgar, Mark Grover, John Gundlach, and Jerry Lawrie 2010. "Third Assessment of California's Compost and Mulch-Producing Infastructure; Management Practices and Market Conditions." *California Department of Resources Recycling and Recovery*. Sacramento. Publication #DRRR-2010-007. August.

Given these tables, the average amount of compost produced per composter in the Central Valley region can be found by simply dividing the amount produced over the total number of composters. This comes out to about 68,000 cubic yards per composter. Given that this is a start up business and there is going to be a learning curve for the owner, the amount produced will be lowered to 50,000 cubic yards. This is a nice round number that underestimates the production capacity based on tables 2 and 3. It creates a situation where, if decided, the owner can produce more if need be.

This 50,000 cubic yards ultimately symbolizes the farmers' demand of the product. The study done by CDRRR accounts for the product sold, this amount sold helps define the point of equilibrium in a supply and demand curve. This means that both supplier and buyer agreed on this amount to be sold. This is a rough estimate, but because of time constraints, it gives the best representation of how much to produce, and in an indirect way, the demand for compost in the Central Valley.

To find out if the business idea will be economically viable when producing 50,000 cubic yards, numerous costs have to be collected, most of which are the located in table 1 in the methodology section of the study. Once these costs are gathered, an enterprise budget which separates revenues, fixed costs, and variable costs is developed in order to find out the revenue gain or loss for each year of the business.

First costs found are the costs of the two pieces of equipment that the company will need in order to produce compost effectively and efficiently. The two pieces of equipment are a compost turner and a horizontal grinder. The compost turner is used, as it states, to turn the compost twice a week. The brand name of the compost turner selected is HCL, which is located close to the business in Dos Palos, CA. The horizontal grinder is used for reducing the particle size of the huller waste, making everything uniform and creating faster composting times. The name of the company from which the grinder was purchased is called Rotochopper Inc. located in Minnesota. All prices were found based on actual salesmen interactions. Conversations were had with both representatives about the equipment, and the decision to purchase the equipment was base on price, reliability, and effectiveness (Quotes given in appendix).

Table 4. List of Purchasing Prices on Equipment

	Prices
turner	$ 25,746.25
Grinder	$ 219,188.00
Total to be borrowed	$ 244,934.25

Sources: HCL Machines and Rotochopper Inc.
Actual Quotes given in the Appendix

Seen in table 2 above are the purchasing prices on the compost turner and the horizontal grinder. These prices include sales tax and freight in order to get the equipment on site. Now that the prices for the equipment are accounted for, financing them becomes an issue. The company that is looking into this business relayed that they could attain an interest rate of 5%.

Since the study is looking into the first ten years of this business, the loan will be amortized over these ten years. This, if needed, gives the owner the data throughout the ten years and that is it. If he decides to get out of the business after these ten years, he can do so without any lingering cost after the fact.

Table 5. Loan Amortization Summary

Interest rate	5%
total borrowed	$ 244,934.25
Total months	120
monthly payment	$ (12,281.91)
Annual Amount	$(147,382.96)

Source: interest rate directly from business owner
Borrowed amount from table 2, full amortization schedule given in appendix.

Seen in table 3, above, is the calculated monthly payment of the amortized loan for the equipment. Since we are creating a yearly enterprise budget, this number has to be multiplied by the number of months in a year, giving us the annual payment for the loan.

All costs associated with the equipment are calculated using the equations stated in the methodology section of the study. The equipment costs are fuel, lubrication, maintenance, Taxes on equipment, shelter for equipment, insurance on equipment, interest on equipment, and depreciation on equipment. A table, using these equations, has been made to summarize the cost of the equipment per year.

Table 6: Depreciation and Cost Table

Years	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Value	$ 244,934	$ 164,106	$ 154,260	$ 145,004	$ 136,304	$ 128,126	$ 120,438	$ 113,212	$ 106,419	$ 100,034
Depreciation	$ 80,828	$ 9,846	$ 9,256	$ 8,700	$ 8,178	**$ 7,688**	$ 7,226	$ 6,793	$ 6,385	$ 6,002
Remaining value	$ 164,106	$ 154,260	$ 145,004	$ 136,304	$ 128,126	$ 120,438	$ 113,212	$ 106,419	$ 100,034	$ 94,032
Accumulated Depreciation	$ 80,828	$ 90,675	$ 99,930	$ 108,630	$ 116,809	$ 124,496	$ 131,723	$ 138,515	$ 144,900	$ 150,902
Average Accumuated Depreciation	$ 80,828	$ 45,337	$ 33,310	$ 27,158	$ 23,362	$ 20,749	$ 18,818	$ 17,314	$ 16,100	$ 15,090
Taxes @4% of RV	$ 9,797	$ 6,564	$ 6,170	$ 5,800	$ 5,452	$ 5,125	$ 4,818	$ 4,528	$ 4,257	$ 4,001
Shelter @ 3% of RV	$ 7,348	$ 4,923	$ 4,628	$ 4,350	$ 4,089	$ 3,844	$ 3,613	$ 3,396	$ 3,193	$ 3,001
Interest @ 3% of RV	$ 7,348	$ 4,923	$ 4,628	$ 4,350	$ 4,089	$ 3,844	$ 3,613	$ 3,396	$ 3,193	$ 3,001
Insurance @ 6% of RV	$ 14,696	$ 9,846	$ 9,256	$ 8,700	$ 8,178	$ 7,688	$ 7,226	$ 6,793	$ 6,385	$ 6,002
Total Fixed costs per year	**$ 120,018**	**$ 36,103**	**$ 33,937**	**$ 31,901**	**$ 29,987**	**$ 28,188**	**$ 26,496**	**$ 24,907**	**$ 23,412**	**$ 22,007**
Total accumulated fixed costs	$ 120,018	$ 156,121	$ 190,058	$ 221,959	$ 251,946	$ 280,134	$ 306,630	$ 331,536	$ 354,949	$ 376,956
Average annual fixed cost	$ 120,018	$ 78,061	$ 63,353	$ 55,490	$ 50,389	$ 46,689	$ 43,804	$ 41,442	$ 39,439	$ 37,696
Fuel costs	$ 42,299	$ 42,299	$ 42,299	$ 42,299	$ 42,299	$ 42,299	$ 42,299	$ 42,299	$ 42,299	$ 42,299
Lubrication	$ 5,076	$ 3,807	$ 3,807	$ 3,807	$ 3,807	$ 3,807	$ 3,807	$ 3,807	$ 3,807	$ 3,807
Repair	$ 460	$ 1,380	$ 2,299	$ 3,219	$ 4,138	**$ 5,058**	$ 5,977	$ 6,896	$ 7,815	$ 8,734
Accumulated Repair cost	$ 460	$ 1,840	$ 4,140	$ 7,359	$ 11,499	$ 16,558	$ 22,538	$ 29,437	$ 37,256	$ 45,996
Labor	$ 5,720	$ 5,720	$ 5,720	$ 5,720	$ 5,720	$ 5,720	$ 5,720	$ 5,720	$ 5,720	$ 5,720
Total operating cost	**$ 53,555**	**$ 53,206**	**$ 54,126**	**$ 55,045**	**$ 55,965**	**$ 56,884**	**$ 57,803**	**$ 58,722**	**$ 59,641**	**$ 60,560**
Total fixed and operating costs	**$ 173,573**	**$ 89,309**	**$ 88,063**	**$ 86,946**	**$ 85,951**	**$ 85,072**	**$ 84,300**	**$ 83,629**	**$ 83,053**	**$ 82,568**
Accumulated total cost	$ 173,573	$ 262,882	$ 350,945	$ 437,891	$ 523,843	$ 608,914	$ 693,214	$ 776,843	$ 859,896	$ 942,464
Average Accumulated total cost	$ 173,573.01	$ 131,441.16	$ 116,981.69	$ 109,472.79	$ 104,768.52	$ 101,485.70	$ 99,030.53	$ 97,105.32	$ 95,544.01	$ 94,246.37

Source: Machinery Management: How to Select Machinery to Fit the Real Needs of Farmers, John Siemens and Wendell Bowers. 1975

Since one enterprise budget is being created to reflect revenues and costs on a yearly basis, estimations have to be made when using these numbers. For any type of revenue, it is always good to under estimate. For any cost, it is always good to overestimate. Using this rule of thumb, Repair (maintenance) and depreciation costs have to be estimated or averaged because they change with each subsequent year. The repair cost increases as time goes on due to the fact that equipment, when older, tends to break down more. So using the repair cost of year six in the depreciation table and putting it in the enterprise budget will give us and overestimated average; the same holds true for the depreciation costs as well. The taxes, shelter, insurance, and interest of the equipment (TSII) are a percentage of the remaining value at the beginning of each year. As the equipment depreciates more every year, the value of TSII will decrease. Using the sixth years remaining value will give us an average of these costs, and will be put into the enterprise budget.

Fuel, lubrication, and labor costs do vary from year to year, which requires no averages or estimations. The number seen on the yearly fuel, lubrication, and labor costs on the table is put directly into the enterprise budget.

Costs not associated with the equipment, which are: the electricity to run the pump at the water well, the synthetic blending material (UN-32), and the manure used to obtain the carbon to nitrogen ratio in the compost. Water costs are simply the electricity bill the owner has to pump the water out of the ground at his well. He estimates it to be about $200 a month when irrigating 40 acres of almonds with the same well and pump set up. The full $200 dollars is put into the enterprise budget because the same amount of water, maybe a fraction less, will be used to create the optimal moisture content in the compost.

The price of the UN-32, which is an aqueous fertilizer that contains urea and ammonium nitrate, was found by contacting multiple fertilizer distributors in the Central Valley. The distributor with the cheapest delivered price, because it is fairly close to the business, is Mid-Valley Ag. Salesmen Brain Dugo quoted a price at $2.50 per gallon. Contracting this type of solution cannot be done, therefore this price can fluctuate, causing variability in the study.

The price of manure was found by negotiating with a nearby dairyman. He claimed that if the business could pick it up and haul it away, the price would be $2.00 per ton. Seeing this reasonable, the business accepted and locked in the price for the full 10 years of the study.

The amount of manure and UN-32 used in the composting process was based on a test of the raw material. It's dry matter content was 75% and the carbon to nitrogen ratio for any wood based material is around 300:1. These amounts were used to find the amount needed to create to optimal composting conditions.

The last two fixed costs are the rent cost, and the permits and licensing cost the business must pay in order to be a composter in the state of California. The owner decided to have the studied business rent from the original business of almonds just to make it simpler. Since this business would take up about a quarter of the land on which the payment made, justifiably it would basically be a quarter of his ranch payment that he has now. The payment is about $6,000, making the rent check per month be $1,500, or $18,000 a year.

Martin Mileck of Cold Creek Compost was contacted to get a feel for the type of permits and fees needed to run a composting business in California. Martin, along with running Cold Creek Compost, is involved with the politics associated with composting in California. He stated that the fees and permits needed to compost in California would equate to $14,593.77 per year and that the CDRRR website could be used to check these figures. This number was checked using said website, on which they label all permits and fees, and it was correct (source in reference cited page).

The revenues for the business come from the huller waste haul away, and the finished compost sales. Almond hullers within 10 miles of the business' location were contacted to find out the price they were willing to pay for the composting business to haul it away. The price that was settled on was $2.50 per cubic yard that the business hauled away.

As explained in the Methodology section, the selling price of the finished product is the cost per cubic yard plus the margin the owner would like to add. It is critical that the price margin selected by enough to where the business makes money, but also low enough to where the price of the material is still competitive. A Price of $4.00 was established; this price is competitive but also allows for substantial revenues per year. Now that all costs and revenues have been discussed, here is the completed enterprise budget.

Table 7. Enterprise Budget

		units	Price per unit	# of units	totals
Revenues					
	waste haul away revenue	cubic yards	$ 2.50	50000	$ 125,000.00
	Finished goods sold	cubic yards	$ 4.00	50000	$ 200,000.00
Total revenue					**$ 325,000.00**
Variable costs					
	water electricity	month	$ 200.00	12	$ 2,400.00
	UN-32 (solution)	gallons	$ 2.50	3000	$ 7,500.00
	manure	tons	$ 2.00	500	$ 1,000.00
	Fuel	gallons	$ 4.33	520	$ 42,299.40
	lubrication (12% of fuel)	gallons	$ 4.35	520	$ 5,075.93
	maintanence (repairs for year 6)	year	$ 5,057.60	1	$ 5,057.60
	Labor	hours	$ 11.00	520	$ 5,720.00
Total Variable costs					**$ 69,052.93**
	Short Run breakeven price of finished product				**$ (1.12)**
Fixed Costs					
	Rent	month	$ 1,500.00	12	$ 18,000.00
	amortized loan payment for equipment	month	$12,281.91	12	$ 147,382.96
	Depreciation of equipment (purchase price-book value at year 6)	year	$7,687.53	1	$ 7,687.53
	TSII for equipment (16% of book value at third year)	year	$ 24,681.53	1	$ 24,681.53
	Permits and liscensing fees	year	$ 14,593.77	1	$ 14,593.77
Total Fixed Costs					**$ 212,345.79**
	Long run break even price of finished product				**$ 3.13**
Net Income					**$ 43,601.27**

Short and long run break-even prices of the finished product are given after the variable and fixed costs of the enterprise budgets. The short run break-even price includes just the variable costs when looking at what finished product price will make us break-even. In this case, since the business has revenue gains from hauling away the huller waste for the huller and shellers, the short run break-even price is negative. This means that the revenue gained from hauling the waste away is greater than the variable costs associated with producing the compost.

The long run break-even price is $3.13 per cubic yard. This Means that the business could drop the price of the finished goods to $3.13 per cubic yard and break-even in the long run, or have zero profit.

Net present value (NPV) and internal rate of return (IRR) calculations use the income from the enterprise budget as the basis for the cash flows for each of the ten years. The first year shows the costs associated with producing the finished product but not the revenue gained. This is because the compost takes a year to produce, making the first year only a producing year and not a selling year. Depreciation is then added back into the net income to get the actual annual cash flows for the ten years. Depreciation is added back because it is a non-cash expense to the business. Since it is a non-cash expense, it is never really seen by the business. The interest rate, or cost of capital, for the NPV and IRR calculations mimic that of the loan amortization interest rate. Since it is the owner's time and money, the calculations have to show that, so the interest rate was kept the same.

Table 8. NPV and IRR

	0	1	2	3	4	5	6	7	8	9	10
Cash flow	$ (156,398.73)	$ 51,288.81	$51,288.81	$51,288.81	$51,288.81	$51,288.81	$51,288.81	$51,288.81	$51,288.81	$51,288.81	$51,288.81
NPV	$ 228,228.41		IRR	30.51%							

As you can see the NPV of the project is a positive $228,228.41, and the IRR is a positive 30.51%. Although these numbers seem high, they fit the data they describe. This sort of business has two sources of revenue, the least of which covers all the variable costs; this makes the NPV and IRR as high as they are.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Throughout the study the main goal has been trying to find out if a business of this sort would be economically viable and whether or not the business could produce enough in order to be profitable. The findings from the market research done by the CDRRR find that the average composter in the Central Valley produces about 68,000 cubic yards. This amount is large enough for a business like this one to in fact make a profit and be economically viable. The hypotheses state that the IRR would be above 15% and the NPV of the business would be a positive value. The findings from the study are that the IRR is about 31% and the NPV a positive $228,228.41, which exceed the estimated hypotheses.

Conclusions

Business owners in the agricultural industry are always looking for ways to diversify while also having outside pressures to become more environmentally friendly. A business such as this looks at solving both of these problems at the same time. This study looks to provided ample information in order to tell if a business of this sort would be economically viable through a ten year span.

One of the first concerns is whether or not the business would be able to produce enough to make a substantial profit. The survey conducted by CDRRR estimates that the average composter in the Central Valley produces 68,000 cubic yards of compost per year. This number was diminished to 50,000 cubic yards to take into account the area of land the original business has to work with and any problems that might occur do to the learning curve the owner would have to go through. It turns out that producing 50,000 cubic yards of compost creates substantial profit, meaning that there is indeed a market for the business to survive.

The NPV of the project while producing 50,000 cubic yards of compost was a positive $228,228.41. Since the NPV is positive, is means that the business is profitable. Not only is the NPV positive, in this case, it is an extremely large number. An explanation for this is the fact that the revenue gained from hauling the waste material away from the almond huller covers all of the variable costs. Having all variable costs covered, one's only expenses are the fixed costs. Since the variable costs are covered, the short run break-even price is a negative number, meaning that the company could give the unfinished product away and still make money. The long run break-even price of the finished product is $3.13. This means the business could charge as low as $3.13 per cubic yard before they start losing money on the finished compost. This helps the business determine the actual price of the finished product when it starts to sell it.

The IRR of the project was about 31%. Once again this is a substantially high IRR, but it is explained by additional income from the waste removal. Being at 31% suggests that interest rates, or the cost of capital, can skyrocket all the way to 31% before the business starts losing money. This provides comfort because interest rates rarely ever, and almost never, go that high.

.

Recommendations

This business has all the right qualifications to be profitable and should therefore be implemented into an actual day-to-day operation business. This sort of business could be new and upcoming; but not enough research, such as this study, has been done pertaining to it for it to flourish. Looking forward, one can take this idea and study a different area besides the Central Valley. The CDRRR survey listed multiple regions that could be studied. A change in the material being composted should come with a change in regions. Almond huller waste was chosen based on the fact that there is an abundance of it in the Central Valley. If a study is being done on the Central Coast, perhaps vine and wine grape waste should be considered because there is an abundance of this material in that region.

References Cited

Dmytrenko, April L. 1997 "Cost Benefit Analysis." *ARMA Records Management Quarterly* (31:1). January. Pp. 16-20.

Cotton, Matthew, Stuart Buckner, Niel Edgar, Mark Grover, John Gundlach, and Jerry Lawrie 2010. "Third Assessment of California's Compost and Mulch-Producing Infastructure; Management Practices and Market Conditions." *California Department of Resources Recycling and Recovery*. Sacramento. Publication #DRRR-2010-007. August. Pp 1-154.

Edmeades, Douglas C. 2003. "The Long-term Effects of Manures and Fertilizers on Soil Productivity and Quality: A Review." *Nutrient Cycling in Agro-Ecosystems* (6:2). June. Pp. 165-180.

Goulin, Francis R. 1998. "Commercial Composting Systems." *Hortscience* (33:6). October. Pp 932-933.

Harpole, George B., 1984 "Internal Rate of Return May Be Used to Define Initial Equity for Composite Rate-of-Return Analyses." *Forest Science* (30:4). November. Pp 1096-1102.

Marr, James B. and Roderick M. Facey. 1995. "Agricultural Waste." *Water Environmental Research* (6:4). June. Pp. 503-507.

Nelson L. B. 1972. "Agricultural Chemicals in Relation to Environmental Quality: Chemical Fertilizers, Present and Future." *Journal of Environmental Quality* (1:1). January.Pp. 1-7.

Radabaugh, Joseph 1980. "The Compost Pile and Its Ecosystem." Unpublished Senior Project. California Polytechnic State University, San Luis Obispo. Project #80-1339. Pp. 1-10.

Rao, Nishant, Hans E. Grethlein, and C.A. Reddy 1995. "Effect of C/N Ration and Miosture Content on the Composting of Poplar Wood." *Biotechnology Letters* (17:8). August. pp 889-892.

Ros M. S. Klammer, B. Knapp, K. Aichberger, and H. Insam. 2006. "Long-Term Effects of Compost Amendments of Soil On Functional and Structural Diversity and Microbial Activity." *Soil Use and Management* (22:2). June. Pp 209-218.

Rouse, Jonathan R., Silke Rothenberger, and Chris Zurbrügg. 2008. Marketing Compost: *A Guide for Compost Producers in Low and Middle-Income Countries.*

Shideler, Richard E. 1966 "A Machine to Pre-clean Almonds." Unpublished Senior Project. California Polytechnic State University, San Luis Obispo. Project #66-0209. Pp. 1-5.

Sikora, Lawrence J. 1996 “Effect of compost-fertilizer Blends on Crop Growth.” *The Science of Composting.* February Pg. 423-430.

Termorshuizen, Aj, Sw Moolenaar, Ahm Veeken, and Wj Blok. 2004. “The Value of Compost.” *Reviews in Environmental Science and Biotechnology* (3:4). December. Pp. 343-347.

Appendix

Horizontal Grinder Quote

QUOTATION
 # 20323
02/26/13

Rotochopper Inc.
217 West Street - PO Box 295
St. Martin, MN 56376
P: 320-548-3586 F: 320-548-3372

For: Jordan
Jordan
San Luis Obispo CA

Sales Rep: Nick Korn
Est. Shipping Date: Currently 16-20 weeks from deposit
Terms: 20% Down, 80% when shipped, FOB St. Martin

MP2 - Mobile diesel powered wood grinder/colorizer

★ Tier 3 FLEX - CAT C7 275 HP Tier 3 diesel engine		
★ 56" wide x 12' long steel belt in-feed conveyor		
★ 24 Tooth Indexable Rotor		
★ 32" dia. x 56" wide power feeder		
★ 48" wide x 26' long under rotor take away conveyor with 10' dump height		
★ Power feed proportional pressure system		
★ Hydraulic power feed shock kit		
★ Slab Ramp		
★ Shear pin protected screen arm assembly		
★ Pintle Hitch		
★ 20,000 lb. single axle with air brakes		
★ Radiator pre cleaner, tool box, and 5lb fire extinguisher		
★ PAS / Colorizer, Dust Control System		
★ Wireless remote control system		
★ Hydraulic Oil Cooler		
★ Commissioning & Training		
★ Delivery to San Luis Obispo, CA - 1,996 miles		
★ Reversible radiator fan		
	Sub Total	$207,738.00
★ 1 3" Forestry Baffled Sq Hole Screen		$0.00
★ 24 2 Bolt Indexable Hardsurfaced Tooth		$0.00
★ California Sales Tax NOT Included (to be calculated upon final order details)		$0.00
TOTAL		**$207,738.00**

Additional Suggested Options Not Included in Total

		Check to Include	Customer Initials	Sales Rep Initials
48" wide cross belt magnetic separator	$11,450.00	☐	_______	_______

- Unless otherwise noted, all prices are shown in US dollars $$.
- Quoted By:____________________ Accepted By:____________________ Date:_________
- This quotation is valid for 30 days. All taxes, levies, duties, or other governmental fees are the responsibility of the buyer.
- Fuel surcharge may apply.
- Rotochopper Standard Terms and Conditions are incorporated herein by reference, they can be read at http://www.rotochopper.com/assets/documents/stc.pdf.

Compost Turner Quote

HCL MACHINE WORKS
15142 MERRILL AVE
DOS PALOS, CA 93620

(209) 392-6103
FAX (209) 392-3000

Quote

Customer No.: CASH4
Quote No.: 1323

Quote To: JORDON MARCHY
CAL POLY
209-496-5206

(209) 392-6103
FAX

Ship To: JORDON MARCHY
CAL POLY
209-496-5206

Date	Ship Via	F.O.B.	Terms
02/08/13	BEST WAY	Origin	Due on receipt

Purchase Order Number	Sales Person	Required
		02/08/13

Quantity Required	Shipped	B.O.	Item Number	Description	Unit Price	Amount
1			CT 10	10' HCL - PTO DRIVEN WINDROW COMPOST TURNER	23950.00	23,950.00

Quote subtotal	23,950.00
Sales tax @ 7.500%	1,796.25
Quote total	25,746.25

FINANCE CHARGE OF 1.5% PER MONTH ON PAST DUE ACCOUNTS

Thank You

Loan Amortization Table

Month	Beginning Principal	Ending Principal	Payment	Interest	Principal
1	244,934	$ 244,899.05	$12,281.91	$ 12,246.71	$35.20
2	244,899	$ 244,862.09	$12,281.91	$ 12,244.95	$36.96
3	244,862	$ 244,823.28	$12,281.91	$ 12,243.10	$38.81
4	244,823	$ 244,782.53	$12,281.91	$ 12,241.16	$40.75
5	244,783	$ 244,739.74	$12,281.91	$ 12,239.13	$42.79
6	244,740	$ 244,694.82	$12,281.91	$ 12,236.99	$44.93
7	244,695	$ 244,647.65	$12,281.91	$ 12,234.74	$47.17
8	244,648	$ 244,598.12	$12,281.91	$ 12,232.38	$49.53
9	244,598	$ 244,546.11	$12,281.91	$ 12,229.91	$52.01
10	244,546	$ 244,491.50	$12,281.91	$ 12,227.31	$54.61
11	244,492	$ 244,434.16	$12,281.91	$ 12,224.58	$57.34
12	244,434	$ 244,373.96	$12,281.91	$ 12,221.71	$60.20
13	244,374	$ 244,310.74	$12,281.91	$ 12,218.70	$63.22
14	244,311	$ 244,244.37	$12,281.91	$ 12,215.54	$66.38
15	244,244	$ 244,174.67	$12,281.91	$ 12,212.22	$69.69
16	244,175	$ 244,101.49	$12,281.91	$ 12,208.73	$73.18
17	244,101	$ 244,024.65	$12,281.91	$ 12,205.07	$76.84
18	244,025	$ 243,943.97	$12,281.91	$ 12,201.23	$80.68
19	243,944	$ 243,859.26	$12,281.91	$ 12,197.20	$84.71
20	243,859	$ 243,770.31	$12,281.91	$ 12,192.96	$88.95
21	243,770	$ 243,676.91	$12,281.91	$ 12,188.52	$93.40
22	243,677	$ 243,578.84	$12,281.91	$ 12,183.85	$98.07
23	243,579	$ 243,475.87	$12,281.91	$ 12,178.94	$102.97
24	243,476	$ 243,367.75	$12,281.91	$ 12,173.79	$108.12
25	243,368	$ 243,254.23	$12,281.91	$ 12,168.39	$113.53
26	243,254	$ 243,135.03	$12,281.91	$ 12,162.71	$119.20
27	243,135	$ 243,009.86	$12,281.91	$ 12,156.75	$125.16
28	243,010	$ 242,878.44	$12,281.91	$ 12,150.49	$131.42
29	242,878	$ 242,740.45	$12,281.91	$ 12,143.92	$137.99
30	242,740	$ 242,595.56	$12,281.91	$ 12,137.02	$144.89
31	242,596	$ 242,443.43	$12,281.91	$ 12,129.78	$152.13
32	242,443	$ 242,283.69	$12,281.91	$ 12,122.17	$159.74
33	242,284	$ 242,115.96	$12,281.91	$ 12,114.18	$167.73
34	242,116	$ 241,939.84	$12,281.91	$ 12,105.80	$176.12
35	241,940	$ 241,754.92	$12,281.91	$ 12,096.99	$184.92
36	241,755	$ 241,560.75	$12,281.91	$ 12,087.75	$194.17
37	241,561	$ 241,356.88	$12,281.91	$ 12,078.04	$203.88
38	241,357	$ 241,142.81	$12,281.91	$ 12,067.84	$214.07
39	241,143	$ 240,918.04	$12,281.91	$ 12,057.14	$224.77
40	240,918	$ 240,682.02	$12,281.91	$ 12,045.90	$236.01
41	240,682	$ 240,434.21	$12,281.91	$ 12,034.10	$247.81
42	240,434	$ 240,174.01	$12,281.91	$ 12,021.71	$260.20
43	240,174	$ 239,900.80	$12,281.91	$ 12,008.70	$273.21
44	239,901	$ 239,613.92	$12,281.91	$ 11,995.04	$286.87
45	239,614	$ 239,312.71	$12,281.91	$ 11,980.70	$301.22
46	239,313	$ 238,996.43	$12,281.91	$ 11,965.64	$316.28
47	238,996	$ 238,664.34	$12,281.91	$ 11,949.82	$332.09
48	238,664	$ 238,315.64	$12,281.91	$ 11,933.22	$348.70
49	238,316	$ 237,949.51	$12,281.91	$ 11,915.78	$366.13
50	237,950	$ 237,565.07	$12,281.91	$ 11,897.48	$384.44
51	237,565	$ 237,161.41	$12,281.91	$ 11,878.25	$403.66
52	237,161	$ 236,737.57	$12,281.91	$ 11,858.07	$423.84
53	236,738	$ 236,292.54	$12,281.91	$ 11,836.88	$445.03
54	236,293	$ 235,825.25	$12,281.91	$ 11,814.63	$467.29
55	235,825	$ 235,334.60	$12,281.91	$ 11,791.26	$490.65
56	235,335	$ 234,819.42	$12,281.91	$ 11,766.73	$515.18
57	234,819	$ 234,278.48	$12,281.91	$ 11,740.97	$540.94
58	234,278	$ 233,710.49	$12,281.91	$ 11,713.92	$567.99
59	233,710	$ 233,114.10	$12,281.91	$ 11,685.52	$596.39
60	233,114	$ 232,487.89	$12,281.91	$ 11,655.70	$626.21

Loan Amortization Table Continued

61	232,488	$	231,830.37	$12,281.91	$	11,624.39	$657.52
62	231,830	$	231,139.98	$12,281.91	$	11,591.52	$690.39
63	231,140	$	230,415.06	$12,281.91	$	11,557.00	$724.91
64	230,415	$	229,653.90	$12,281.91	$	11,520.75	$761.16
65	229,654	$	228,854.68	$12,281.91	$	11,482.70	$799.22
66	228,855	$	228,015.50	$12,281.91	$	11,442.73	$839.18
67	228,016	$	227,134.37	$12,281.91	$	11,400.78	$881.14
68	227,134	$	226,209.17	$12,281.91	$	11,356.72	$925.19
69	226,209	$	225,237.72	$12,281.91	$	11,310.46	$971.45
70	225,238	$	224,217.69	$12,281.91	$	11,261.89	$1,020.03
71	224,218	$	223,146.66	$12,281.91	$	11,210.88	$1,071.03
72	223,147	$	222,022.08	$12,281.91	$	11,157.33	$1,124.58
73	222,022	$	220,841.27	$12,281.91	$	11,101.10	$1,180.81
74	220,841	$	219,601.42	$12,281.91	$	11,042.06	$1,239.85
75	219,601	$	218,299.58	$12,281.91	$	10,980.07	$1,301.84
76	218,300	$	216,932.65	$12,281.91	$	10,914.98	$1,366.93
77	216,933	$	215,497.37	$12,281.91	$	10,846.63	$1,435.28
78	215,497	$	213,990.32	$12,281.91	$	10,774.87	$1,507.04
79	213,990	$	212,407.92	$12,281.91	$	10,699.52	$1,582.40
80	212,408	$	210,746.41	$12,281.91	$	10,620.40	$1,661.52
81	210,746	$	209,001.81	$12,281.91	$	10,537.32	$1,744.59
82	209,002	$	207,169.99	$12,281.91	$	10,450.09	$1,831.82
83	207,170	$	205,246.58	$12,281.91	$	10,358.50	$1,923.41
84	205,247	$	203,226.99	$12,281.91	$	10,262.33	$2,019.58
85	203,227	$	201,106.43	$12,281.91	$	10,161.35	$2,120.56
86	201,106	$	198,879.84	$12,281.91	$	10,055.32	$2,226.59
87	198,880	$	196,541.92	$12,281.91	$	9,943.99	$2,337.92
88	196,542	$	194,087.10	$12,281.91	$	9,827.10	$2,454.82
89	194,087	$	191,509.54	$12,281.91	$	9,704.36	$2,577.56
90	191,510	$	188,803.11	$12,281.91	$	9,575.48	$2,706.44
91	188,803	$	185,961.35	$12,281.91	$	9,440.16	$2,841.76
92	185,961	$	182,977.50	$12,281.91	$	9,298.07	$2,983.85
93	182,978	$	179,844.47	$12,281.91	$	9,148.88	$3,133.04
94	179,844	$	176,554.78	$12,281.91	$	8,992.22	$3,289.69
95	176,555	$	173,100.60	$12,281.91	$	8,827.74	$3,454.17
96	173,101	$	169,473.72	$12,281.91	$	8,655.03	$3,626.88
97	169,474	$	165,665.49	$12,281.91	$	8,473.69	$3,808.23
98	165,665	$	161,666.85	$12,281.91	$	8,283.27	$3,998.64
99	161,667	$	157,468.28	$12,281.91	$	8,083.34	$4,198.57
100	157,468	$	153,059.78	$12,281.91	$	7,873.41	$4,408.50
101	153,060	$	148,430.86	$12,281.91	$	7,652.99	$4,628.92
102	148,431	$	143,570.49	$12,281.91	$	7,421.54	$4,860.37
103	143,570	$	138,467.10	$12,281.91	$	7,178.52	$5,103.39
104	138,467	$	133,108.54	$12,281.91	$	6,923.36	$5,358.56
105	133,109	$	127,482.06	$12,281.91	$	6,655.43	$5,626.49
106	127,482	$	121,574.25	$12,281.91	$	6,374.10	$5,907.81
107	121,574	$	115,371.05	$12,281.91	$	6,078.71	$6,203.20
108	115,371	$	108,857.69	$12,281.91	$	5,768.55	$6,513.36
109	108,858	$	102,018.66	$12,281.91	$	5,442.88	$6,839.03
110	102,019	$	94,837.68	$12,281.91	$	5,100.93	$7,180.98
111	94,838	$	87,297.65	$12,281.91	$	4,741.88	$7,540.03
112	87,298	$	79,380.62	$12,281.91	$	4,364.88	$7,917.03
113	79,381	$	71,067.74	$12,281.91	$	3,969.03	$8,312.88
114	71,068	$	62,339.21	$12,281.91	$	3,553.39	$8,728.53
115	62,339	$	53,174.26	$12,281.91	$	3,116.96	$9,164.95
116	53,174	$	43,551.06	$12,281.91	$	2,658.71	$9,623.20
117	43,551	$	33,446.70	$12,281.91	$	2,177.55	$10,104.36
118	33,447	$	22,837.12	$12,281.91	$	1,672.33	$10,609.58
119	22,837	$	11,697.06	$12,281.91	$	1,141.86	$11,140.06
120	11,697	$	(0.00)	$12,281.91	$	584.85	$11,697.06
Totals				**$1,473,829.57**	**$**	**1,228,895.32**	**$244,934.25**