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**College of Agricultural and Environmental Sciences**

# The Feasibility of Operating a Poultry Litter Pelletizing Facility in South Georgia

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## Introduction

This study examines the economic feasibility of operating a poultry litter pelletizing facility in Coffee County, Georgia. The product being considered is a heat and pressure pelletized poultry litter product that is free of pathogens. The product is about the diameter of a drinking straw and a quarter of an inch in length. The issues to be examined include raw poultry litter availability, marketing of the finished product, volume, price determination, and economic breakevens for processing the litter.

Specifically, the feasibility study will consist of market, financial, and impact analysis. The market analysis focuses on identifying and estimating potential markets for pelletized poultry litter. There appears to be a number of existing markets currently using animal waste, particularly lawn and garden products. The size and potential of each of these markets are discussed in detail in the market analysis section of the report.

The financial analysis section of the report will examine the various costs and returns associated with constructing and operating the proposed facility. The financial analysis will examine a facility operating under two scenarios: operating the facility with one eight-hour work shift and producing 36,000 tons of final product per year; operating the facility using a double shift, resulting in 72,000 tons of final product annually.

The impact analysis provides information on how the proposed facility, if constructed, will impact the local and state economies in terms of employment and tax revenue generation. The proposed facility has the potential to create a number of jobs in the local area and generate a significant amount of tax revenue.

## Reason for Study

It is believed that soil quality guidelines will soon be facing Georgia's agricultural community through regulations controlling nitrogen and phosphorus levels in the soil. The Environmental Protection Agency already has a tentative plan in place that requires states to have written plans of control by 2005 and actual working plans by 2007. Coffee County poultry producers feel a pelletizing facility will assist in, if not, control the problem and enable them to create a potential profit, while obeying any new regulations. Environmental benefits to reducing phosphate and nitrogen levels on the soil will also affect water quality and surrounding habitat.

## Product

The proposed facility will produce pelletized poultry litter. The pelletizing process will rid the final product of pathogens and possible contaminants. The end product will be a versatile soil amendment with some fertilizer properties. The pellets will contain 3% nitrogen, 3%

phosphate, and 3% potash (typically referred to as a 3-3-3 fertilizer) making it a relatively weak fertilizer. However, the high organic matter makes the product a good soil additive. Regulations associated with different types of lawn and garden products vary according to the product label.

The final product can be labeled as organic since the majority of its inputs are natural and not synthetic. The organic label provides a method of differentiating the product in the highly competitive homeowner marketplace. The organic label will be less effective in the commercial market.

Currently, the Coffee County group plans to utilize a marketing firm (AgriRecycle, Inc.), to market most of the product in bulk. The main market is anticipated to be Florida citrus producers. However, there are other marketing channels for the product that offer significant market potential.

## State Product Regulations[1]

The following information on soil amendment and fertilizer regulations were taken directly from the Georgia Department of Agricultures web site. The final product, no matter how it is marketed, either as a soil amendment or fertilizer will require that the business receive a license and register the product. The products label will also have to meet specified guidelines with regard to the types of information it is required to provide consumers bulk and bagged. The following are just a highlight of the regulations involved with selling soil amendment and fertilizer products in Georgia.

*Soil Amendments Regulations*

“Soil amendment" means any substance intended for changing the characteristics of soil or other growth medium for the purposes of: (A) Increasing penetrability of water or air; (B) Increasing water-holding capacity; (C) Alleviating or decreasing soil compaction; or (D) Otherwise altering the soil or other medium in such manner that the physical properties are materially enhanced. The term "soil amendment" does not include any substance, for which nutritional claims are made, such as, but not limited to, commercial fertilizers, liming materials, or unmanipulated vegetable or animal manures.

Every soil amendment distributed in this state shall be registered with the Commissioner of Agriculture on forms obtained from the Commissioner's office. The applicant for registration shall provide such information as the Commissioner may require by regulation after opportunity for public hearing.

In determining the acceptability of any product for registration, the Commissioner may require proof of claims made for the soil amendment. If no specific claims are made, the Commissioner may require proof of the usefulness and value of the soil amendment. As evidence of proof, the Commissioner may rely on experimental data furnished by the applicant and may require that such data be developed from tests conducted under conditions identical to or closely related to those conditions present in this state. The Commissioner may reject any data not

[1] Georgia Department of Agriculture. http://www.agr.state.ga.us/html/plant_food_feed_grain.html

developed under such conditions and may rely on the advice of the University of Georgia College of Agricultural and Environmental Sciences experiment station personnel or other university personnel in evaluating data for registration.

The registration fee shall be $50.00 per year for each product. Registration shall expire on December 31, annually, unless an application for renewal has been received prior to the expiration date.

Each registrant shall keep accurate records of his sales and shall file semiannual reports covering the periods January 1 through June 30 and July 1 through December 31. Such reports shall be due within 30 days from the date of the close of each such period. If the report is not filed within the 30-day period or is false in any respect, the Commissioner may revoke the registration.

*Fertilizer Regulations*

"Fertilizer material" contains important quantities of no more than one of the primary plant nutrients: nitrogen (N), phosphate (P O ), and potash (K O) and has 85 percent or more of its plant nutrient content present in the form of a single chemical compound. It is derived from a plant or animal residue or by-product or natural material deposit which has been processed in such a way that its content of plant nutrients has not been materially changed except by purification and concentration.

No person whose name appears upon the label of a fertilizer shall distribute that fertilizer in Georgia until a fertilizer license has been obtained from the Commissioner. All licenses expire on the thirtieth day of June each year. The license fee shall be $50.00 per year, and must be renewed annually with fees paid by July 1 of each year. If the license renewal fee is not paid by July 1, the applicable license fee shall increase in the manner prescribed by regulation.

The fertilizer product must have a "guaranteed analysis" indicating the minimum percentage of nutrients, and should follow this order, N, P, K, and other ingredients:

| | |
|---|---|
| Total nitrogen (N) | ____Percent (%) |
| Available phosphate (P O ) | ____Percent (%) |
| Soluble potash (K O) | ____Percent (%) |

The guarantees for such other nutrients shall be expressed in the form of the element, or in other forms as the Commissioner may require by regulation. The source (oxides, salts, chelates, etc.) of such other nutrients may be required by regulation to be stated on the application for registration and may be included on the label. Other beneficial substances or compounds, determinable by laboratory methods, also may be guaranteed by permission of the commissioner. When any plant nutrients or other substances or compounds are guaranteed, they shall be subject to inspection and analysis in accord with the methods and regulations prescribed by the Commissioner.

**Adding Value**

Animal waste products may be marketed as value-added items commanding $80 to $120 per ton at retail. Certain niche or emerging markets may actually create significant opportunities to market waste products. Markets for manure and manure products have always existed, but current concerns pertaining to feeding animal waste to livestock, as well as environmental concerns, have closed and opened different markets.

In some communities, environmental issues have created awareness of and often hostility toward animal agriculture. The general trend toward confined animal operations, coupled with smaller amounts of land devoted to farming, has contributed to an excess supply of manure in many production areas. While waste management has become an accepted part of farming, waste marketing has not yet been generally accepted as an alternative. In many cases, negative images of animal manure have created problems, burdens, and expenses for animal producers.

Continual use of manure nutrients applied directly to land has the potential to create environmental problems. Overtime, the application of chicken manure may lead to an over abundance of phosphorus in the soil. The problem and solution can be expressed in very simple terms. Feed material from all over the United States is brought into Georgia and used for poultry feed and results in a significant volume of poultry waste products. These feed inputs are not being redistributed into the grain producing regions but are being disposed of locally. Therefore, there may be a nutrient build-up in local soils that have the potential to cause environmental problems.

Expected environmental regulations may create a requirement to move these nutrients further away from the poultry farm by creating new products. These new products would not be used in a manner that would lead to the levels of buildup observed in areas that are heavy users of poultry litter. This should lead to a decline in poultry litter's impact on the environment as well as provide an economic benefit. Selling these new products may offset the costs of creating value-added poultry litter products and potentially enhance producer revenues. Therefore, changing the image of pelletized poultry litter into a desirable asset rather than an environmental liability should help to increase market opportunity. Proper product nutrient labeling should be able to change the image of poultry litter from a waste product into a useful fertilizer and soil conditioner for home and commercial horticulture use. Some markets already exist for organic residuals and others can likely be developed. If the final product can be labeled organic, the revenue potential is greatly enhanced.

While alternative markets and uses for animal manure do exist, markets for high-quality, pelletized manure products are relatively undeveloped. Pelletized poultry manure products can be used in horticultural businesses to enhance their soil fertility programs. In addition to agricultural markets, animal manure has also been used in horticulture (gardening, landscaping, nurseries, and top soil production), silviculture (Christmas trees, ornamentals) and for reclamation (landfill covers, mine reclamation) purposes. Direct application of pelletized litter to the land is the most common use. However, opportunities to develop new uses for the product appear to exist.

The three most traditional markets for manure and manure products are feed, fertilizer and soil conditioner, and energy. The demand for manure in any of these markets is determined by the buyers' desire to obtain it. However, a soil conditioner/limited fertilizer product seems to represent the most common market for poultry litter. The market value of raw manure at the farm is between $1 and $11 per ton. Processing manure for the homeowner and commercial markets can increase the retail value of manure to about $50 per ton. This is the price of bagged manures found at suburban garden center. Traditional markets for manure products are becoming more popular and therefore more developed as people become aware of the potential benefits of such products. Creative marketers have found potential retail markets as high as $7,000 to $10,000 per ton. This indicates what consumers are willing to pay for novelty items such as manure figurines. These markets are limited, but serve to illustrate that consumers demand natural, environmentally friendly products and more importantly, benefit from these products in greater measure than agricultural nutrient users do[2]."

**Feed Ingredient Market Potential**

The market for pelletized poultry litter, as a feed ingredient does not look promising. In-depth conversations with feed mills and regulatory agencies suggest that this market is questionable at best.

It is estimated that one-third of the cattle raised in the southeast are "backgrounded." This is a practice of growing cattle in an attempt to secure a cost-effective rate of gain prior to their placement in a feedlot. Most backgrounding uses farm-grown or commercial feed along with mineral supplements. If the negative perceptions and cost of pelletized poultry litter were diminished, backgrounding cattle producers may be willing to utilize pelletized poultry litter.

There could be a significant market for cattle block and cubed products that use poultry litter. Currently, in the target marketing states (Georgia, North Carolina, Virginia, and Kentucky), there are approximately 6.4 million head of cattle. It is estimated, within these four states, that there are 116,000 producers, who sell between 1 and 99 cows annually, representing 95% of all cow/calf operators. The majority of the producers have herds of 25-40 head. Assuming an average herd size of 35 head, the market potential is a total of 4.06 million head of cattle. However, it is estimated that only 33% of the 4.06 million head are backgrounded, resulting in a market potential of approximately 1,339,800 head cattle annually.

Assuming two hundred pounds of cattle block would supply one calf (400 lbs.) for 60 days, total market saturation is estimated to be about 267 million pounds during the two main winter months (Table 1). It is assumed the number of cattle and producers in these four states will be relatively stable over the next three years.

[2]Reinventing Manure: Managing Nutrients by Adding Value," Mark Jenner, Economist & Commodity Policy Specialist for Aquaculture, Poultry and Manure, American Farm Bureau, June 8, 1997. (http://www.fb/com/issues/analysis/manure.html).

| Table 1. Cattle Backgrounding Estimated Market Potential* | | |
|---|---|---|
| **Back Grounded Cattle** | **Cattle Block -60 feed Program** | **Estimated Annual Market Potential** |
| 1,339,800 | 200 lbs (60 days) | 267 million pounds |
| * Blackwell, William, Jordan, Jamie, Rsuhton, Matt, Hall, Lee and Charles Dorminey, GrowBlock© Cattle Feed that makes CENTS, Cotton Producers of Georgia, University of Georgia NAMA | | |

According to Mr. Larry Stewart, Director of purchasing for Purina Mills, Purina is not interested in purchasing pelletized poultry litter. Horses and other livestock (mono-gastric animals) cannot properly digest poultry litter. The Purina Mills plant in Nashville, Tennessee, is similar to other mills in the southeast that produce a number of animal feeds in the same facility. Therefore, the possibility of cross-contamination between non-cattle feeds and cattle feeds containing the poultry litter has lead them to prohibit the use of poultry litter as a feed ingredient.

In-depth interviews with other feed mill operators located throughout Georgia provided similar results. A total of 13 feed mills in Georgia were contacted to investigate their interest in using pelletized poultry litter as a feed ingredient or supplement. Of the 13 interviewed, none of the mills are currently purchasing any poultry litter to mix with their feed. There appeared to be some interest in purchasing pelletized poultry litter as a feed supplement, but it would depend on cost and nutritional value. Again, there were concerns with potential cross-contamination.

Mr. John Niver, with the corporate headquarters of the Tennessee Farmers Cooperative, indicated they would not purchase pelletized poultry litter as an ingredient for feeds. However, individually, the county cooperatives might purchase some bags of the pelletized product. Each of the approximately 130 individual cooperative outlets would have to be contacted individually about carrying the product. The Tennessee Farmers Cooperative does not distribute a list of its retail outlets.

According to the Georgia and Texas Departments of Agriculture, the FDA is currently reviewing its Bovine Spongiform Encephalopathy (BSE) regulations, which includes reviewing the use of pelletized poultry litter as a feed ingredient. Dr. George Grayber, with the Food and Drug Administration's (FDA) Center for Veterinary Medicine indicated that the U.S. Congress is currently reviewing legislation that may ban the use of all manure feed ingredient products. In addition, the FDA is currently reviewing its feed regulations pertaining to BSE which will include re-evaluating the use of poultry litter in ruminant feed products.

In addition to the possible regulations banning the use of poultry litter as an animal feed, The National Cattlemen's Beef Association has taken the stance of "not supporting" the feeding of poultry litter to cattle. This is significant in terms of producers' image and acceptance of a litter based product. The lack of support by this organization implies a negative connotation regarding the use of poultry waste as cattle feed. This may produce a perception by the general meat consuming public that poultry waste is an inferior or unacceptable feed supplement for cattle.

Extension specialists throughout the region identified other issues that will impact the demand for pelletized poultry litter as an animal feed ingredient. Raw litter can be used as well as pelletized litter. The only advantage of pelletizing the litter is sterility and ease of handling.

Poultry litter must be combined with other feed ingredients to make an acceptable cattle feed and would constitute about 50% of the final feed product. The pellets sold to farmers for cattle feed would need to be in bulk. A major concern is the small number of Georgia cattle farmers with the capability and desires to mix their own feed.

In 1999, Mr. Eric Maupin, International Marketing Specialist, with the Tennessee Department of Agriculture, had been asked to explore the international market potential for pelletized poultry litter as a feed ingredient. It is Mr. Maupin's conclusion that at the current time, there does not appear to be an international market for pelletized poultry litter as a livestock feed ingredient. In addition, the CAED contacted several FAS employees in South and Central America to identify any potential export markets for the pelletized litter products. They were unable to identify any market opportunities.

*Feed Market Conclusion*

Information obtained through conversations with various experts and industry representatives, indicated that it does not appear to be a viable market in Georgia for poultry litter as a livestock feed ingredient. Indications are that large U.S. feed lot operations that can use the product as an ingredient to be mixed with other feed ingredients would be the only potential market. However, representatives from Georgia's feed manufacturers, Tennessee Farmers Coop, and Purina Mills, have said that their respective organizations would not be interested in purchasing pelletized poultry litter. It appears the feed ingredient market in Georgia is in small niche markets (i.e., selling directly to cattle producers).

The large livestock producer niche market would require locating and contacting larger cattle producers across the state. Discussions with these producers would be needed to gauge their interest in the product. After talking with a few of these cattle producers, product enhancements or packaging alterations may need to occur to better meet their needs for a quality feed. For example, these individuals will likely mix their own feed rations and desire custom feed ingredients. However, it is important to remember that the National Cattlemen's Beef Association does not support using poultry litter as a cattle feed. This lack of endorsement or inferred negative endorsement may discourage the niche market producers from using the product as a cattle feed ingredient.

**Fertilizer and Soil Amendment and/or Conditioner Market Potential**

Homeowners and commercial businesses offer potential marketing for pelletized poultry litter. The CAED investigated the homeowners' market potential for Georgia and surrounding states as well as the market potential for nurseries, golf courses, landscaping contractors and sod producers. There appears to be a significant market potential in the homeowner market if the product is packaged and marketed appropriately.

Pelletized poultry litter may not effectively compete in the fertilizer market, as it is considered a weak fertilizer. The N-P-K levels are lower than typical chemical fertilizer found on the market. However, pelletized poultry litter could compete successfully as a soil conditioner or soil amendment. It would have to be priced competitively but it provides a unique mixture of nutrients and conditioning properties. The convenience of bagging, packaging the product correctly, being locally produced, and natural or organic, combined with the fact that it is pelletized, might differentiate it sufficiently in the marketplace to attract competing product's customers.

The advantages of a pelletized fertilizer or soil amendment product would be minimal at best. Ease of handling for the processor and consumer would be the largest benefit derived from pelletizing the litter. Pelletizing would not alleviate the odor problem but it would reduce the odor after the product has been applied. Pelletizing also makes the product more stable as a soil conditioner compared to raw manure, because the pellets would have to be broken down by the elements before they could condition the soil.

*Homeowners/Retailers*

Georgia and the surrounding states were used in estimating the homeowner/retail market potential for the pelletized product. The reason for extending the market potential estimates outside the state of Georgia is that a bagged product lends itself to being transported greater distances than a bulk product due to market prices. For example, the pelletized product might be worth $50/ton in bulk but $3.50 per 20-pound bag or $350 a ton.

Data on homeowner use and expenditures obtained from the University of Tennessee's Agricultural Development Center (ADC) makes it possible to estimate the market potential for pelletized litter product. Using Census Bureau data, it is possible to estimate homeownership in Georgia and the surrounding states. This data indicates a tremendous market for lawn and garden care products (Table 2).

There are an estimated 10.4 million households in Georgia and the four surrounding states. The percent of households owning their own homes in 2001 varied by state. Homeownership ranged from a low of 67.5% in Georgia to a high of 72.5% in Alabama (U.S. Census Bureau).

**Table 2. Estimated Regional Home and Garden Market Potential**

| State | Number of Households | Percent Ownership | Household Owning Home |
|---|---|---|---|
| Georgia | 3,006,369 | 67.5% | 2,029,299 |
| Florida | 6,337,929 | 70.1% | 4,442,888 |
| S. Carolina | 1,533,854 | 72.2% | 1,107,443 |
| Alabama | 1,737,080 | 72.5% | 1,259,383 |
| Tennessee | 2,232,905 | 69.9% | 1,560,801 |
| **Total** | **14,848,137** | 70.04% | **10,399,813** |

*2001 home owner rate was obtained from the Census Bureau.

However, not every homeowner will use lawn and garden products. The ADC survey data provides homeowner product usage levels (Table 3) and retail prices paid for lawn care products (Table 4). The total number of homeowners was multiplied by the percentage of who indicated they use each lawn care product to derive the estimated market potential.

Once the estimated homeowner market potential is calculated, this figure can then be multiplied by the stated usage levels to derive southeastern total market potential for potting soil, fertilizer and topsoil products. When examining the market potential estimates, it is important to consider that many consumers have a problem distinguishing between fertilizers, soil amendment and topsoil products. The total southeastern market potential for these three products is estimated to be approximately 582 million pounds annually. It is important to remember that these figures are based on estimated usage levels of animal manure based products provided by homeowners and may over or under estimate their actual usage levels.

**Table 3. Homeowners Past Year Expenditures and Usage of Various Lawn and Garden Care Products**

| Product | Southeastern Homeowners (Million) | Percentage who Purchased Product[1] | % of Homeowners Using Manure Based Products[1] | Estimated Homeowner Market Potential | Median Usage (lbs) | Southeastern Market Potential |
|---|---|---|---|---|---|---|
| Potting Soil | 10,399,813 | 68% | 33% | 2,333,718 | 68.63 | 160,163,069 |
| Fertilizer[2] | 10,399,813 | 59% | 33% | 2,024,844 | 100.00 | 202,484,359 |
| Topsoil | 10,399,813 | 32% | 33% | 1,098,220 | 200.00 | 219,644,051 |
| **Total Estimated Market Potential** | | | | | | **582,291,479 lbs** |

[1] Based on the ADC's 1999 Survey of Tennessee Homeowner. Usage and quantity figures reflect stated expenditures per product

[2] Does not distinguish between different N-P-K levels

Using southeastern estimated market potential for these three products, it is possible to calculate the homeowner's total estimated expenditures on these products. Table 4 estimates total annual household expenditure for each lawn and garden product. It is estimated that homeowners spend over $87 million annually on manure based lawn and garden products.

**Table 4. Homeowners Past Year Expenditures and Usage of Various Lawn and Garden Care Products**

| Product | Southeastern Market Potential (lbs.) | Median Expenditure/ lb.[1] | Total Estimated Revenue Potential |
|---|---|---|---|
| Potting Soil | 160,163,069 | $0.15 | $24,024,460 |
| Fertilizer | 202,484,359 | $0.15 | $30,372,654 |
| Topsoil | 219,644,051 | $0.15 | $32,946,608 |
| **Total** | **582,291,479** | $0.15 | **$87,343,722** |

[1] Based on the existing product prices.

To successfully market millions of bags of product, the proposed facility would have to market its product through a number of large retail outlets. Mass merchandisers such as Wal-Mart® and Home Depot®, who purchase products in large quantities for resale, would provide access to a larger number of potential customers.

Mass merchandisers would be easier to work with on a large-scale basis. Contacting the central purchasing agent and working out an agreement with them to buy and distribute the product to individual stores would alleviate some of the need for a new distribution channel. These mass merchandisers have an area and/or regional distribution center where the product can be shipped for further distribution.

If the product is not regionally or nationally marketed through large outlets, some type of distribution channel would be needed. For example, Wal-Mart® only hauls products that cannot contaminate food products. Manure based products could not be dropped off at Wal Mart's® central distribution center and delivered on their trucks. The individual producer would be responsible for delivering the product to each individual store. This could provide a major obstacle given the number of Wal-Mart's® and their many locations across the state. Add to this the numerous independent lawn and garden stores scattered across the state and region and the problem intensifies.

According to the results of a 1999 Master Gardener survey, the public generally purchases lawn care products from mass merchandisers. One-quarter of those surveyed indicated they purchased lawn care products from Home Depot. Other frequently mentioned outlets were local lawn and garden stores i.e., Lowe's®, Wal-Mart®, K-Mart®, and local nurseries. These are the outlets must be targeted by the proposed pelletizing facility. Table 5 presents the number of identified lawn and garden product retail outlets just in Georgia that might carry pelletized poultry litter products. As stated earlier each of these stores will have to be supplied directly.

**Table 5. Number of Mass Merchandiser Stores in Georgia ***

| **Mass Merchandiser[1]** | **Number of Stores in Georgia** |
|---|---|
| Lawn and Garden Stores | 195 |
| Garden Stores | 186 |
| Wal-Mart® | 143 |
| Nurseries | 126 |
| K-Mart® | 83 |
| Target® | 68 |
| Home Depot® | 61 |
| Lowe's® | 35 |
| **Total** | **897** |

[1] Number of identified retail outlets in Georgia using SIC code classification and 2001 Pro CD Phonebook software as well as store locator on company website.

The proposed pelletizing facility will produce between 36,000 and 72,000 tons of products annually. Bagging all of the facilities output for the homeowner market would produce 3.6 to 7.2 million 20-pound bags of finished product annually. Table 6 indicates how many bags of pelletized poultry litter must be sold per retail outlet to exhaust 3.6 and 7.2 million bags of product. The table looks at marketing the product in 50 to 5,000 retail outlets at two different production levels.

**Table 6. Bags per Outlet**

| | Number of Bags Needed to be Sold per Outlet | |
|---|---|---|
| **Number of Outlets** | **Bags available =3,600,000** | **Bags available =7,200,000** |
| 50 | 72,000 | 144,000 |
| 100 | 36,000 | 72,000 |
| 500 | 7,200 | 14,400 |
| 897[1] | 4,013 | 8,027 |
| 1,000 | 3,600 | 7,200 |
| 2,000 | 1,800 | 3,600 |
| 4,040 | 900 | 1,800 |
| 5,000 | 720 | 1,440 |

[1]Number of identified mass merchandiser outlets in Georgia using SIC code classification and 2001 Pro CD Phonebook software.

The figures shown in Table 6 are very significant. Selling to Georgia mass merchandisers would require selling 4,013 20-pound bags annually through each of the 897 identified retail outlets. Given the large number of retail outlets required to sell 3.6 million bags of product, all major mass merchandisers or chain outlets must carry the product.

*Packaging Preferences*

In order to package the litter product and appeal to consumers, it is essential to have an understanding of consumers' perceptions and preferences for this product. The results of a survey conducted in 1999 by the ADC in Tennessee, were used to obtain an understanding of product and package acceptance. The study surveyed 67 master gardeners in Knoxville, and Nashville, Tennessee, to determine their thoughts and opinions on animal waste fertilizer and soil conditioner products based on litter compost. The results of the survey provided significant insight into the manure based fertilizer and soil condition product consumer. The survey results are based on a composted fertilizer and/or soil conditioner products but they are very applicable to pelletized poultry products in that it investigated factors that impact consumer fertilizer and soil amendment purchasing decisions.

**Packaging**

A 20-25 pounds bag is perceived to be the most convenient. However, the type of bag should be biodegradable and re-sealable.[3] There appears to be no distinct preference between a clear or white bag. However, a black bag was the least preferred. Forty-three percent (43%) of

[3]When the bag characteristic preference question was asked, the issue of additional cost being associated with these characteristics was not considered.

the respondents indicated that being able to see the product was important, while a slightly higher percentage of the respondents (46%) indicated it was not important. Given these results, either a clear or white bag seems to be acceptable.

Based on the survey, there is no data to suggest that having a biodegradable and re-sealable bag would increase sales; however, a bag with these characteristics would definitely differentiate the product from its competitors. The biodegradable characteristic would add to and be consistent with the idea of using recycled waste products and environmentally friendly products.

**Product Labeling**

It is very important for a soil amendment or fertilizer product to have nutritional information. The survey results suggest that more than half of the respondents would not purchase a product that did not have nutrient content information. Only 3% of the sample indicated that a lack of nutrient content information would have no effect on their decision to purchase a product, thus possibly hampering sales. The respondents indicated they need nutrient information to effectively use and apply the compost, as well as to evaluate its soil improvement potential. Failure to include the soil amendment or fertilizers nutrient content information may be perceived by consumers as "hiding something" or as being inconsistent.

Questions addressing the nutrient content information on purchase decisions reconfirmed the importance of having this information on the product label. For example, if the respondents were evaluating two competing products that were identically priced, nutrient value (16%) and the product's smell or odor (10%) were listed as the top two criteria influencing a respondent's decision to purchase one product over the other. Consumers were shown three panels, each with different nutrient labels. The panel with the most detailed nutrient content information (58%) was preferred to the panel listing only N-P-K (31%).

The study results indicate the product label must contain basic nutrient content information (N-P-K) before consumers consider purchasing the product. Gardeners rely on nutrient information to evaluate the product's usefulness and benefits relative to competing products. The absence of nutrient content information does not allow the user to evaluate the product's potential uses and benefits and may result in a negative perception of the product.

**Educational Information**

Respondents indicated that it is important to have educational material on a product's label or package. Potential consumers need to be educated on how to use the product, application rates, and the benefits derived from using the soil amendment or fertilizer product. However, in addition to including basic application rates, procedures, and benefits on the actual compost package, the creation of point of purchase information or a "display" to would assist customers. The product display should have two positive effects: First, attract consumer attention to the product, and second, to provide more detailed educational information to consumers on product usage and benefits.

**Manure Soil Amendment or Fertilizer Concerns/Problems**

Product odor and lack of educational material were the two primary concerns gardeners associated with manure-based products. Other issues identified were product content and purity. The issue of educating consumers on the soil amendment or fertilizer product's use, application, and benefits should be addressed on the label and display, if used. The odor issue must be addressed to generate repeat business.

**Overall Homeowner Considerations**

The results of the homeowner market analysis indicate that there is a significant market potential. However, the product will have to be packaged accordingly, educational and promotional material will have to accompany the product in the retail outlets and an aggressive marketing campaign will have to be implemented. The marketing campaign may have to target the retailers as opposed to the end consumer. It is essential to have the product in mass merchandising stores as well as local lawn and garden centers.

**Commercial Uses**

In addition to the homeowner market, there are a number of commercial marketing channels to consider. The nursery, golf course, landscaping contractor, and sod producer markets were also investigated to determine whether they are viable markets for pelletized poultry litter. Interestingly, these markets do not offer the same potential as the homeowner market.

It is important to have an understanding of the target market and perceptions and preferences for using a product. Results from nursery, golf course, and landscaping contractors were based on information obtained from a 1999 study conducted by the University of Tennessee's Agricultural Development Center. The results are based on a small sample of each market segment, but provide insight into each market with regard to current use, future use, and quantities used. The survey focused on manure based products but the findings are applicable to this study given it is and manure based product.

*Nurseries*

The nursery market as identified in this section is generally a business that wholesales plants, trees and other products. However, some of the nursery businesses interviewed engaged in both the wholesale and retail sales. Earlier research indicates one in five nurseries used a manure based lawn and garden care product. It is encouraging that a significant portion of the market is familiar with manure based fertilizers and soil conditioner and does not need to be educated on their benefits. In addition, about one-third of the nurseries interviewed indicated beliefs that manure based products are worth more than competing synthetic products. Top soil (soil conditioners) and compost products were the most frequently mentioned as the manure based products being used. On average, nurseries reportedly used 9,500 pounds of manure based topsoil products in the course of a year. Typically they purchased these products pre-bagged, and not in bulk. The bag sizes range between 20 and 50 pounds. In addition, 71% of the

nurseries interviewed indicated that they plan to increase their use of manure-based products over the next year.

The results of the study suggest that nurseries offer a potential market for pelletized litter products (Table 7). However, there are issues that must be addressed before this market can be accessed. Nurseries perceive manure based products as being environmentally friendly, organic, and a good soil conditioner. These perceptions provide insight into how the product should be marketed to this group.

**Table 7. Nursery Estimated Market Potential**

| State | Nurseries[1] | Current Use %[2] | Estimated Nursery Potential | Annual Usage lbs | Estimated Total Market Potential (lbs) |
|---|---|---|---|---|---|
| Georgia | 126 | 18.1% | 23 | 9,500 | 218,500 |
| Florida | 1,257 | 18.1% | 228 | 9,500 | 2,166,000 |
| S. Carolina | 68 | 18.1% | 12 | 9,500 | 114,000 |
| Alabama | 73 | 18.1% | 13 | 9,500 | 123,500 |
| Tennessee | 114 | 18.1% | 21 | 9,500 | 199,500 |
| **Total** | **1,638** | **18.1%** | **296** | **9,500** | **2,821,500** |

[1] Derived from Select Phone software
[2] Percentage of nurseries who reported using manure based products in 1999, ADC 1999 Survey Results

It appears that roughly 3 million pounds of pelletized poultry litter could be marketed through nurseries in the five surrounding states. This number reflects the total pounds used by nurseries during 1999. This market is small but potentially important market for the product.

*Golf Courses*

Golf courses was another marketing channel that was investigated to determine whether it was a viable market for pelletized poultry litter. The market potential is somewhat more limited for golf courses than it is for homeowners and nurseries. Golf courses tend to purchase their products in bulk and shipping bulk material is very expensive. Transporting a ton of pelletized poultry litter more than 100 miles becomes impractical using the logic that the facility cannot economically transport raw material more than 50 miles before it becomes cost prohibitive. Based on these shipping figures, the market potential for golf courses only includes golf courses within 100 miles of the city of Douglas.

In addition to the positive use by nurseries, approximately one-third of the golf courses interviewed indicated that manure based products are worth more than competing products. Golf courses surveyed reported using 180 pounds of manure-based topsoil and 1,994 pounds of manure based fertilizer products over the course of a year. They typically purchase these products pre-bagged (53%) while 34% indicated they purchase their products in bulk. In

addition, 40% of the golf courses interviewed indicated they plan to increase their use of manure-based products over the next year.

The results of the study suggest that golf courses offer an opportunity to market pelletized litter products. However, there are issues that must be addressed before this market can be accessed. Golf courses are most likely to use these products on flowerbeds and putting greens. As a result, the issue of odor must be addressed. Forty-three percent of all the golf courses interviewed indicated that the product's odor is a serious problem that would prevent them from purchasing the product. Thus, it is important that the final product be odor free.

Table 8 demonstrates that almost 100,000 pounds of pelletized poultry litter could be marketed through this channel. This number reflects the total estimated pounds used by golf courses during 1999. This market is small but offers a viable area market for the product.

**Table 8. Golf Course Estimated Market Potential**

| Golf Courses [1] | Current Use %[2] | Estimated Course Potential | Annual Usage (lbs.)[3] | Estimated Total Market Potential (lbs) |
|---|---|---|---|---|
| 90 | 50% | 45 | 2,174 | 97,830 |

[1] Number of private and public golf courses within 100 mile of Douglas
[2] Percentage of golf courses who reported using manure based products in 1999, ADC 1999 Survey Results
[3] Combines topsoil and fertilizer usage

*Landscaping Companies*

Landscaping contractors, both installation and maintenance businesses, were also identified as a potential market for pelletized poultry litter. The landscaping contractor market potential for Georgia, Alabama, Tennessee, Florida, and South Carolina. The reason this market area was expanded to the surrounding states is that contractors demand both bagged and bulk product and that these contractors frequently patronize lawn and garden establishments to purchase bagged lawn care products. The logical marketing channel for this market is the same as with the homeowner market segment, retail outlets.

According to survey results, 44% of the contractors interviewed indicated that they purchased manure-based products over the past year. The contractors mentioned they would use more of these types of products if they were readily available as it compliments other soil amendment products. Contractors are less likely to mention that manure-based products are worth more than other soil amendment products.

On average, contractors reportedly used 7,986 pounds of manure-based topsoil and 2,677 pounds of manure based mulch/potting soil products over the course of a year. These products were purchased in both bags and in bulk. In addition, 33% of the contractors interviewed indicated that they plan to increase their use of manure-based products.

Table 9 illustrates that roughly 16 million pounds of pelletized poultry litter could be marketed through contractors annually, reflecting the total estimated pounds used by Georgia

contractors during 1999. This market offers a potentially viable market for the product given that contractors would have used more of these products if they were available.

**Table 9. Landscaping Contractor Estimated Market Potential**

| Landscaping Contractors[1] | Current Use %[2] | Estimated Contractor Potential | Annual Usage lbs[3] | Estimated Total Market Potential (lbs) |
|---|---|---|---|---|
| 3,722 | 40% | 1,488 | 10,663 | 15,866,544 |

[1] Number of Landscaping Contractors operating in GA,TN,FL,AL & SC. Derived from Select Phone software.
[2] Percentage of Landscaping contractors who reported using manure based products in 1999, ADC 1999 Survey Results
[3] Combines topsoil and mulch/potting soil figures

The contractors look for information on new products mainly in journals and professional publications. It would be important to identify these media outlets in Georgia and the surrounding states and advertise the availability and benefits of pelletized litter products.

*Sod Producers*

While investigating the commercial viability of pelletized poultry litter, the CAED was able to identify Georgia sod producers as a potential market. There are approximately 200 businesses listed as being sod producers within a 100-mile radius of Douglas. The actual number was larger but after contacting a number of the businesses identified, it was apparent that roughly a third of those contacted did not actually grow sod. Therefore, the potential was reduced to reflect the CAED's findings. The large number of producers indicated there might be a market for bulk product as they generally purchase their products in bulk. Again, transporting the bulk material is very expensive and transporting a ton or two at a time becomes expensive making the product more expensive than products currently on the market. As a result, the market potential for sod producers only includes those within 100 miles of the city of Douglas.

The CAED contacted 15 sod producers throughout Georgia to determine their interest level in purchasing a pelletized litter product. The results of the in-depth survey indicated a market for the litter product as long as it was competitively priced. However, sod producers are currently using products with higher N-P-K levels and the pelletized product would have to be priced accordingly. Since this product is not being labeled as organic or natural, it could be combined with more traditional fertilizer sources to produce a quality fertilizer and soil conditioner product. This market segment must be explored in more detail to obtain a better understanding of the market and its requirements.

Table 10 provides information that over 16 million pounds of pelletized poultry litter could be marketed through sod producers annually. This market offers a potentially viable market for the product but would have to be delivered directly to sod farms.

**Table 10. Sod Producers Estimated Market Potential**

| Sod Producers[1] | Likely to use %[2] | Estimated Producers Potential | Average Acres | Number of Applications[3] | Mean Application lbs/acre | Estimated Market Potential (lbs) |
|---|---|---|---|---|---|---|
| 200 | 60% | 120 | 100 | 9 | 150 | 16,200,000 |

[1] Number of Sod Producers operating in Georgia and N. Florida. Derived from Select Phone software.
[2]Percentage of sod producers reporting they would consider using pelletized litter product, 2002 CAED small sample survey.
[3] Assuming 1.5 applications/month for six months

*Timberland Companies*

Existing publications reference pelletized poultry litter use in preparing timberland prior to planting. The CAED investigated this potential market given the size and number of timberland companies operating in Georgia. The CAED contacted a number of large and small timberland companies in Georgia to gauge their interest in using the pelletized litter product in their pre-planting preparations. It appears that small timber companies do not use soil amendments or fertilizer products prior to planting their products nor do they fertilize once the trees are established. This is attributed to the expense of purchasing and applying the materials. The CAED also learned that larger timber companies may use fertilizer and soil conditions during the first three years after planting but were unwilling to share this type of information. As a result of this limited research, the CAED has determined that the timberland market is not viable.

*Estimated Revenue Potential*

Given the various market usage estimates, it is possible to estimate the total revenue potential for these markets (Table 11). Assuming that a synthetic 3-3-3 fertilizer costs approximately $50 per ton and assuming a 10% mark-up, it is estimated that pelletized poultry litter could be sold for $55.00 per ton or about 2.4¢ per pound in all commercial markets. The homeowner market is estimated to bring $3.00 per 20 pound bag or 15¢ per pound as it can be marketed as an organic product. The cattle blocks are assumed to sell for about $5.00 per 50-pound bag.

| Table 11. Total Estimated Market Potential for Pelletized Poultry Litter | | | |
|---|---|---|---|
| **Outlet** | **Estimated Total Market Potential (lbs)** | **Price/lb.** | **Estimated Total Revenue Potential** |
| Homeowners[1] | 582,291,479 | $0.150 | $87,343,721 |
| Landscaping Companies[2] | 15,866,544 | $0.024 | $380,797 |
| Nurseries[2] | 218,500 | $0.024 | $5,244 |
| Golf Courses[2] | 97,830 | $0.024 | $2,348 |
| Sod Producers[2] | 16,200,000 | $0.024 | $388,800 |
| Cattle Blocks[2] | 267,000,000 | $0.10 | $26,700,000 |
| **Total** | **881,674,353** | **$0.11** | **$114,820,910** |
| ***AgriRecycle (36,000 tons)*** | *72,000,000* | *$0.028* | *$2,016,000* |
| ***AgriRecycle (72,000 tons)*** | *144,000,000* | *$0.028* | *$4,032,000* |

[1]Price of existing products on the market
[2]Prices identified in earlier research

Assuming the proposed pelletizing business can capture 10% of Georgia's market potential, it could expect to generate over 10 million dollars in sales. However, it is important to remember that it takes time to start and grow a business. In addition, success in capturing this market share level will hinge directly on the facilities ability to develop an efficient and extensive distribution channel.

In reviewing the use of pelletized poultry litter as a soil amendment/fertilizer, several areas of concern arise. Table 12 is a list of some of these areas of concern, a brief description, and examples of actions to minimize them.

| **Table 12. Marketing Concerns** | | |
|---|---|---|
| Labeling Justification | Claims (on the label or otherwise) must be justifiable. Examples include organic, nutrition content, capabilities, components, etc. | • Regularly and routinely take batch samples of product and run analysis.<br>• Maintain proper records of inputs and sources of inputs.<br>• Maintain proper records of procedures (dates, quantities) and analyses.<br>• Ensure that process is consistently performed in approved facilities and by approved practices. |
| Odor Problems | The nature and content of the product tends to breed offensive odors. | • Especially important to the homeowner, golf course and landscaping contractor markets.<br>• Consider addition of lime (lime will alter the pH and fertility composition of the product).<br>• Consider an aeration system of piles or windows of end product prior to bagging. |
| Potential Public Relation Problems with Product Origination | If not properly disclosed, consumers may take offense with product contents when they learn of their origin. | • Proper identification and disclosure of product and ingredients on bag.<br>• Product liability insurance.<br>• Business formation as Cooperative. |
| Distribution | If the product is going to be marketed outside of AgriRecycle, Inc., a distribution system will have to be developed to service the many retail outlets in Georgia and the Southeast. | • Lawn and Garden distributors will have to be identified and contacted<br>• Delivery trucks will have to be purchased and used<br>• May have to deliver both bulk and packaged products |
| Marketing | If the product is going to be marketed by the cooperative, a full-time marketing position will have to be created. | • Marketer will have to be hired<br>• Promotional material will have to be developed<br>• A marketing plan will have to be developed |

**Market Analysis Conclusion**

There appears to be a market for pelletized poultry litter in Georgia and around the Southeastern region. It is estimated that the combined Georgia market for pelletized poultry litter is nearly 400 million pounds annually or 300,000 tons. Assuming that the cooperative can capture 10% of this market, it could sell 30,000 tons of products at a weighted average price of $222 per ton generating $6,660,000 million dollars annually. Given that the vast majority of the

product will be marketed toward homeowners and cattle farmers, the proposed pelletizing facility's success will be dependent on its ability to develop an efficient distribution system. Conducting business with national and/or chain retail outlets could accomplish this objective. Otherwise, you may need to contact a distributor.

**Economic Feasibility of a Poultry Litter Pelletizing Facility**

This section investigates the costs and potential returns in light of the marketing analysis of operating a pelletizing facility in Coffee County, Georgia. This economic analysis applies to full annual operation; it does not serve as a cash-flow, or start-up cost analysis. The figures cover a "normal" operating year including a "normal" sales year. The economic analysis is provided to determine the true profit or loss potential of the proposed operation. Cash flow analysis is used to determine the feasibility of any particular financing plan.

Equipment costs for the operation include all necessary components for sorting, mixing, drying, and pelletizing poultry litter. This allows the litter to be weighed entering the facility, separated into nutrient groups, mixed to adequate levels, dried, crushed, and then pushed through the pellet die, and transported to the pick-up staging area. The system studied can produce approximately 15 finished tons per hour. The equipment costs were collected from California Pellet Mill, Astec, and AgriRecycle. The equipment used includes: receiving station, pellet mill, hammer mill, cyclone, dryer, cooler, dust collector, front end loaders and trucks. A detailed list can be seen in the appendix. The facility is assumed to operate 50 weeks per year, six days per week.

The size investigated was a single line producing 15 tons per hour. It was chosen by the requesting groups to be similar to the Agricycle facility in Seaford Delaware but at a size feasible for South Georgia. The building size is sufficient to add another pelletizing line in the future if needed but the groups decided to start with one line and increase labor versus investing a substantial increase in capital for the purchase of two pellet lines.

Four different scenarios were calculated for this feasibility section. They are an 85% capacity single shift, full capacity single shift, 85% capacity double shift, and full capacity double shift. Full capacity is assumed to be 90% of the equipment and facility designed capacity to allow for production losses and normal variations in production flow. Each shift consists of eight hours with eight employees. There is a dedicated shift each day for maintenance requiring two employees. Full capacity includes accepting the delivery, sorting, mixing, and shrinkage. The feasible processing plant capacity was determined from a similar plant operated by AgriRecycle, Inc.

*Capital Cost*

The capital cost figures include the necessary equipment for collecting raw litter from the farm, receiving the raw product, processing the product, and distributing the pelletized product in bulk bags for the wholesale and bulk market. Additional equipment will be required if a retail size bag product is to be sold. Equipment cost totals $3,117,417. Sales tax on the equipment is $218,219 resulting in a grand equipment total of $3,335,636. The land, building, concrete, and

grading cost total are estimated at $930,625. The land cost are minimal based on conversations with the major investor group and party interested in this project.

Working capital is included in the capital costs, working capital changes with the levels of production. Working capital are the resources used to support a business until that business begins to generate its own support, generally in the form of profits. Most working capital comes in the form of start-up, short-term loans. Working capital is essential in starting and operating any new business. It is enough capital to cover expenses incurred by the business during the startup phases and slow sales periods to remain in production. Working capital to cover two months of operation with no income produced, including payment to producers for the raw litter and any debt payment that may be incurred is assumed. Table 13 indicates the total capital cost needed for each level of production.

**Table 13. Capital Cost Per Scenario**

| | **Single Shift** | | **Double Shift** | |
|---|---|---|---|---|
| **Processed Tons** | 85% (30,600 tons) | Full Capacity (36,000 tons) | 85% (61,200 tons) | Full Capacity (72,000 tons) |
| **Equipment Cost** | $3,335,636 | $3,335,636 | $3,335,636 | $3,335,636 |
| **Building/Land** | $930,625 | $930,625 | $930,625 | $930,625 |
| **Working Capital** | $238,449 | $252,076 | $408,864 | $436,116 |
| **Total Capital Cost** | **$4,504,711** | **$4,518,337** | **$4,675,125** | **$4,702,377** |

Table 13 indicates a slight increase in the capital needed per operation based on tons processed. The increase in tons adds more litter cost, labor cost, and operating cost in natural gas and electricity.

*Fixed Costs*

Total fixed costs are expenditure which will not change with production levels. Stated another way, it does not matter if 10 tons or 72,000 tons are produced these cost remain the same. Fixed costs are flat and consistent with the same costs occurring each period, whereas other costs are related to the level of output. Included in fixed cost are interest, depreciation, taxes and insurance and administrative costs. Economic depreciation is used to cover physical deterioration and function obsolescence of equipment and/or regulations. The annualized cost of the internal capital and return on investment is built into the economic analysis. If helpful depreciation can be thought of as the annual average principal debt payment occurring if a loan is structured for the entire capital costs for the anticipated useful life of the facility. Return on invested capital can be thought of as the average annual interest payment for a loan capitalized over the anticipated useful life of the facility. Fixed costs are equivalent for all scenarios since each uses the same equipment. Annual fixed costs associated with the project totaled $941,404 (Table 15).

Salaried employees are considered "fixed" for this analysis since their costs are not easily changed with production levels. Administrative employees include: manager, salesperson, bookkeeping, and a secretary. The manager and salesperson receive annual salary of $75,000 and $50,000, respectively, with the potential for commissions. These people are responsible for scheduling delivery of finished and raw products, ordering input supplies, and creating contacts for direct sales. The administrative employees are to receive benefits, estimated at $49,500. A part-time bookkeeper, with an estimated salary of $15,000, will be hired to assist the manager.

**Table 14. Fixed Costs Per Scenario.**

| | Single Shift | | Double Shift | |
|---|---|---|---|---|
| **Processed Tons** | 85% (30,600 tons) | Full Capacity (36,000 tons) | 85% (61,200 tons) | Full Capacity (72,000 tons) |
| **Fixed Cost** | $30.76 | $26.15 | $15.38 | $13.08 |
| | | | | |

**Table 15. Total Fixed Costs**

| **Processed Tons** | **Total Cost** |
|---|---|
| Administrative Cost & Benefits | $214,500 |
| Taxes & Insurance | $42,663 |
| Depreciation – Building | $40,838 |
| Depreciation - Plant Equipment | $405,091 |
| Interest on Investment - Building/Start Up Costs | $71,531 |
| Interest on Investment - Plant Equipment | $166,782 |
| **Total Fixed Cost** | **$941,404** |

A 1% change in the interest rate affects the total cost figure by $21,331. Each $1 million dollar subsidy reduces the fixed cost by $202,857. Even with all the equipment subsidized by the government the facility would still have fixed cost such as administrative employees, depreciation and taxes and insurance. With all the equipment costs covered by the government fixed costs would be $272,163. However, it assumes there is not a return on investment.

*Litter Cost*

The minimum price paid per ton for the poultry litter was decided by Coffee County poultry producers. The producers felt the need to receive $10 per ton of litter due to current market utilization, clean out equipment and labor. A 15% drop in moisture level was assumed from raw products to finished product as based on tests run by AgriRecycle. Thus, processed tons are less than the raw tons of litter needed. The numbers in parenthesis are the amounts of finished products per level of production.

Table 16 gives the number of houses needed based on 125 tons of raw litter per house. In the surrounding 50 mile radius from Douglas approximately 600 houses are in operation,

according to a local integrator. If the facility ran at 100% capacity on the double shifts almost every house would be needed to provide enough litter to run the facility.

**Table 16. Direct Cost for Raw Litter and Tons of Raw Litter Needed**

| | Single Shift | | Double Shift | |
|---|---|---|---|---|
| **Processed Tons** | 85% (30,600 tons) | Full Capacity (36,000 tons) | 85% (61,200 tons) | Full Capacity (72,000 tons) |
| **Direct Litter Cost** | $355,419 | $418,140 | $710,838 | $836,280 |
| **Raw Tons Needed** | 35,190 | 41,400 | 70,380 | 82,800 |
| **Houses Needed** | 245 | 288 | 490 | 576 |

One issue that may affect the direct cost and feasibility of the pelletizing facility would be the current use of litter. Producers in this area presently use their litter on agronomic crops. The replacement value of the nutrients in the chicken litter totals approximately $60 per ton of a 4-4-4 commercial fertilizer and $50 per ton for a 3-3-3 commercial fertilizer. It is possible that the nutrient replacement cost may become worth more than the final product. However, environmental regulations may not allow direct land applications and the plant may still be economically feasible based on the cost alternatives for handling the litter.

*Direct Labor*

The labor cost for this operation is based in the equipment manufacturers suggested guidelines, (California Pellet Mill and Astec). The labor figures are automatically adjusted with an increase in raw product. The wages for 10 laborers are calculated at $12 per hour per employee, (6 line operators, 2 truck drivers, and 2 maintenances). The total labor cost for the single shift is $473,700 and $732,900 for the double shift (Table 17).

**Table 17. Labor Cost per Scenario**

| | Single Shift | | Double Shift | |
|---|---|---|---|---|
| **Processed Tons** | 85% (30,600 tons) | Full Capacity (36,000 tons) | 85% (61,200 tons) | Full Capacity (72,000 tons) |
| **Labor** | $473,700 | $473,700 | $792,900 | $792,900 |
| **Cost per Ton** | $15.48 | $13.16 | $11.98 | $10.18 |

*Variable Costs*

Other direct **v**ariable costs associated with this project include utilities, insurance, repairs, rental agreements, disposal, interest on working capital, and operating costs. Positive relationships exist among the processed tons and the variable costs, although this is not linear. An increase in processed volume increases the variable costs. This is seen significantly in the utilities (natural gas and electricity). Table 18 provides the different scenarios variable cost. A detailed list of these costs can be seen in appendix page.

| Table 18. Direct Cost per Scenario | | | | |
|---|---|---|---|---|
| | **Single Shift** | | **Double Shift** | |
| **Processed Tons** | 85% (30,600 tons) | Full Capacity (36,000 tons) | 85% (61,200 tons) | Full Capacity (72,000 tons) |
| **Variable Cost** | $601,578 | $620,613 | $1,009,443 | $1,047,513 |
| **Variable Cost Per Ton** | $19.66 | $17.24 | $16.49 | $14.55 |

*Income*

Income was derived by assuming the facility ran at full capacity or 85% of full capacity for both shift scenarios, single and double. The final product was sold for $55, which is the equivalent in nutrient value and organic material available on the market at this current time. It was also mentioned that AgriRecycle would pay between $50 and $55 dollars per ton for the processed pelletized litter and more for the granules. Table 18 illustrates the difference in income for the each scenario.

As seen in Table 19, income is a linear relationship based on the hours of operation and capacities. However, the income above assumes that 100% of the final product is sold. This is not typical for any new operation and it could take several years before the full production is sold.

| Table 19. Income Based on Different Shifts and Capacities | | | | |
|---|---|---|---|---|
| | **Single Shift** | | **Double Shift** | |
| **Processed Tons** | 85% (30,600 tons) | Full Capacity (36,000 tons) | 85% (61,200 tons) | Full Capacity (72,000 tons) |
| **Income** | $1,683,000 | $1,980,000 | $3,366,000 | $3,960,000 |

*Total Cost & Profit/Loss*

The total costs per ton produced can be determined by adding variable (labor, litter, and operating cost) and fixed (administrative labor, depreciation, taxes and insurance) costs. Table 20 provides the total profit/loss costs for each scenario. Table 21 illustrates the profit/loss per finished ton.

| Table 20. Total Cost and Profit/Loss per Scenario | | | | |
|---|---|---|---|---|
| | **Single Shift** | | **Double Shift** | |
| **Processed Tons** | 85% (30,600 tons) | Full Capacity (36,000 tons) | 85% (61,200 tons) | Full Capacity (72,000 tons) |
| **Income** | $1,683,000 | $1,980,000 | $3,366,000 | $3,960,000 |
| **Litter Cost** | $355,419 | $418,140 | $710,838 | $836,280 |
| **Labor Cost** | $473,700 | $473,700 | $732,900 | $732,900 |
| **Variable Cost** | $601,578 | $620,613 | $1,009,443 | $1,047,513 |
| **Fixed Cost** | $726,904 | $726,904 | $726,904 | $726,904 |
| **Total Cost** | **$2,157,601** | **$2,239,357** | **$3,180,085** | **$3,343,597** |
| **Profit/Loss** | **$(474,601)** | **$(259,357)** | **$185,915** | **$616,403** |

| Table 21. Profit/Loss Per Ton | | | | |
|---|---|---|---|---|
| | **Single Shift** | | **Double Shift** | |
| **Processed Tons** | 85% (30,600 tons) | Full Capacity (36,000 tons) | 85% (61,200 tons) | Full Capacity (72,000 tons) |
| **Income** | $55.00 | $55.00 | $55.00 | $55.00 |
| **Litter Cost** | $11.62 | $11.62 | $11.62 | $11.62 |
| **Labor Cost** | $15.48 | $13.16 | $11.98 | $10.18 |
| **Variable Cost** | $19.66 | $17.24 | $16.49 | $14.55 |
| **Fixed Cost** | $23.76 | $20.19 | $11.88 | $10.10 |
| **Total Cost** | **$70.51** | **$62.20** | **$51.96** | **$46.44** |
| **Profit/Loss per Processed Ton** | **$(15.51)** | **$(7.20)** | **$3.04** | **$8.56** |

Table 21 provides the breakeven figure per ton for the different scenarios. To compete with synthetic fertilizer of equal nutrient value the price of the processed tons should be under $55, the current price for equal nutrient fertilizers on the market. Only the two double shift scenarios achieve total cost under the sales price of the competition.

**Sensitivity Analysis**

*Profit versus Budgeted Cost*

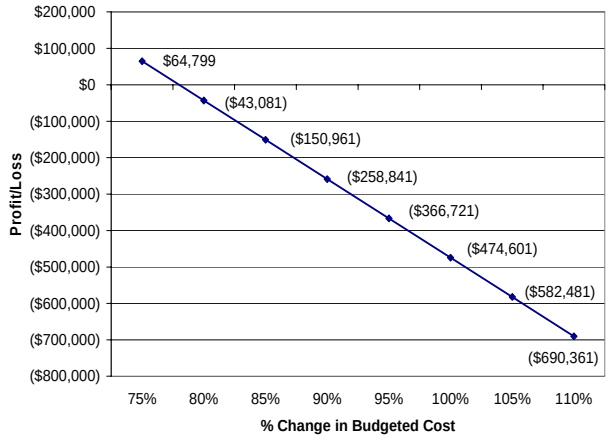
In order to determine the potential viability and risk of a project a sensitivity analysis is performed. The sensitivity analysis adjusts the budgeted cost by 5% increments to test the profitability of the operation if cost increased.

The budget numbers included operating expenses (utilities, taxes, labor, and supplies), fixed costs (interest on start-up cost, depreciation), and income from sales of processed litter. Total costs are subtracted from income, resulting in profit or loss. Each scenario will have a separate sensitivity graph.

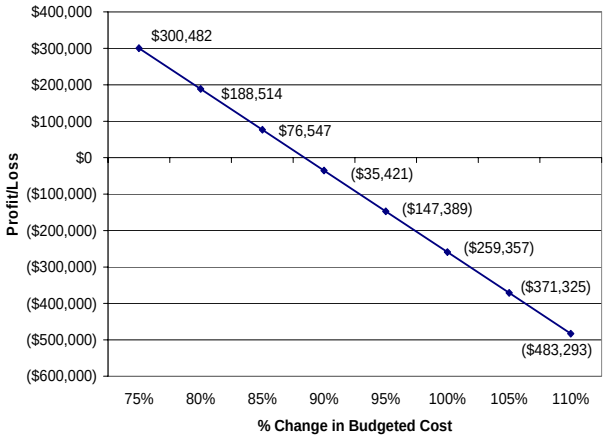
This information is useful for decision planning and risk aversion, as costs are subject to change. Utilities for example, can fluctuate periodically through the year depending on supply of their inputs. The CAED suggests allowing for a 10-15% over budgeted cost for large projects. Often costs change after the start up of the business or the feasibility report, so to ensure all cost are covered a buffer should be included.

Graphs 1 through 4 indicate the relationship between budgeted cost and profit. The cost estimates are moved incrementally at 5% intervals to see the results on profitability and assess risk.

**Graph 1.** Change in Profit versus Change in Budgeted Cost, 85% Capacity Single Shift

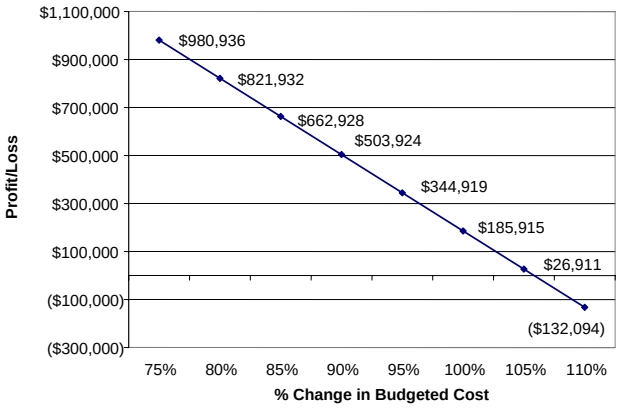



**Graph 2.** Change in Profit versus Change in Budgeted Cost, 100% Capacity Single Shift

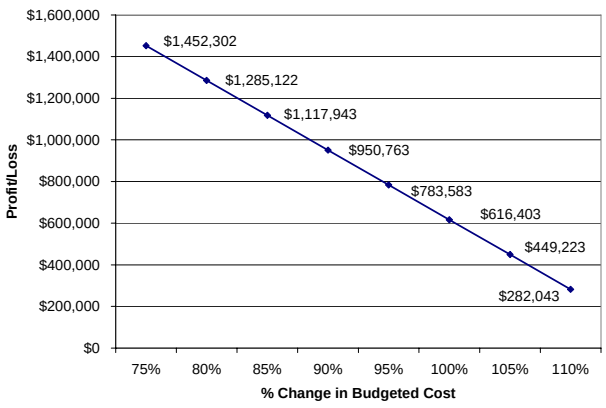



Graph 1 demonstrates that the single shift 85% capacity scenario appears feasible only when costs are reduced by 22%. Graph 2 indicates that the single shift full capacity scenario does not appear to be feasible based on the budgeted cost but is profitable when costs are reduced 11%.

**Graph 3.** Change in Profit versus Change in Budgeted Cost, 85% Capacity Double Shift




**Graph 4.** Change in Profit versus Change in Budgeted Cost, 100% Capacity Double Shift

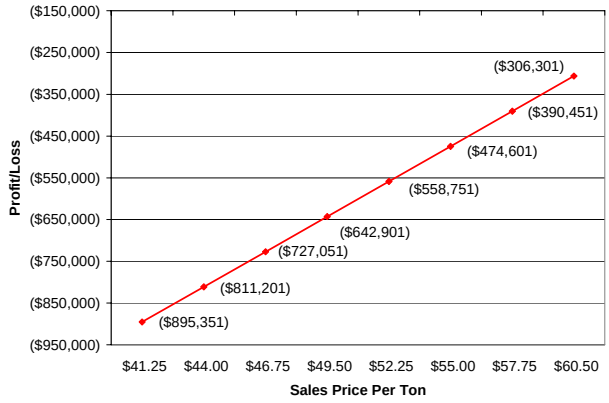


Cost of the double shift 85 capacity operations could increase as much as 6% over budgeted cost, but Graph 3 proves risk exists if costs increase 10%. Graph 4 shows that the double shift full capacity operation could increase as much as 18% and still be profitable.

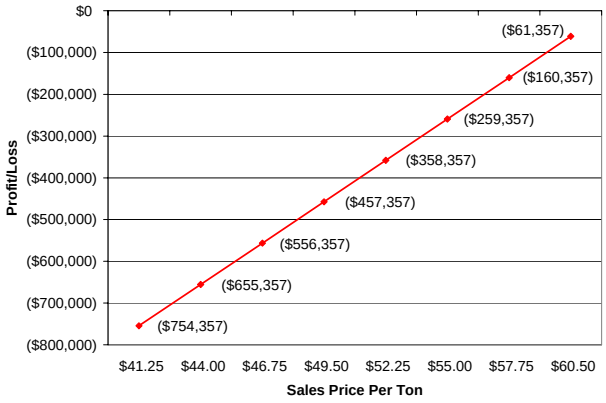
*Profit Versus Percent Over/Under Estimated Sales Price*

This section of the sensitivity analysis displays how a change in the sales price of pelletized litter affects profitability. The obvious result is as prices decrease, profits decrease. New products are often offered at prices under competition products to gain market share. In response the competition may respond to new products by cutting their sales price. To understand the outcome of sales price shifts on profitability Graphs 5-8 use a 5% change in sales prices to illustrate the sensitivity of profits to change in market conditions.

**Graph 5.** Profit versus Over/Under Estimated Sales Price, 85% Capacity Single Shift.

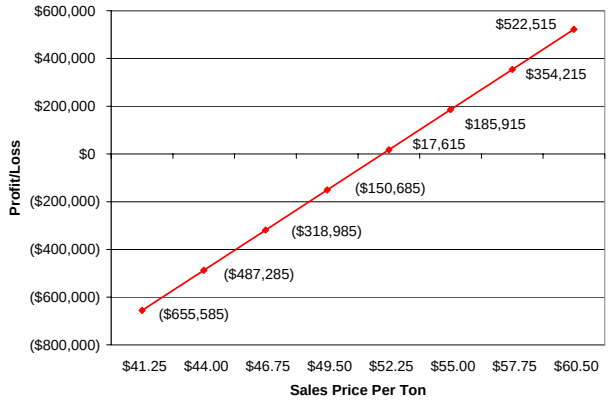



**Graph 6.** Profit versus Over/Under Estimated Sales Price, 100% Capacity Single Shift.




Graphs 5 and 6 indicate that the single shift 85% capacity scenario needs to receive a sales price of $70.51 to breakeven; while the single shift full capacity scenario needs $62.20 to breakeven.

**Graph 7.** Profit versus Over/Under Estimated Sales Price, 85% Capacity Double Shift.



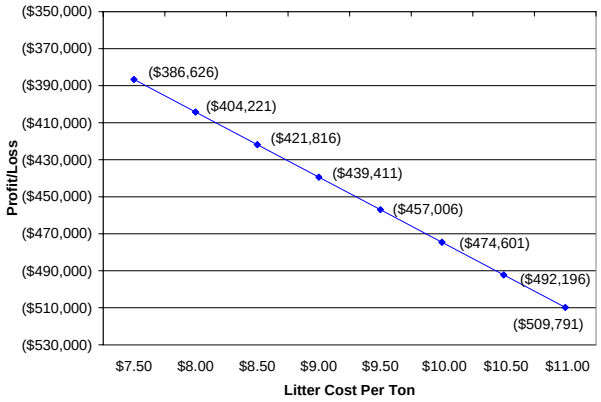

**Graph 8.** Profit versus Over/Under Estimated Sales Price, 100% Capacity Double Shift.

Graph 7 indicates how a scenario is profitable at the current price, $55 per ton, but becomes unprofitable with a 5% price decline at $51.96 the double shift 85% capacity breaks even, indicating a degree of risk associated with this scenario. Graph 8 reveals semi-positive news that the double shift full capacity scenario can withstand a 16% price decline until the sales price reaches $46.44, its breakeven point.

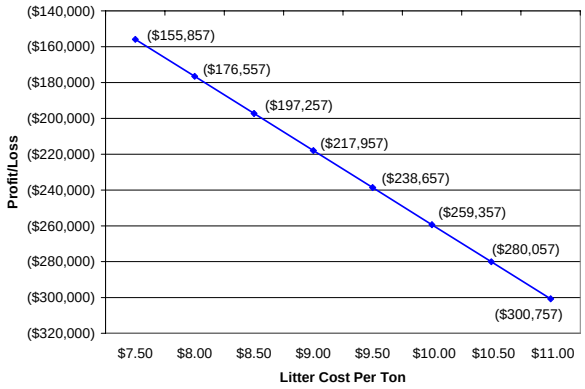
*Profit versus Change in Litter Cost*

Graphs 9-14 indicate how a change in the direct cost, or prices received by the producers selling the litter into the facility affects profitability. The litter price was modified in 5% increments to see the effect on the bottom line.

**Graph 9.** Profit versus Direct Cost, 85% Capacity Single Shift.

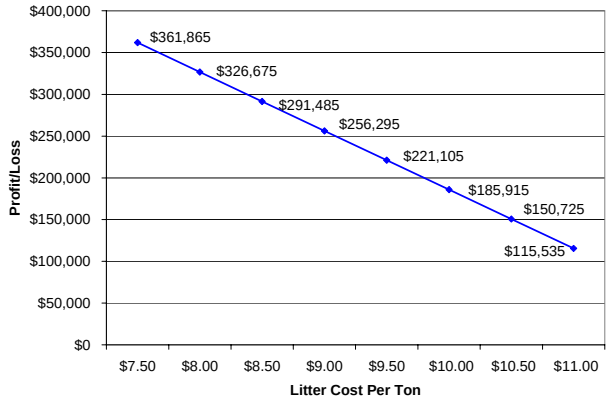



**Graph 10.** Profit versus Direct Cost, 100% Capacity Single Shift

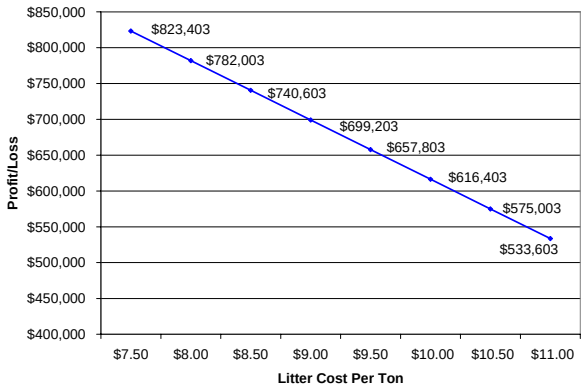



Graphs 9 and 10 show that even purchasing the raw poultry litter at $7.50 per ton ($2.50 below the minimum wished to be accepted by the producers in the area), the single-shift scenarios were unprofitable. The single shift 85% capacity would need the litter to be available at for free and with an additional payment of $3.50 to cover all cost. The single shift full capacity would need a subsidy that would reduce the litter price to $3.75 in order to break even.

**Graph 11.** Profit versus Direct Cost, 85% Capacity Double Shift.




**Graph 12.** Profit versus Direct Cost, 100% Capacity Double Shift



Graphs 11 and 12 reveal room for the raw litter cost to increase while still remaining profitable. The maximum increase for the 85% capacity double shift is $2.64 per ton, yielding a per ton price of $12.64, while the full capacity double shift can increase the price per ton received up to $17.44 per ton. An alternative way to view this is that the producers would be receiving a value of $12.64 or $17.44 at each level of production.

**Organizational Structure and Alternative Financing Arrangements**

*New Generation Cooperatives*

A marketing cooperative is one of the financing and ownership methods being considered for the processing facility in Coffee County, Georgia. The main purpose of this facility is to further process poultry litter into commercial fertilizer and return the added value to producers in the community. The recommended organizational structure would be to form a value added poultry litter cooperative of defined or selected membership whereby members invest through the purchase of stock shares.

The basic concept of this new type of cooperative is that producers capture profits occurring beyond the farm gate by owning and controlling the local businesses that are positioned to earn those profits. The motivation of new generation cooperatives is more offensive than defensive, by taking control of its own destiny and being proactive rather than reactive. The main emphasis in cooperatives of this type have been on value-added processing, niche marketing, and producer/members viewing themselves as producing a finished product rather than supplying a raw product.

These new type of producer processing cooperatives are called “New Generation Cooperatives” (NGC), “closed cooperatives,” or “stock cooperatives.” NGCs combine solutions to financing and operating questions posed by new producer/owned, processing operations. First, producers raise an initial portion of the investment and working capital cost through stock sales. The remaining capital could be raised through debt financing. Second, the shares serve as a dual contract. Each shared owned provides the producer with both the obligation and the right to deliver to the cooperative. Likewise, the cooperative is obligated to accept delivery given quality standards are met. These delivery rights and obligations are transferable. Each member is still granted only one vote regardless of the number of shares owned. Thus, the NGC stock sale, properly structured, assures that the processing venture will be financed AND has adequate supply to operate efficiently.

Producers tend to take greater interest in operations developed as a NGC cooperative since they are also investors. The typical amount of member equity required is 40-60% of the initial capital needed for the project. This gives potential lenders the security of sufficient producer commitment. Commercial banks have been the primary source of financing for the remaining 40-60% needed by new cooperatives. The USDA also has numerous financial programs that can assist cooperatives that meet certain criteria. Credit unions and the Farm Credit System have also actively lent funds to farmers for investment in new cooperatives. Other helpful support systems in the development of these new cooperatives include communities,

regional economic development commissions, individual rural electric cooperatives, and university extension services.

The initial stock share price of an NGC is calculated by taking the total capital cost needed to start the plant divided by the total number of tons of raw litter needed for a standard operating year. This will yield a share price for 100% financing by the producers. If the producers wish to the lower their amount of equity, the share prices will drop accordingly to the amount financed outside the operation.

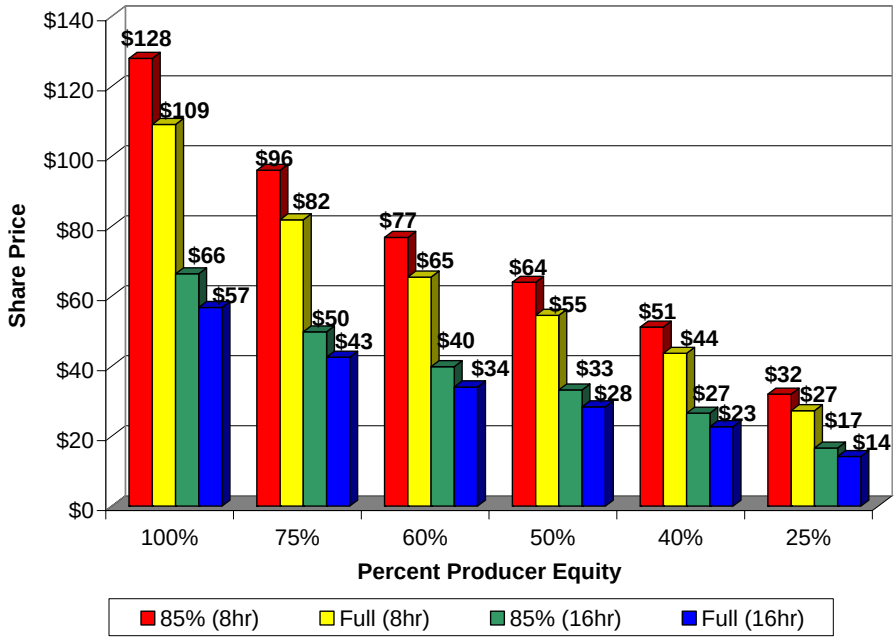
Graph 13 displays the different initial share prices per ton of raw litter based on various levels of producer financing. For example, if producers were to raise all the capital needed, then each share would be priced at $57 for the full capacity double shift. The calculations is total capital cost divided by tons needed, for the double shift full capacity the total capital cost needed are $4,702,377 and the tons needed are 82,800, or $4.7 million/82,800 is approximately $57. Each share represents one ton of raw litter to be supplied to the facility. Each share purchased requires a commitment to deliver one ton of raw product for the duration of the cooperative. However, the stock purchase price is paid once with the opportunity to receive returns annually.

NGCs retain many principles of traditional cooperatives: democratic control through a one member one vote policy; distribution of excess earnings among members as patronage refunds or dividends; and member-elected board of directors. The financing of NGCs allows the return of virtually all net earnings to members at year-end since members invest capital up-front. Future expansion is financed in the same way as original equity: members invest through the purchase of shares. In some instances, preferred shares may be offered to the community or general public. Issuing this non-voting stock is allowed under Georgia Cooperative law. This allows communities to support the project while keeping control in the hands of the members. Some of the advantages of the NGCs include the ability of producers to react quickly to opportunities or problems, the creation of wealth within a community, stability for producers, efficiency for the processing through restricted membership, consideration of the interests of the community through a diverse set of stakeholders, and commitment to the quality of the product by both the producers and processor.

One of the keys to success of a NGC is producer commitment. Groups of producers must be motivated, determined, and committed. Other keys to success include public policy that supports cooperative formation, financial institutions willing to finance the cooperative, and consultants or facilitators to help producer groups through the process. These keys to success seem to be available in Coffee County. Georgia poultry producers have an opportunity to take ownership of a pelletizing facility and increase producer returns through marketing of the commercial fertilizer.

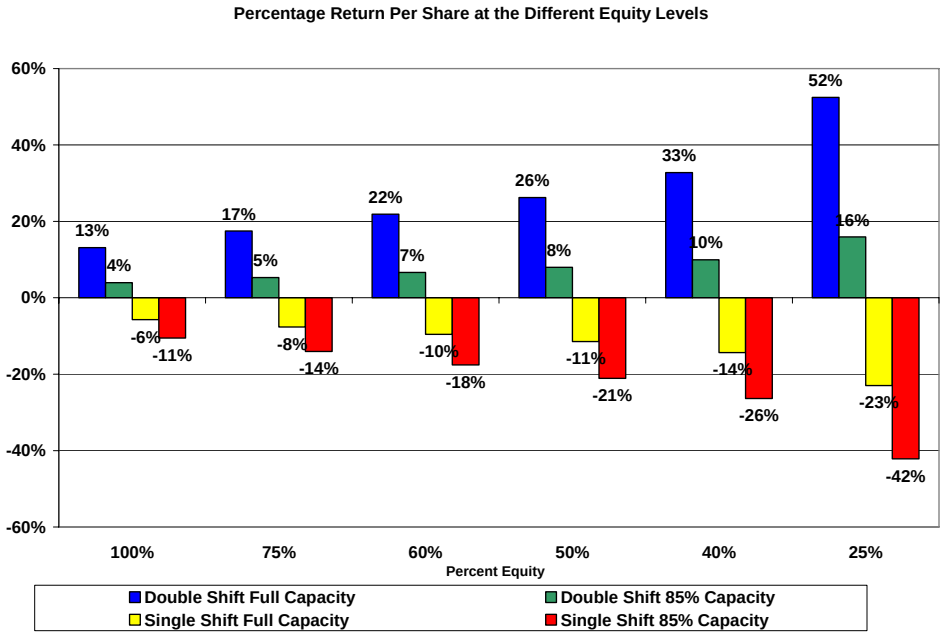
Graph 13 displays the different share prices per ton based on various levels of producer financing. Each share represents one ton of raw litter to be supplied to the facility, requiring a commitment to deliver one ton of raw product for the duration of the cooperative. However, the purchase price is paid once with the opportunity to receive returns annually.

**Graph 13.** Share Price per Ton for the Double Shift Scenarios. .




Any profits made from the business will be returned to the shareholders on a time-period to be determined by the cooperative's board of directors. The profit is split among the shareholders based on the number of shares each individual owns. Graph 14 indicates the percent return per share on an annual basis at the various producer financed levels.

**Graph 14.** Estimated Returns to the Various Financed Levels per Share



**Impact Analysis**

Impact analysis is a key component of any feasibility study. An impact analysis shows the effect of a new venture on the local and state economy. Building and implementing a poultry litter pelletizing facility in Georgia would impact the economy on two levels. The new plant would generate output as it begins selling pellets. These sales would, in turn, generate additional sales as the plant purchases inputs. The suppliers to the plant will increase the purchase of their inputs, thus increasing demand for those items. These increased sales will ripple through the economy. An input-output model will capture and quantify these effects.

The input-output model, IMPLAN (Impact Analysis for PLANning, Minnesota IMPLAN Group) was utilized for this project. IMPLAN can predict the effects of a new venture on output (sales), employment and tax revenue. IMPLAN models can be constructed for a state, a region or a county. Input-output models work by separating the economy into its various sectors, such as agriculture, construction, manufacturing and so on. An IMPLAN model will show each sector and industry in the specific region's economy. The model can capture how a change in one industry (for example, poultry litter pelletizing) will change output and employment in other industries. The changes in the initial industry (poultry litter pelletizing) are labeled direct effects and the changes in the other industries are called indirect effects. The direct and indirect effects are summed to give the total economic impact.

The first scenario (Table 22) examines a plant that runs 8 hours a day at 85% of its total capacity. The plant will have sales of $1,683,000. It will employ 16 people. Table 22 indicates that sales from the plant will increase economic activity by $1.7 million, bringing the actual total state impact of the plant to $3.4 million. In addition to the 16 jobs at the plant, another 19 jobs would be created in Georgia. Finally, the plant will increase state and local tax revenue by $179,251.

**Table 22. Impacts of 8 Hours and 85% Capacity**

| | Direct | Indirect | Total |
|---|---|---|---|
| Output | $1,683,000 | $1,771,036 | $3,454,036 |
| Employment | 16 | 19 | 35 |
| Tax Revenue (State) | NA | NA | $179,251 |

The second scenario (Table 23) considered is a plant operating 8 hours a day at full capacity. This plant would have sales of $1,980,000. It would employment 16 people. Table 23 illustrates the impact of this plant size. In addition to its direct output, the plant will generate $1.8 million in additional sales. Thus, the total impact of the plant in Georgia will be $3.8 million. In terms of employment, a total of 35 new jobs will be created due to the plant, 16 actually at the plant and 19 in other various sectors. Tax revenues for the local and state government would rise by $187,000.

**Table 23. Impacts of 8 Hours and Full Capacity**

| | Direct | Indirect | Total |
|---|---|---|---|
| Output | $1,980,000 | $1,842,788 | $3,822,788 |
| Employment | 16 | 19 | 35 |
| Tax Revenue (State) | NA | NA | $187,064 |

The third scenario (Table 24) examines a processing scenario of 16 hours run time and 85% capacity. This would create sales for the plant of $3,366,000 and employment of 26 workers. Table 24 outlines the output, employment, and sales impacts. A plant of this size would generate a total of $5.9 million in new sales for Georgia. Of these, roughly half will be from the plant and half from other sectors in the economy. A total of 54 new jobs would be created, 26 at the plant and 28 in other areas of commerce. State and local government tax revenues would increase by $257,000.

**Table 24. Impacts of 16 Hours and 85% Capacity**

| | Direct | Indirect | Total |
|---|---|---|---|
| Output | $3,366,000 | $2,617,007 | $5,983,007 |
| Employment | 26 | 28 | 54 |
| Tax Revenue (State) | NA | NA | $257,203 |

The fourth and final scenario (Table 25) is a plant running 16 hours a day at full capacity. A plant of this size would generate sales of $3.96 million and employ 26 people. Table 25 highlights the impacts of this plant. The $3.96 million of direct sales will trigger $2.7 million in additional spending. The total economic impact would then be $6.7 million in Georgia. Employment in Georgia would increase by total 55 jobs, 26 at the plant and 29 in other industries. Tax revenues for the local and state governments would increase by $273,000.

**Table 25. Impacts of 16 Hours and Full Capacity**

| | Direct | Indirect | Total |
|---|---|---|---|
| Output | $3,960,000 | $2,762,932 | $6,722,932 |
| Employment | 26 | 29 | 55 |
| Tax Revenue (State) | NA | NA | $273,018 |

Table 26 is designed to compare the total output, employment, and tax revenue increases for the four scenarios. One can see as plant capacity and run time increases, the size of the impacts also increase. This is due to the increase in sales by the plant.

**Table 26. Comparison of Impacts for Various Sizes**

| | Total Output | Total Employment | Total Tax Revenue |
|---|---|---|---|
| 8 hours, 85% capacity | $3,454,036 | 35 | $179,251 |
| 8 hours, 100% capacity | $3,822,788 | 35 | $187,064 |
| 16 hours, 85% capacity | $5,983,007 | 54 | $257,203 |
| 16 hours, 100% capacity | $6,722,932 | 55 | $273,018 |

## Conclusion

It is believed that soil quality guidelines will soon be facing Georgia's agricultural community through regulations controlling nitrogen and phosphorus levels in the soil. The Environmental Protection Agency already has a tentative plan in place that requires states to have written plans of control by 2005 and actual working plans by 2007. Coffee county poultry producers feel the pelletizing facility will assist in, if not, control the problem and enable them to create a potential profit, while obeying any new regulations. Environmental benefits to reducing phosphate and nitrogen levels on the soil will also affect water quality and surrounding habitat.

The information used to determine the economic feasibility for the poultry litter facility in Coffee County came from AgriRecycle, Astec, California Pellet Mills Inc, Farmgate and historical prices. All information obtained was utilized to best fit the project. However, prices change over time, often following supply and demand.

The marketing analysis investigated seven different markets for pelletized poultry litter. Of the identified markets, the homeowner and cattle backgrounding markets appear to be the most viable. These markets require additional packaging, a 20 – 25 pound bag, and the establishment of a complex distribution channel. The sod producer market is estimated to be over 16 million pounds annually. However, due to the cost of transporting relatively small quantities of bulk product, this market may not be viable.

When the price per pound for the seven identified markets and a marketing firm offering $55/ton or $0.028/lb (AgriRecycle, Inc.), were compared, only the homeowner ($0.15/lb) and cattle block ($0.10/lb) markets will bear a price higher than the proposed contract. Interestingly, these two markets offer the greatest potential in terms of product price and volume. Prices for the pelletized litter ranged from $.024 per pound in the bulk market to a high of $.15 per pound in the retail bag market.

The economic analysis revealed returns per ton to range from $-15.51 with the 8 hour shift and 85% capacity to $8.56 in the 16 hour shift at 100% capacity. The returns are in addition to the $10 already received by the poultry producers for the raw litter. Each alternative did prove to have a significant impact in the community in the form of tax revenues and employment. The new generation cooperative is the suggested organizational structure for purchasing and operating the poultry litter pelletizing facility.

The chance for successful operation of which covers the true economic cost of operating appears to be unlikely for the single shift levels of production, however the double shift levels of production appear likely to cover all economic cost, once in full operation. However, this size operation will have to handle almost all poultry litter in the Coffee County area. Also, the market share will take time to develop and enough working capital needs to be raised to cover expenses for an extended period. Long term contracts with purchasers could prove to be useful when entering the market. Of course this analysis does not include the environmental benefits that would occur to the state from such an operation. It is possible that due to such impacts, state or federal subsidies in the form of low cost financing or direct capital may be used to position such an operation to cover cost.

# The Center for Agribusiness & Economic Development

The Center for Agribusiness and Economic Development is a unit of the College of Agricultural and Environmental Sciences of the University of Georgia, combining the missions of research and extension. The Center has among its objectives:

> To provide feasibility and other short term studies for current or potential Georgia agribusiness firms and/or emerging food and fiber industries.
>
> To provide agricultural, natural resource, and demographic data for private and public decision makers.

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**J. Scott Angle, Dean and Director**