Assessing the economic impact of using compost for field-grown vegetables

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Overview

Every year, millions of tons of organic wastes are disposed of in landfills in North Carolina. This practice disrupts the natural cycle of degradation that restores and replenishes soils through the microbiological breakdown of wastes, increases landfill sizing requirements by as much as 40 percent in the state, and contributes to leachate management headaches at disposal sites.

Problems resulting from the millions of tons of naturally derived nutrients and other soil-building qualities lost to horticulture and agriculture through landfilling have been exacerbated by today's conventional growing systems that rely almost exclusively on synthetic fertilizers, herbicides, and pesticides. Loss of topsoil, nutrient run-off, and lack of soil tilth and fertility are but a few of the negative side effects of chemically based agriculture.

Results from many studies over the years have indicated that wide-scale compost utilization by farmers would offer a cost-effective remedy to many of these problems, one that would dramatically improve agricultural land and effect the rapid reduction of organic wastes from North Carolina's landfills.

In the middle, between the waste stream and the end use, exists the technology, the expertise, and the facilities that could convert the organic fraction of municipal waste streams to compost.

Unfortunately, compost demand within the conventional agricultural community is virtually non-existent. Without the farmers to drive demand, large scale composting of the organic fraction of multi-source cannot be an economically viable venture, and landfills will continue as the primary disposal option for these materials.

The biggest hurdles are related to economics:

• This region is a top-producing area for intensive livestock production, and raw manures and effluents are readily available to growers. Why should farmers pay for compost when they can get their hands on raw manures and effluents for next to nothing?

• Looking at NPK values alone, manufactured compost products are expensive and not competitive when compared to synthetic fertilizers. Why use them?

In order to move toward a more sustainable waste management system, it will be necessary to answer these questions and build a compelling case for compost use in agriculture through demonstration and research based on the crops, acreage, equipment, and technologies currently utilized by professional growers in North Carolina.

Local farmers who have incorporated compost into their cropping plan report increased yields and continue to up the quantity ordered each growing season, indicating economic viability for compost use.

The challenge is to demonstrate this success on a larger scale and find ways to help farmers make a successful transition from a system that relies solely on chemical input to one that includes compost products.

Project description

In southeastern North Carolina, where farmers are close to large swine and poultry operations, the application of raw manures and effluent to farmland has a long tradition. However, in these mostly sandy soils, nutrients in raw wastes rapidly leach from the root zone and contribute to run-off and pollution problems.

Composts, on the other hand, offer many benefits (high Cation Exchange Capacity, moisture retention, pH buffering, desirable microbial activity, etc.) that raw wastes do not. It has been a mainstay of growing systems of farmers who market organic products, and their experience indicates the real value of compost comes as much from its soil building/enhancing qualities as from nutrient content. Healthy soils, able to hold moisture and nutrients, have shown the ability to produce healthy plants that are naturally resistant to the ravages of pests and diseases. While these growers often see reduced yields compared to conventionally grown crops, they generally report higher profits due to reduced input and premium crop prices.

But, the widespread adoption of compost use by conventional farmers in North Carolina has not happened. Right or wrong, conventional growers tend to dismiss cultivation practices of organic growers (including compost use) as inappropriate or economically unsound. Over the years, conversations with conventional growers have revealed varying opinions about compost:

• Cultivation practices of small, specialty growers will not "scale up" to very large operations.

• The climate of the Carolinas will not allow profitable crop production without herbicides and pesticides.

• The benefits of compost use will not out-weigh costs if no premium is received from the sale of farm products (as with certified organic produce).

The experience of local, conventional growers who are beginning to incorporate compost into their soils refutes these opinions, and one can conclude that compost, whether used alone or in conjunction with synthetic products, can benefit the bottom line of farmers in southeastern NC.

One of the area's larger growers has discontinued the application of synthetic fertilizers in some fields and reports increased yields through compost use alone.

But this, like so much other "field experience" over the years, remains undocumented and lacks corroborating data.

Formal research at the university level in the state has only recently begun to examine compost use and is confined to comparatively small plots. In the absence of any *bona fide* research data, the Cooperative Extension Service has not stepped forward to champion compost use. Compounding this communication/dissemination problem is the fact that chemical ag product suppliers continue to dominate the editorial and advertising content of widely-circulated farming publications.

With no one out there talking to growers about compost use, providing factual information about what it can and cannot do, or demonstrating successful techniques and methods, farmers simply aren't getting the message.

As a manufacturer of compost products, McGill Environmental Systems (MES) saw a need to collect, compile, and disseminate the type of practical information farmers would require when making decisions about compost use. It proposed to undertake a project to develop meaningful data through an assessment of the economic impact of compost utilization as part of a large scale farming system, concentrating on high value, produce crops.

The project's intent was to collect data from on-going farming operations using experienced growers, standard equipment, and conventional methods augmented by applications of compost derived from mixed source composts.

It was also intended that the study would take place over a period of years at the same location(s), recognizing the progressive nature of the benefits of compost use over a number of growing seasons.

Study design. The focus of the 2000 study was to use multi-source compost as the primary nutrient source for vegetable production and to measure/observe other possible benefits of this compost use, such as high CEC, moisture and nutrient retention, and disease suppression. Measurements of microbial activity, nematode populations, total crop yields, and avoided costs were also planned.

The study was designed by Pieter Westerbeek, a crop consultant and former horticultural agent with the Cooperative Extension Service, who was to serve as project manager and lead researcher. However, Mr. Westerbeek withdrew from the study in late 1999 to concentrate on another research project. Subsequently, two of the three commercial growers initially identified also withdrew.

Rondeli Inc., another compost producer, dropped out of the project when it was determined that the company would not be able to generate a sufficient volume of finished product to meet project requirements.

Burl Williamson, a cantaloupe grower from Clinton, Sampson County, agreed to participate in the study, but restricted the scope to a ½ acre experimental plot. Herbie Cottle, a contract produce grower from Rose Hill, Duplin County, was recruited along with Roy Kelly, who sells to local residents from his farm near Magnolia, Duplin County. Cottle identified a 7-acre field for sweet corn, while Kelly set aside a 1.5-acre plot for sweet potatoes.

All of these fields were small when compared to the typical size for commercial growers in the area, whose larger fields commonly have more than one soil type, poor drainage, compaction problems, and other less-than-perfect qualities. Since one of the primary objectives of the project was to gather data generated under actual field conditions, MES opted to join the list of growers by leasing a 28-acre field near Magnolia ( ) to represent typical field conditions encountered by commercial vegetable growers. A crop of watermelon was to be followed by greens, both planted and harvested by Mr. Cottle.

In an attempt to fill the void created by Mr. Westerbeek's departure, Tim Hall, an agronomist with the North Carolina Department of Agriculture and adviser to the project, agreed to take on data collection responsibilities, but within a limited scope and as his schedule would permit.

Robert Lucas, a McGill employee, assisted Mr. Hall with data collection. Ron Alexander, a horticulture and compost marketing specialist, was retained to develop a cropping plan for the McGill field, assess horticultural/agricultural trends relative to compost use (volumes and dollar value), and assist in developing a long-range crop plan.

Other advisers to the project included Whit Jones, horticulture agent with Duplin County Cooperative Extension Service; James Parsons, area poultry specialist with the Cooperative Extension Service; James Hartsfield, small farm specialist with the Cooperative Extension Service; and Stefan Hartmann, Black River Organic Farm, who has produced and used compost on his 35-acre produce farm for many years.

Both the spreader truck and manure spreader used to apply compost to the test plots were calibrated by CES/NCDA personnel prior to the start of the project. All compost rate calculations were based on Waste Report #W05595, which is typical of McGill's compost.

All tissue and soil sampling was conducted by the NCDA laboratory.

Compost totals. Total compost products used in Y2000 included:

Compost = 538 cyds @ $8/cyd spread = $4,304 dollar value

Liming agent (wood ash) = 180 cyd (4 loads) @ $70/load = $280

Project activities

Fields were identified, mapped, and sampled during the first quarter of 2000. A training program for growers, covering the benefits and use of compost, was held on March 10, but none of the growers attended (Mr. Cottle did not join the project until late March). Instead, the time was used by the advisory team for planning.

Cantaloupe. Burl Williamson grows 30 acres of cantaloupe each year under plastic mulch with drip irrigation. A ½ acre field set aside for experimental use, located off Beulah Road in Clinton, was dedicated to the compost study.

The field was laid out with 16 rows in blocks of four. Individual blocks were used as replications and individual rows as plots. With plots randomly assigned, half of each row was treated with methyl bromide (the grower's standard practice). The remaining half of each row was left untreated.

Initial sampling for soil fertility and nematode populations took place on February 16, 2000. The grower had indicated that a severe Root Knot nematode problem existed on the farm, but sampling did not corroborate this contention.

Based on the grower's typical preplant fertilizer rate of 2000 lb./acre 6-6-18 (supplying 120 lb. N and 360 lb. K), 120 N was set as the base rate for compost. Compost was applied at rates of 1X, 2X, and 4X (or 20, 40, and 80 tons per acre, respectively) on April 24, 2000, using a manure spreader supplied by Duplin County Cooperative Extension. The machine was calibrated for the 20 ton rate and multiple passes were made over the field for the higher rates.

A shroud was used over the beaters to concentrate the compost on top of the row. Compost and fertilizer were incorporated with a rotovator.

On April 17, methyl bromide fumigant was applied to half of each row, the rows bedded, and plastic mulch laid. Cantaloupe transplants were set out on May 2, 2000. Variety: Summet.

Approximately four weeks after planting, all plants were observed to have a healthy appearance in both fruit and foliage, with some minor variation between rows. Soil, nematode, and leaf tissue samples were taken on June 21, 2000, with no nematode problems indicated.

Fields are typically irrigated twice a week during dry weather.

A fungicide, typically applied to the growing plants, was not applied to the test plots. The grower indicated to Mr. Hall that no foliar treatments were applied, but a foliar fertilizer treatment is suspected because of the levels of calcium and boron reported from the tissue sampling.

Fruit was harvested on June 30 in two 30-ft. wide transects through the field, one through the plots treated with methyl bromide and one through the plots without treatment. Fruit was graded as it was harvested based on a visual estimation of weight, with fruit four pounds or larger (market weight) included in the count.

The 4x (80 tons/acre) compost plots had the highest average market count (709.5 units per acre for untreated compost compared to 643.5 units for the untreated conventional plot), but at numbers not thought by Mr. Hall to be statistically significant. There was also an increase in tissue potassium as compost use increased, but these did not approach the levels of commercial potassium.

All fruit in the field ripened at about the same time, which was unusual. But, as the same thing happened in the adjacent commercial field, the abnormality is thought to have been the result of climate rather than a factor of the study. Mosaic virus and fungus problems were also observed at similar levels in both the commercial and experimental fields.

Cantaloupe Cost Comparisons. In both the conventional fertilizer plots and those receiving a 4x compost application, the yield of the plots without methyl bromide treatment exceed the treated strips and resulted in greater net income than the treated strips. Although the untreated 1x compost plots did not out-produce the treated plots, the reduced input also resulted in a higher net return for the untreated plots over the treated strips.

However, cost of the 1X compost, at $8 per cyd spread, was $76 higher per acre than conventional fertilizer, and when combined with the smaller yields of those plots, did not match the profit-per-acre of the conventional plots. Production cost of the highest yielding compost plot (4x rate without methyl bromide) of $1,280 per acre did not compare favorably to the best conventional plot (without methyl bromide) of $244 per acre, even through yield count was 66 units higher and weight of fruits was marginally higher. Overall, cantaloupes in the compost plots were smaller than fruit in the conventional sections.

Cantaloupe Cost Comparison Table

	FERTILIZER per acre*		**1X COMPOST per acre***		**4X COMPOST per acre***	
	w / MB	**w / o MB**	**w / MB**	**w / o MB**	**w / MB**	**w / o MB**
Cost of initial application (fertilizer = 6-6-18)	244	244	320	320	1280	1280
Cost of Methyl Bromide treatment	258	none	258	none	258	none
TOTAL COST / AC	**502**	**244**	**578**	**320**	**1538**	**1280**
Average weight (lbs/ac)	2695.4	2868.4	1086.9	510.0	2420.6	3302.7
Average count (units/ac)	610.5	643.5	280.5	181.5	610.5	709.5
Y2000 avg. market value @ 70¢ each	**427**	**450**	**196**	**127**	**427**	**496**
MKT VALUE - TTL COST	**- 75**	**206**	**- 382**	**- 193**	**-1,111**	**- 784**

***spreading / application costs included**

Sweet corn. Herbie Cottle grows produce (sweet corn, squash, strawberries, greens) under contract for grocery chains and runs a U-pick operation outside of Rose Hill. He also grows traditional field crops, which are included in his annual rotations.

A field with an estimated spreadable area of 6.25 acres off Yellow Cut Road in Rose Hill was set aside for the sweet corn trial. The field had laid fallow in 1999 and was planted to soybeans the previous year. Mr. Cottle has also used organic soil amendments on the field over the years, including poultry litter and grape hulls.

The test area was laid out in four strips of approximately 120 ft. wide x 550 ft. long for compost applications using a spreader truck. The strips were sampled for fertility on February 23, 2000.

Nematode assays showed the presence of Sting nematodes, a potentially significant pathogen for corn, in strips A and D. No other significant nematode threat was revealed, and it was decided to orient nematode observations around those strips.

The grower routinely applied Counter insecticide/nematicide for sweet corn, and Mr. Hall requested that the outside half of strips A and D would not receive the chemical application. The nematacide was applied at planting in granular form at a rate of 7 lb/ac 15G. Cost of the treatment was approximately $20 per acre plus spreading.

The grower's normal fertilization practice was 350 lb/ac 5-14-39, followed by a side-dress application of 120 lb/ac N from 24S liquid. Totals of about 140 lb/ac N and 140 lb/ac K fit the N:K ratio of the compost reasonably well. Compost rates were set at 1X, 1.5X, and 2X the grower's standard N rate or about 23, 34, and 46 tons/acre, respectively, assigned to strips C, B, and A, respectively. Strip D received the commercial fertilizer.

Compost was spread April 7-9, with corn planted on April 10. Variety: Rogers 710A.

Follow-up nematode and fertility samples were taken on May 12. Samples were taken from 50 ft. plots laid on parallel transect lines across strips, four plots per strip. Extra samples were taken from nematicide-free halves of strips A and D. Samples did not reveal any activity by or abundance of Sting or Root Knot nematodes.

At time of sampling, Mr. Hall observed that N solution had been applied and incorporated to the entire field, counter to design of the test. The grower acknowledged this error, noting that 24S sulfur-nitrogen had been applied a few days earlier. While Mr. Hall felt this would eliminate any discernible difference in yield, it was decided to continue with the study to see if any negative or positive impact would be observed.

Although irrigation lines were in place, the wet growing season eliminated the need to irrigate this field.

Plots were sampled for yield on June 26, 2000. According to Mr. Hall, harvest counts/weights for all compost strips were higher than the conventional strip, though not statistically significant.

Soil sampling results showed a drop in pH for all test plots between the February and May sampling events to levels lower than what might be expected after compost application. Although a crop of mustard greens followed the sweet corn and was turned under mid-November, another set of soil samples was taken on November 28, 2000, to see if pH had returned to pre-compost application levels. At the time of report filing, results of these tests were not yet available.

Sweet Corn Cost Comparisons. Average weight per ear was slightly higher for 1X compost-grown corn, and the per acre ear count exceed the conventional plot by 300 ears. However, the cost per acre of compost plus 24S sidedress exceeded the cost per acre of conventional fertilizer plus sidedress and nematicide by $132, netting only $35 more per acre at market.

Overall, all compost plots out-produced the conventional plot with regard to average ear counts and weight. However, the increased yield was not enough to compensate for the higher cost of the compost.

Sweet Corn Cost Comparison Table

	FERTILIZER per acre*	**1X COMPOST per acre***
Cost of initial application (fertilizer = 5-14-39)	208	368
N cost of 24S side-dress	46	46
Cost of nematicide (Counter)	28	none
TOTAL COST / AC	**282**	**414**
Average weight (lbs/ac)	2997.1	3345.4
Average count (ears/ac)	4377.4	4678.4
2000 avg. market value @ $7 per box packed 5 dozen per box	**511**	**546**
MKT VALUE - TTL COST	**229**	**132**

*** spreading / application costs included**

Sweet potatoes. Roy Kelly grows watermelon, greens, peanuts, and other produce crops outside of Magnolia, where he sells from his home to local residents.

A 1.5-acre field was identified for a sweet potato trial and divided into three test strips. Conventional fertilizer was applied at 400-450 lb/ac of 15-0-14 to Strip A in banded rows. The plot width was approximately 65 feet.

Strips B and C were each 40 ft. wide. Strip B received the 1X compost rate targeting 10 tons/acre or 60-65 lb/ac PAN. The Strip C compost application rate was twice the 1X rate at 20 tons/acre or 120 lb/ac PAN. All strips were approximately 540 ft. long.

Unfortunately, the grower did not plant in one day, but set out plants over a period of weeks, which negated the study. No additional samples were taken by Mr. Hall. Observation of the field continued, but the grower did not make any additional pesticide or fertilizer treatments, as directed by Mr. Hall. The conventional strip, the last to be planted, failed a few weeks after planting. Plants in the compost strips were not vigorous and only a handful produced potatoes of acceptable size or number. The grower did observe that the plants in the 20 tons/acre strips were a little better than plants in the 10 tons/acre strips. However, he said 80 tons needed to be applied to the fields for good growth.

On October 12, 2000, Whit Jones and the grower dug a couple of rows and observed a sparse crop with considerable worm damage. Mr. Jones estimated over 70 percent of the crop had been destroyed and a crop failure was declared; no counts or weights were taken by Mr. Hall.

The McGill field. Initial samples were taken of the Magnolia field in late March, but Mr. Hall felt irregularities in the field (multiple soil types, poor drainage, erosion) would distort results and decided not to use the field for the official study. However, after the problems with both the sweet corn and sweet potato fields, the field was again considered for formal study and was resampled and replotted in late May with 12 test plots to allow numerous replications. The window of opportunity had passed for planting watermelon, so a late-summer planting of fall squash was planned.

An unusually wet summer made the field inaccessible to McGill's large trucks and trailers, despite repeated attempts to deliver product. Compounding the problem was a very tight trucking schedule throughout the summer with few windows of opportunity to make deliveries. As a result, compost delivery and spreading was not completed until September, too late for fall squash.

The plot plan was modified by McGill staff, increasing the size of each test plot, but reducing the number to six. The field was split in half. One side received an application of a liming agent (wood ash) at a rate of 7.5 tons/acre. The other side received no amendment. Each half of the field was divided into three strips – one for conventional management, one at a generic compost rate for N at 10 tons/acre, and one at a 2X compost rate (20 tons/acre).

The field was planted with a cover crop of winter wheat in early November and will be planted to soybeans or other field crop in the spring.

Website and exhibit. At the end of March, a page was posted to the McGill Compost website, which chronicled the progress of the study. Updates were made throughout the growing season. MES is now working on a new website, which will be published under the Leprechaun Organic Products name in early 2001 at (www.leprechaunorganicproducts.com). The final report will be published to the new site, along with additional photos from Y2000 study activities and planned research/demonstration activities for 2001.

As of the end of November 2000, the old McGill website(s) were discontinued.

In early November, general information about the study was included in the McGill exhibit at the Sustainable Agriculture Conference in Wilmington. Because data from one complete crop year had not been collected, no other exhibits were planned.

Trends assessment. Mr. Alexander conducted a market trends assessment in an area east of I-95 between Hwy. 70 and Myrtle Beach to identify and evaluate local trends that would affect the development of markets for compost products manufactured at the Delway facility. This information, along with other input, was used to guide the design of the research and demonstration plan for Y2001.

In a region where the number of farms has decreased, total land in farms has increased, and Cooperative Extension agents report growth in the nursery/landscape and vegetable/berry industries. The top five commodities in the region (based on value) are cotton, nursery/greenhouse crops, potatoes, and vegetables/berries.

Compost use projection. The survey revealed a total of 1,880,918 acres in farm land in 1997 in the 16 counties which constitute the primary service area for the Delway facility. Using a conservative compost use figure of 10 tons/acre, this region could easily utilize 18.8 million tons of compost products each season with a market value of more than $300 million dollars (at $8/cyd).

1.88 million acres x 10 tons/acre = 18.8 tons = 37.6 cyds x $8/cyd = $300.8 million

Golf courses, another targeted market for compost products, numbered 166 in this geographic region in 1999. Using the PGA average fairway acreage for a small (100 acre), 18-hole course, 23 acres of fairway per course or 3,818 total acres would be suitable for the application of generic compost products with a market value of almost $500,000.

Calculation: 3,818 acres x 10 tons/acre = 30,818 tons = 61,636 cyds x $8/cyd = $493,088

Conclusions and recommendations

All study plots were flawed to the point where results could not be considered valid from either a scientific or economic perspective. However, the following observations/suppositions have been drawn from the experiences of the 2000 crop season:

1. The loss of Mr. Westerbeek was damaging to the study. A field manager is needed to visit research sites, collect data, and connect with growers on a regular basis. Despite the "fill-in" efforts of Mr. Hall, Mr. Jones, and McGill personnel, the remaining project team was unable to complete all study objectives. The absence of regular, on-site communications with growers that would have been provided by a field manager, especially at critical stages during the growing season, resulted in a number of mistakes in the field.
2. A third-party cooperator-grower may not be able to give the priority or flexibility required for scientifically valid research without the support of a project field manager to provide input at critical junctures and insure attainment of all research objectives. Exceptions may be studies where the grower is also the researcher, as indicated by the success of some producer-run studies.
3. The compost plots at the Cottle field averaged 318 more pounds and 401 more ears of corn per acre than the conventional plots. Average ear weight for the compost plots was about the same as the conventional plot at .70 and .69 pounds, respectively. This might indicate that compost used in conjunction with a conventional fertilizer produces better results than either compost or chemicals alone (as has been concluded by some other compost studies), or that yield is improved through the application of additional nitrogen.

4. Some of the difficulties associated with collecting and extrapolating scientific data from a working field might be avoided if the Center for Environmental Farming at Cherry Farm (or other research institution) were to run parallel studies that would compliment larger field trials. As an alternative, a graduate student or other qualified individual affiliated with the research institution could assume responsibility for the scientific aspects (sampling and analysis, monitoring, scouting, data collection) of the project.
5. Methods must be devised to balance the anticipated delay in benefit of compost use (negligible benefit in year one, increasing benefit in years 2 and 3) in a commercial production setting. Some studies have indicated positive results by using smaller amounts of chemical fertilizer (50% of normal application rates) in conjunction with compost in the first year.

Conclusions drawn from the trends assessment included the following:

1. Population growth and other related indicators suggest increased landscaping activities, thus a need to diversify research to include nursery/landscape crops including container-grown hollies and azaleas and field grown woody ornamentals. Scientific investigations should include phytophtera (in clay soils) and nematodes (in sandy soils), both problems in the landscaping industry.
2. The large acreage and greater value of cotton, and possibly potatoes/sweet potatoes, indicates a need for crop research. Additional high value crops (strawberries, blueberries, tomatoes, green peppers, sweet corn, melons, and squash) also merit study. Specific scientific investigations should include rhizoctonia, stem blight, and nematodes.

In addition to Mr. Alexander's recommendations, Mr. Hall and Mr. Cottle both encouraged formal study of the use of compost as a replacement for fumigation and plastic mulch, both mainstays of the growing vegetable/berry industry. In addition to cost issues, both fumigation and plastic mulch present environmental concerns that would be eliminated if these management tools could be replaced with compost.

Finally, the need to bring the cost of compost use in line with synthetic fertilizers is a necessary step to wide-scale use of these products. While restricting compost application to rows, rather than broadcast over the entire field, will reduce the total volume of compost required, this measure could cut the cost significantly, opening the door to wider commercial acceptance.

For example, a 25% savings in the 1X compost application cost in the cantaloupe trial would have brought the cost down below the cost of synthetic fertilizer. In the sweet corn trial, a 25% savings in compost cost would have resulted in a net market profit of $224 … just $5 less than the conventional section. If similar yield results could have been achieved with compost alone (no 24S side-dress), the compost section's net market yield would have been $270 … $41 *more* than the conventional section.

However, other factors, such as the difference in the time required to spread an entire field by truck vs. row application with a tractor and modified manure spreader must also be considered. Other technologies known to improve profit margins by reducing input (cultivation instead of herbicides, spot treatment rather than whole-field pesticide applications, companion planting and biointensive methodologies) could also be used in conjunction with compost to improve the "bottom line." Of course, these same techniques might be expected to have a similar impact on a conventional cropping system.

Comparing actual costs of conventional fertilizers and compost used, rather than per acre averages, might also prove worthwhile.

Proposed scope of work for 2001

Correlating lessons learned from Y2000 activities with current market trends and identified agricultural needs, McGill Environmental Systems is proposing the following activities for next year's study:

1. Eliminate the mobilization/coordination problems associated with multiple research sites by moving the bulk of the formal research activities to the Delway facility. About 3 acres (divided between two fields) is available for this project. This will not only locate fields, personnel, equipment, and compost all at the same place, but also eliminate the drainage/erosion difficulties encountered with the Magnolia field. MES proposes to grow one crop (squash) using compost and compare its cost/yield figures with regional averages for the same crop grown in a conventional system.
2. Purchase and modify a standard manure spreader to use in banded row application of compost products to reduce total amount of compost required per crop, to be paid from DPPEA grant funds. Compare cost of application using a spreader truck vs. tractor and manure spreader.
3. Split the Magnolia field in half, using a liming agent (as needed) on one side only and adding 10 tons/acre of compost each year to the entire field for a number of years. The center section of the field will not receive any liming agent or compost and serve as a control. No other fertilizer or input will be added to the field. Cost/yield comparisons will be made against regional averages of the same conventionally grown crops. A composite soil sample of each half of the field will be taken after each harvest, along with nematode assay. Pest/disease, moisture retention, and other observations will be made on a regular basis throughout the growing season.
4. Establish a number of small test plots at the end of one of the Delway fields to run trials using compost as a mulch and nematode control. Strawberries, blueberries, tomatoes, green peppers, watermelon, cantaloupe, and other high-value crops will be grown in raised beds using compost in the soil mix and as mulch. Yields will be compared to regional averages for conventional crops and nematode populations will be monitored. Observations will include pest/disease resistance and moisture retention. Results of these smaller trials will be used to design future field trials.
5. Solicit cooperation and testimonials from existing compost customers to allow data collection from on-going commercial use of these products such as squash and container-grown ornamentals. Share information and testimonials through incorporation in literature and a short, generic video on compost use to be shown at the McGill booth at conferences and trade shows (to be made available to other compost producers at cost) and posted to the website. Solicit cooperation/input from the DPPEA and CCC on the production of the video.
6. Hire a qualified research assistant associated with NCSU or other research institution to assume responsibility for scouting, monitoring, data collection, and other scientific aspects of the project. Salary and travel for this individual to be paid from DPPEA grant funds. Purchase the monitoring equipment necessary to support the scientific investigations, including meters, scales, rain gauges, etc., to be paid from DPPEA grant funds.