IMPLEMENTING FISHERY-BASED COMPOSTING APPLICATIONS: THE NEXT STEP

Scott Andree
Sea Grant Extension Agent
FL Sea Grant Extension Program
615 Paul Russell Road
Tallahassee, FL 32301-7099

INTRODUCTION

Landfills have been and still are the primary means of disposal for seafood processing and fishery related by-products in Florida and in many other states (9, 15). In Florida, landfill space is rapidly being depleted and the cost to close and open new landfill cells is ever increasing. Fishery and seafood processing by-products, because of their high protein content, are extremely malodorous and require extra chemicals and/or soil cover to control their putrification odors. This adds cost and reduces the life expectancy of the landfill cell. One county in the Florida Big Bend region, where seventy (70) percent of the state's blue crab processors are located, spends twenty-five (25) percent of their landfill operating budget on seventeen (17) percent of the waste-stream..."crab garbage" (2).

In the near future, landfills will not be available for disposal of these processing by-products. In Florida, the 1988 Legislature passed a Solid Waste Management Act, which states that "commercial food processors may not dispose of any animal parts, fats, by-products, waste products... in landfills unless approved by the department" (FL Department of Environmental Regulation-FDER)(4). Although most seafood processors in Florida are relatively small waste generators (less than 3 cubic meters/day (2)), landfills fees are increasing dramatically to eliminate unwanted and often expensive waste streams. Leon County, Florida, for example, implemented a $100/ton fee for blue crab processing by-products.

Many alternative methods of by-product recovery have been examined and used to eliminate wasting by-products, including dehydration (11, 14), land application (5, 16), ensiling (1, 13), composting (6, 7, 8) and anaerobic bioconversion (3, 10). All of these methods, among others, have potential benefits, yet composting may be the best least-cost option for a long term solution. It also has the potential to eliminate several waste streams from landfills. Not only the fishery related by-products, but also other carbon-based materials, such as yard trimmings, brush and some construction debris can be utilizing for composting. In Florida, there is a mandated thirty percent (30%) recycling requirement by the end of 1994. Therefore, several objectives can be met with composting.

There are several entities for which composting applications can be implemented, depending on location and amount of bulk and organic material available. These include the processing plants, marinas and commercial composting operations, in the private sector, and publicly owned facilities, such as, landfills, sewage treatment plants and road departments.

MATERIALS AND METHODS

Three large-scale demonstrations of seafood processing by-products composting were demonstrated in Florida during 1989-1991 (10). Two different mechanical aeration methods were used for: 1) blue crab by-products (Taylor County), and 2) calico scallop viscera (Brevard County). The third demonstration involved static pile methods for blue crab scraps (Wakulla County). Availability of various carbonaceous and nitrogenous by-products in the area were inventoried. Windrows of carbonaceous by-products, primarily wood chips and sawdust, were set up at county landfills. Incoming seafood processing by-products were added to the windrows via a frontend loader and mixed with the bucket or the mechanical aeration equipment. The ratio of carbon to nitrogen was 2:1, by volume. The windrows were turned daily during the mechanical aeration demonstrations. Static pile procedures required that the material be ground with a tub grinder after approximately two months and allowed to reheat and finish composting. Total time from start to finished compost was four (4) months.

RESULTS AND DISCUSSION

When examining composting as an alternative for disposal or recovery of a current fishery related by-product, several factors need to be assessed. A few of the major attributes and limiting factors are discussed below.

ATTRIBUTES

Simple Methods. No matter what method is chosen whether it is open windrow or containment systems, active aeration or static pile, the methods are simple and cookbook in nature. They can be adjusted to scale and are flexible to fit the smallest processor to the largest commercial operation.

Affordable. Because of the simplicity, composting does not require expensive equipment or facilities, to operate successfully. This is dependent on scale, however. The larger the operation, the larger the equipment needed. But this can be minimized by utilizing equipment already purchased for other uses. For example, a front end loader at a landfill can also be used at the compost site; a fork lift or small bobcat used in a seafood plant or marina could be used for composting.

Minimal Labor. Composting does not require excessive manpower. One man working two-three (2-3) hours per day can maintain a large-scale compost operation. In Taylor County Florida, one man was able to handle daily waste inputs of up to ten (10) tons in a 2-3 hour period (Figure 1). This adds to the affordability of the process by reducing labor costs. Efficient composting does require that one person be responsible for coordinating the delivery of bulking materials and organics with the labor schedule, to meet the needs of the compost mix. However, this management task is also a part-time job.

Marketable End Product. Obviously, the attribute that brings the most attention is the one determined by value. In general, seafood-based composts will command a higher price on the market if quality control is maintained. Particularly crustacean-based composts, containing chitin, which have limited nematicide value, as well as soil enhancement properties (10). The fact that the end-product can be sold, thereby providing a means of recovering a portion, if not all, the cost of production, indicates that composting can be a least-cost option for handling these by-products.

FIGURE 1. Composting daily procedures: Wakulla County landfill

PROCEDURE	HOURS OF THE DAY
	6am .0 11 2n 5pm
RECEIVE MATERIALS	
STACKING	
MIXING	
MAINTENANCE	
SET-UP RECEIVING	
GRINDING	per ith
STORAGE	needed

LIMITING FACTORS

Carbon/Nitrogen Supply. The composting process requires the right mix of ingredients for the micro-organisms to function (6). The general rule of thumb is a two to one (2:1) ratio of carbonaceous to nitrogenous material, by volume. The availability of carbon and nitrogen sources can vary dramatically over the course of the year as seasons change. One must be flexible and ready to substitute other types of carbon or nitrogen to maintain an ongoing composting operation. Certain fisheries, e.g. Calico scallops and spanish mackerel, tend to be seasonal; therefore, composts produced from by-products of these fisheries will also be cyclical. Difficulties in marketing may arise due to an unpredictable supply throughout the year, or inconsistent quality, e.g. NPK, pH, organic content, etc., due to changing ingredients.

Space. Space can be limiting at processing plants or marinas. Commercial operations and landfills generally have plenty of room. A seafood processing plant or marina may have to find a remote site to have enough room to set up windrows or store finished compost. This is not a large problem to overcome, however, space limitations will affect the operational logistics and ultimately the cost for long term composting.

Maintaining Quality. The quality of the finished compost will determine its value on the market. Even though we are taking what is currently thought of as a "waste" by-product and making compost from it, quality control is still required to produce a high quality end-product. Our experience in Florida with blue crab processors was that often the incoming "crab garbage" also contained plastics, metal cans, fish boxes, waxed cardboard boxes, bed springs, garden hoses, trash bags, etc. Needless to say, more time was spent sifting out the unwanted materials than mixing the compost. Landfills and commercial operations will need to screen incoming compost ingredients to maintain quality and reduce time and manpower "cleaning" the compost.

Regulations. The biggest obstacle in Florida's development of compost operations at processing plants, or at private facilities, are the regulations regarding siting and site design criteria. Since the composting industry is just getting started, the regulatory agencies in Florida have set up very cost prohibitive rules without much input from the fledgling industry, or available research data. These strict rules are primarily related to protection of groundwater quality. For example, sites must have concrete, or asphalt, pads under the windrows and have on site leachate collection and removal systems (FL. Admin. Code, Rule 17-709.5). Many of these precautions may be alleviated over time as more information is gained and research conducted on leaching, contaminants, etc. However, at the present time, regulations may limit operations in certain areas. Landfills are not faced with this problem since compost permits can be added to their landfill operation permit.

TECHNOLOGY TRANSFER

If composting technology is simple, manageable, affordable and the end-products marketable, putting these applications into practice in the real world should be relatively easy as well. Unfortunately, this may be easier said than done. Although on a small scale this may be true, on a larger scale there is some question as to where this industry will ultimately fit in.

In Florida, the ultimate goal of the three large-scale composting demonstrations was to turn the demonstrations over to either county governments or private enterprises to be continued as ongoing operations. The two projects that were continued at county landfills (Brevard and Wakulla Counties) were approved by the Florida DER under their landfill operation permits and are successfully planning to proceed with composting. The Taylor

County demonstration was transferred to a private farm in a neighboring county with the assistance of the Suwannee River RC & D Council. However, after two (2) attempts to acquire the necessary permits from Florida DER, each denied for leachate concerns, this operation will be temporarily put on hold (12).

The difficulties in acquiring permits, specifically the costs associated with meeting the compost design criteria and the apparent unwillingness of the permitting agencies to work with the industry, may prevent the private sector from getting involved at the present time. However, the prediction is that a large percentage of the Municipal Solid Waste-stream (MSW) will be composted by 1994 to meet the mandated recycling requirements (4). Composting fishery and seafood processing by-products will complement this pattern, at least in the public sector and hopefully in private sector in the future.

IMPLEMENTATION NEEDS

The following needs assessment is based on the Florida composting demonstrations and results reported in earlier papers. There appear to be four gaps that need filling and this technology will take hold and begin operate on its own.

First, as mentioned above, there is an immediate need for more research-based information on compost leachates and their potential effects on ground and surface waters. This will help the permitting agencies understand what level of contaminants exist in composts, and be better able to determine what site designs are necessary to protect water supplies.

Secondly, there is a need for manuals and guides directed to the audiences mentioned before, that will be producing compost: by-product generators, commercial compost operators, landfill operators, etc. It should include a cookbook of recipes for the novice composter to the experienced. These recipes should describe a variety of inputs with some formulas for producing desired end-products. It should also describe the different compost technologies listing their advantages and limitations. The final product of this conference will begin to solve this need.

Third, a manual describing the uses of the various compost products themselves will be necessary for teaching the consumers how to best apply them. Since these composts are just being developed, studies are needed on how to best use them for vegetables, horticulture, nematacide, etc. or how to use them in conjunction with more traditional soil amendments.

A final need is in the marketing area. With the volume of compost products expected to be produced, moving these products may become a bottleneck. With the higher quality attributes of the seafood-based composts, marketing studies would be a great help in placing these products in the best form and packaging for the consumers to recognize them as a better value. This will ensure a premium price on the market.

CONCLUSION

The future looks bright for the development of fishery-based composting, an idea whose time has come. Composting has been around a long time, but now the time is right to apply this age old practice to the current disposal problems of fishery and seafood processing by-products. The outcome is a natural and cost-effective solution which will produce long term positive results for many businesses and communities.

REFERENCES

1. ABAZINGE, M.D.A., J.P. FONTENOT, and V.G. ALLEN. 1986. Effect of various additives on the preservation and ensiling characteristics of crab waste. Animal Science Research Report No. 5: 107-111. Blacksburg: Virginia Polytechnic Institute.

2. ANDREE, S. 1988. Alternatives for Wakulla County management of blue crab processing solid waste. Florida Sea Grant Technical Paper No. 53. Gainesville: University of Florida.

3. ANDREE, S. and J.F. EARLE. 1990. Blue crab processing waste management: In Plant Methods: Tropical/Subtropical Fisheries Tech. Conf. of the Americas, Proceedings, W.S. Otwell, ed. Florida Sea Grant Report No. 105: 327-333. Gainesville: University of Florida.

4. Anonymous. 1991. Solid waste management in Florida: 1990 Annual Report. Tallahassee: Florida Dept. of Environmental Regulation.

5. AUNG, L.H., G.J. FLICK, G.R. BUSS, and H.H. BRYAN. 1981. Fish and seafood wastes as nutrients for agricultural crop fertilization. In: Seafood Waste Processing in the 1980's: Conference proceedings, W.S. Otwell, ed. Florida Sea Grant Report No. 40: 275-280. Gainesville: University of Florida.

6. BRINTON, W.F. 1990. Composting seafood processing by-products: Solutions for the 90s. In: International Conference on Fish By-products, Proceedings, S. Keller, ed. Alaska Sea Grant Report No. 90-07: 183-186. Fairbanks: University of Alaska.

7. BRINTON, W.F., and M.D. SEEKINS. 1988. Composting fish by-products: A feasibility study. Time & Tide RC & D Council, Mid-Coast Compost Consortium Report. Mt. Vernon, Maine: Woods End Research Laboratory.

8. CATHCART, T.P., F.W. WHEATON, R.B. BRINSFIELD, D.W. LIPTON, I.E. STRAND and D.G. SWARTZ. 1984. Composting blue crab processing plant waste. Maryland Sea Grant Publication UM-SG-TS-84-01. College Park: University of Maryland.

9. CATO, J.C. 1991. Composting blue crab and calico scallop processing plant scrap materials. In: Environmentally Sound Agriculture Conference, Proceedings, Volume 2. pp. 533-540. Gainesville: University of Florida.

10. CATO, J.C., ed. In press. Composting and using processing by-products from blue crab and calico scallop plants in Florida. Florida Sea Grant Report 107. Gainesville: University of Florida.

11. HANSEN, E. 1990. Economics of fish by-product utilization for small processors in Alaska. In: International Conference on Fish By-Products, Proceedings, S. Keller, ed. Alaska Sea Grant Report No. 90-07: 151-160. Fairbanks: University of Alaska.

12. JOHNSON, V. 1991. Message from the President. Suwannee River RC & D Newsletter. Vol. 3(6). Live Oak, Florida: Suwannee RC & D Council.

13. MEYER, R.O., D.D. Johnson, W.S. Otwell and W.R. Walker. 1987. Potential utilization of scallop viscera for solid waste management and as feedstuff for swine. Florida Sea Grant Technical Report No. 48. Gainesville: University of Florida.

14. MURRAY, T.J. and W.D. DUPAUL. 1981. Feasibility of crab meal processing in the Chesapeake Bay region. Virginia Institute of Marine Science Sea Grant Special Report No. 248. Gloucester Point: College of William and Mary.

15. OTWELL, W.S., ed. 1981. Seafood waste management in the 1980's: Proceedings. Florida Sea Grant Report No. 40. Gainesville: University of Florida.

16. WYATT, B. and G. MCGOURTY. 1990. Use of marine by-products on agricultural crops. In: International Conference on Fish By-Products, Proceedings, S. Keller, ed. Alaska Sea Grant Report No. 90-07: 187-196. Fairbanks: University of Alaska.