Agricultural Waste Market Research Study for New York State
Part One
Survey of County Representatives on LDPE Agricultural Plastic Film Management

PREPARED FOR:
Cornell Cooperative Extension
Cornell Waste Management

IN COOPERATION WITH:
Black River-St. Lawrence Resource Conservation & Development - Agricultural Recycling Committee and
NYS Department of Environmental Conservation

PREPARED BY:
CANADIAN-US BUSINESS CONSULTING SERVICE
CLARKSON UNIVERSITY

MAY 14, 1996
Acknowledgments

This report was researched and written by the Canadian-U.S. Business Consulting Service at Clarkson University. Contributions were made by the following individuals:

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Shannon Jordan
Shana Rainey
Derek Short
Consultants

Christine M. Da Costa
Manager
May 14, 1996

Dear Reader,

As a Cornell Cooperative Extension Educator from an involved major agricultural area of New York State and as an investigator in this issue of agricultural plastic film wastes, I am pleased to introduce the findings of this project and account for at least some of its creation. Intended to be applied cooperatively by those in best positions to address this issue, the project grew from team effort in Northern New York and from around the state. Such contributions of support well demonstrated benefits of networking toward common goals and it is hoped by this project’s team that others will soon find ways together to apply our determinations. By such cooperation, we can all help affect improvements for our agricultural industry and our environment.

Much credit must be given the Canadian-U.S. Business Consulting Service based at Clarkson University for working in a highly professional matter for the project. The Service’s staff honed project concepts and its consultants worked diligently over many months to conduct this assessment of agricultural plastic film waste. Their results stem from a high dedication to quality.

Cornell Waste Management Institute recognized the growing significance of this issue in the state over recent years and invested quality work on a broad scale to begin seeking improvement. As part of Cornell University’s Center for the Environment, the Institute provided grant support to do the project along with crucial involvement of Extension Associate Jean Bonhotal. This made the project possible.

Northern New York’s Black River-St. Lawrence Resource Conservation and Development Regional Project Office continues to provide a model role of integrating and organizing various stakeholder interests through its Agricultural Recycling Committee. Based on its early survey measures that identified this particular waste problem, R.C. and D. has successfully brought industry, agriculture and agencies together to get things done about it. R. C. and D. Coordinator Peter Spadara has well shown how synergy can be developed to get results, when nowadays it’s often difficult for single stakeholders to achieve as much individually. The above committee plans already to be a leading user of this project’s results.

Region Six N.Y.S. D.E.C. Environmental Program Specialist Lawrence Ambeau joined the effort early on through R.C. and D. and provided important oversight. Although D.E.C. presently does not regulate Agricultural solid waste management, such staff support shows that if the environment can best be served by education and problem-solving to find more environmentally-sound solutions for these plastic wastes, they support this projects type of process.
Cornell Cooperative Extension in Sullivan County, Agricultural Agent Colleen McKeon added an insight into the economics related to farmers' use of plastic films to store forage. Some of the financial factors she identifies lead to implications for trends in the use of the plastic around the state. Others will likely find ways to apply her comparisons and conclusions to the farm financial dynamics directly tied to generating plastic wastes.

The Cornell Cooperative Extension Association of St. Lawrence County exemplified local Extension support for such projects even though the work involved was for the benefit of more areas in the state than just one county. Association volunteers from the St. Lawrence farm community clearly voted to proceed, recognizing the value such research could return locally, and for others.

Those above are still only part of the background to the project; there are many others to recognize for their contributing roles but space precludes a listing here. It's important to emphasize that cooperative efforts by others can develop applications out of this project; much like the way it was created. It works.

Now it's up to us all to work on ways to use the findings to make improvements, especially through education. The team above especially invites you to contact us about joining this effort.

Sincerely,

[Signature]

Stephen F. VanderMark
Cooperative Extension Agent

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EXECUTIVE SUMMARY

This report was commissioned by Cornell Cooperative Extension of St. Lawrence County, in conjunction with Cornell Waste Management Institute, NYS Department of Environmental Conservation and Black River-St. Lawrence RC&D to assess the use and disposal of LDPE agricultural plastic film in the state of New York.

The objectives of the report were to: identify current options available to farmers and all barriers to the management of the LDPE agricultural plastic film; investigate any and all barriers to the management of LDPE agricultural plastic film in every county in New York State; organize counties into “clusters” based on similar characteristics in order to correlate feasible solutions and needs; and to summarize the finding and major issues to be addressed.

Primary research consisted of administering a questionnaire via telephone targeted at recycling coordinators or individuals managing agricultural plastics for all counties in New York State. An in-depth, open ended qualitative survey was designed to elicit opinions, feedback on current and possible waste management solutions, concerns for conventional and possible alternatives, and the ability and willingness to participate in the management process of LDPE agricultural plastic film.

Research concluded that currently there are no collection programs strictly for LDPE agricultural plastic film in New York State, therefore, most of this material enters management facilities as part of the waste stream.

There may be a need for more used LDPE agricultural plastic film to stay within the recycling “loop.” The LDPE agricultural plastic film “loop” refers to the movement of the material from the manufacturers to the dealers, farmers, and county recycling/solid waste facilities.

Proper management of LDPE agricultural plastic film will involve a coordinated effort between the manufacturers, dealers, farmers, and county recycling/solid waste facilities. Breakdowns in the recycling loop occur when the LDPE agricultural plastic film does not complete the cycle. Breakdowns can occur within the recycling loop as a result of disposal on the farm; county-controlled landfilling and/or incineration; or use into other LDPE end markets.

It was found that farmers play a critical role in the LDPE management process because much of the contamination takes place on the farm. With proper use and storage of this material, contamination levels can be significantly reduced, thus easing recycling and managing efforts.
The research conducted also uncovered the barriers to proper management of LDPE agricultural plastic film. They include: lack of collection procedures, ridding of contaminants, lack of convenient options for farmers, improper storage, lack of educational programs, lack of cost effective transportation, and lack of end markets.

The most popular recommendations by all 43 county respondents for encouraging management of LDPE agricultural plastic film involved: finding an end-market; increasing levels of education; developing an economic incentive for farmers; creating convenient options for farmers in managing this material; and closing the LDPE recycling loop.

As more end markets are found, collection costs may fall and the transportation of recovered material may become more cost-effective for everyone involved in the recycling loop.

Clusters of counties in New York state were formed based on the similarity of production levels of milk, hay, and corn. It was found that certain clusters had higher levels of knowledge and awareness of the issues involving LDPE agricultural plastic film than other clusters.

The North County cluster has the highest awareness of LDPE agricultural plastic film and perceived that improper storage is a significant barrier because of the greater volume of LDPE agricultural plastic film brought into their facilities relative to other clusters.

The Genesee Valley cluster only has landfilling capabilities for the management of LDPE agricultural plastic film and stated expansion of education on the management process was the most important place to start.

The Western cluster had attempted to run pilot programs to better manage LDPE agricultural plastic film, although no successful end-market was found. In addition, the western cluster charges a lower tipping fee relative to the other clusters, thus encouraging farmers to better manage their plastic through county facilities.

The Central cluster conducted a study to find an end-market for LDPE agricultural plastic film. However, because of the stringent requirements, a sufficient end-market could not be found.

It was found that because the barriers to the effective management of LDPE agricultural plastic film are closely related on one another, addressing one barrier may alleviate another. For example, having an efficient management process that creates a demand for the used plastic would assist in developing an end market.

Moreover, the advantages of the LDPE agricultural plastic film recycling loop may be lower costs and a secure end market. With a guaranteed end market, many of the barriers such as a lack of collection procedures, cost-effective transportation, and the obvious lack
of an end market may be overcome. It was concluded that the management of LDPE agricultural plastic film needs to be a cooperative effort among all participants in the management process.

Furthermore, education can be facilitated through Cornell Cooperative Extension, Cornell Waste Management Institute, NYS Department of Environmental Conservation, Black River-St. Lawrence RC&D, and other agricultural supportive agencies. However, they cannot be solely responsible for this education, because all participants in the management process should be involved.

It was also concluded that changes in the management process may require the support of state and local government since most current regulations allow farmers to dispose of waste on their own property. Therefore, incentives are needed to encourage farmers to retain used agricultural plastics rather than dispose of them on the farm. Finally, it was concluded that a deposit/refund system could be developed to encourage farmers to return their LDPE agricultural plastic film to a recovery site.

Nonetheless, the most effective management process for LDPE agricultural plastic film depends on many factors, such as amount used in the county or region, ability to manage it in each community, and the geographic and economic conditions specific to each county or cluster of counties. If counties are interested in collecting LDPE agricultural plastic film to better manage it, education of users will be the key.
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1.0 INTRODUCTION

Mr. Steve VanderMark, Extension Associate for the Cornell Cooperative Extension of St. Lawrence County, Jean Bonhotal for the Cornell Waste Management Institute, Larry Ambeau of the NYS Department of Environmental Conservation, and Peter Spadona of the Black River-St. Lawrence RC&D approached the Canadian-U.S. Business Consulting Service requesting an assessment of the use and disposal of agricultural plastics in New York State. This project was focused primarily on the county recycling coordinators in the state of New York, in order to more accurately define the level of knowledge and current means of management within the counties.

2.0 OBJECTIVES

The agricultural waste market research study was conducted in order to achieve the following objectives:

- to identify current options available to farmers in New York State for managing used LPDE agricultural plastic film,

- to investigate any and all barriers to the best managing of LPDE agricultural plastic film in each county in New York State,

- to organize counties into “clusters” based on similar characteristics in order to correlate feasible solutions with needs and,

- to summarize findings and develop a comprehensive recommendation plan.

3.0 METHODOLOGY

The information obtained in this report was gathered through both primary and secondary research in order to assist extension associates and waste management agencies in agricultural communities across the state and establish effective local policies and procedures on managing agricultural plastic waste. The Canadian-U.S. Business Consulting Service worked under the guidance of Mr. VanderMark and Ms. Jean Bonhotal, the DEC, and the Agricultural Recycling Committee of the Black River-St. Lawrence RC&D to ensure that our secondary research efforts did not overlap existing data and to help consultants establish contacts with experts in the field. Dr. Fredric Menz, professor of economics, who specializes in environmental issues, provided necessary information and insight throughout the development of the project.
Primary Research

Primary research consisted of administering a survey (Appendix A) via telephone aimed at recycling coordinators or individuals who managed agricultural plastics for all of the counties in New York State.

An in-depth, open ended, and qualitative survey was developed to structure the discussion between the interviewer and respondent. Questions were designed to elicit options and feedback on current and possible waste management solutions, concerns for conventional and possible alternatives, and the ability and willingness to participate in management programs. Information provided insight into concerns and interests associated with the issue and provided the basis for the final recommendations. Interviewers were trained to probe respondents for in-depth explanations as to the current procedures and attitudes in the respondent's area.

From the initial contact list provided by Cornell Cooperative Extension, Cornell Waste Management, and NYS Department of Environmental Conservation, prospective respondents were screened to determine if they were responsible for the management of LDPE plastic film. An appointment was made to survey the county representative at their convenience and the surveys were completed over the telephone by the consultants on the project.

The survey was divided into three sections: general management practices, specific process practices, and demographics (Appendix B: County Demographic Information). These sections were designed to flow in a logical manner allowing the respondent to communicate their personal and professional knowledge.

The first question filtered out respondents that did not manage LDPE agricultural plastic film or were not knowledgeable of LDPE agricultural plastic film. Of the counties, municipalities, and townships contacted, forty-three county representatives completed the survey (Appendix C: Survey Respondents).

The clusters were formed based on the similarity of characteristics among different counties. The primary characteristics considered were production levels of milk, hay, and corn. Counties with similar total production levels were placed in their respective cluster. Cluster names were chosen based on their geographic location within New York State: North Country, Genesee Valley, Western, Central, and Catskill.
Secondary Research

Secondary resources (Appendix D) were used to identify and assess the current use and management of agricultural plastics throughout the United States and Canada. The steps toward assessing the management of agricultural plastics were to:

- Contact plastic industry companies and associations at both the state and national level.
- Obtain industry directories, government publications, and agricultural literature.
- Contact various university experts in the field of agricultural plastics.
- Contact farm bureaus and cooperative extension offices throughout New York State.
- Conduct research via the Internet regarding agricultural plastics.

4.0 LIMITATIONS

- Primary information was limited by individuals and organizations that were unwilling or unable to divulge facts and about LDPE agricultural plastic film use. Therefore, all counties are not represented in the study.

- Several respondents to the telephone survey were unable to provide comprehensive information about particular topics.

- Some counties did not have recycling coordinators; in others, waste management departments were combined with the counties’ recycling or solid waste management programs.

- The scope of the report was limited because there was no opportunity to speak with farmers. In addition, the county representatives’ interpretation of the survey questions may differ, thus varying answers from one respondent to the other.

- Subsequent to executing the surveys and tabulating the results, it was found that answers to some questions were repetitive. Therefore, some survey questions and responses were combined for clarity purposes in the primary research analysis section of the report.
5.0 TERMINOLOGY

The following schematic illustrates the terminology and concepts used throughout the report:

LDPE Agricultural Plastic Film Recycling "Loop"

The LDPE agricultural plastic film "loop" refers to the movement of the material from the manufacturer (box 1) through to the LDPE recycler (box 5) and back to the manufacturer (box 1).

Breakdowns in the recycling loop occur when the LDPE agricultural plastic film does not complete the cycle. Breakdowns can occur within the recycling loop as a result of:

- disposal on farm,
- county-controlled landfilling and/or incineration, or
- use into other LDPE end markets.
5.1 Disposal on Farm

The first breakdown in the recycling loop occurs if the farmer disposes of LDPE agricultural plastic film on site by either burning or burying the material. This may limit the amount of LDPE agricultural plastic film that is collected (box 4) to be either landfilled or incinerated through the county-controlled process or recycled.

5.2 County-controlled Landfilling and/or Incineration

The second breakdown in the recycling loop occurs when the LDPE agricultural plastic film is landfilled and/or incinerated through a county-controlled facility. This may again limit the amount of LDPE agricultural plastic film that can be recycled.

5.3 Other LDPE End Markets

The third breakdown in the recycling loop occurs if the LDPE agricultural plastic film is not returned to the manufacturer (box 1) and is used in non-agricultural end markets, such as lumber, pallets, and sheeting.

5.4 LDPE Agricultural Plastic Film Management Methods

LDPE agricultural plastic film can be managed through:

- On-site incineration (on the farm)
- On-site landfilling (on the farm)
- County-controlled landfilling
- County-controlled incineration
- County-controlled recycling

5.5 Tipping Fee

A tipping fee is a monetary charge for the service of managing solid waste or recyclable materials. The tipping fee is paid by the farmer or hauler to the management facility.
6.0 PRIMARY RESEARCH

6.1 New York State

Recycling coordinators and waste disposal managers representing forty-three New York State Counties were surveyed to determine management practices for LDPE agricultural plastic film within each county. The chart below represents the 43 counties participants (Appendix C):

<table>
<thead>
<tr>
<th>County</th>
<th>Position Surveyed</th>
<th>Name of Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegany</td>
<td>Recycling Coordinator</td>
<td>Department of Public Works</td>
</tr>
<tr>
<td>Broome</td>
<td>Materials Recovery Manager</td>
<td>Broome County Division of Solid Waste</td>
</tr>
<tr>
<td>Cattaraugus</td>
<td>Recycling Coordinator</td>
<td>Cattaraugus County Department of Public Works</td>
</tr>
<tr>
<td>Cayuga</td>
<td>Program Administrator</td>
<td>Solid Waste Management Program</td>
</tr>
<tr>
<td>Chautauqua</td>
<td>Recycling Coordinator</td>
<td>Division of Solid Waste</td>
</tr>
<tr>
<td>Chemung</td>
<td>General Manager</td>
<td>Solid Waste Management District</td>
</tr>
<tr>
<td>Chenango</td>
<td>Recycling Coordinator/Waste Station Operator</td>
<td>Chenango County Recycling Center</td>
</tr>
<tr>
<td>Clinton</td>
<td>Recycling Coordinator</td>
<td>Clinton County Recycling Center</td>
</tr>
<tr>
<td>Cortland</td>
<td>Recycling Coordinator</td>
<td>Cortland County Recycling Center</td>
</tr>
<tr>
<td>Delaware</td>
<td>Solid Waste Coordinator</td>
<td>Department of Solid Waste</td>
</tr>
<tr>
<td>Dutchess</td>
<td>Recycling Coordinator</td>
<td>Dutchess County Recycling Center</td>
</tr>
<tr>
<td>Erie</td>
<td>Environmental Agricultural Specialist</td>
<td>Department of Environment and Planning</td>
</tr>
<tr>
<td>Essex</td>
<td>Recycling Coordinator</td>
<td>Serkil Limited Liability Company</td>
</tr>
<tr>
<td>Franklin</td>
<td>Recycling Coordinator/Solid Waste Director</td>
<td>Franklin County Solid Waste Facility</td>
</tr>
<tr>
<td>Fulton</td>
<td>Recycling Coordinator</td>
<td>Fulton County Recycling Center</td>
</tr>
<tr>
<td>Genesee</td>
<td>Recycling Coordinator</td>
<td>GLOW Regional Solid Waste</td>
</tr>
<tr>
<td>Herkimer</td>
<td>Director of Recycling</td>
<td>Oneida / Herkimer Recycling Center</td>
</tr>
<tr>
<td>Jefferson</td>
<td>Director of Solid Waste</td>
<td>Department of Public Works</td>
</tr>
<tr>
<td>Lewis</td>
<td>Solid Waste Supervisor</td>
<td>Lewis County Solid Waste and Recycling</td>
</tr>
<tr>
<td>Livingston</td>
<td>Recycling Coordinator</td>
<td>GLOW Regional Solid Waste</td>
</tr>
<tr>
<td>Montgomery</td>
<td>Executive Director</td>
<td>MOSA Solid Waste Management Authority</td>
</tr>
<tr>
<td>Monroe</td>
<td>Environmental Facility Coordinator</td>
<td>Department of Environmental Services</td>
</tr>
<tr>
<td>Oneida</td>
<td>Director of Recycling</td>
<td>Oneida / Herkimer Recycling Center</td>
</tr>
<tr>
<td>Onondaga</td>
<td>Recycling Coordinator Public Information Officer</td>
<td>Onondaga County Resource Recovery System</td>
</tr>
<tr>
<td>Ontario</td>
<td>Director of Solid Waste Management</td>
<td>Ontario County Department of Solid Waste</td>
</tr>
<tr>
<td>Orleans</td>
<td>Recycling Coordinator</td>
<td>GLOW Regional Solid Waste</td>
</tr>
<tr>
<td>Otsego</td>
<td>Executive Director</td>
<td>MOSA Solid Waste Management Authority</td>
</tr>
<tr>
<td>Saratoga</td>
<td>Recycling Coordinator</td>
<td>Department of Public Works</td>
</tr>
<tr>
<td>Schoharie</td>
<td>Executive Director</td>
<td>MOSA Solid Waste Management Authority</td>
</tr>
<tr>
<td>Schuyler</td>
<td>Cornell Cooperative Agent/Recycling Coordinator</td>
<td>Schuyler County Recycling Program</td>
</tr>
<tr>
<td>Seneca</td>
<td>Public Relations and Education Coordinator</td>
<td>Western Finger Lakes Solid Waste Authority</td>
</tr>
<tr>
<td>St. Lawrence</td>
<td>Recycling Coordinator/Compliance Officer</td>
<td>St. Lawrence Solid Waste Authority</td>
</tr>
<tr>
<td>Steuben</td>
<td>Recycling Coordinator</td>
<td>Department of Public Works Solid Waste Division</td>
</tr>
<tr>
<td>Sullivan</td>
<td>Recycling Coordinator</td>
<td>Sullivan County Division of Solid Waste</td>
</tr>
<tr>
<td>Tompkins</td>
<td>Recycling Coordinator</td>
<td>Tompkins County Solid Waste</td>
</tr>
<tr>
<td>Tioga</td>
<td>Solid Waste Manager</td>
<td>Tioga County Solid Waste Division</td>
</tr>
<tr>
<td>Ulster</td>
<td>Recycling Coordinator</td>
<td>Ulster County Resource Recovery</td>
</tr>
<tr>
<td>Warren</td>
<td>Plant Manager</td>
<td>Warren County Recycling Center</td>
</tr>
<tr>
<td>Washington</td>
<td>Recycling Coordinator</td>
<td>Washington Department of Public Works</td>
</tr>
<tr>
<td>Wayne</td>
<td>Public Relations and Education Coordinator</td>
<td>Western Finger Lakes Solid Waste Authority</td>
</tr>
<tr>
<td>Westchester</td>
<td>Program Administrator of Resource Management</td>
<td>Department of Environmental Facilities</td>
</tr>
<tr>
<td>Wyoming</td>
<td>Recycling Coordinator</td>
<td>GLOW Regional Solid Waste</td>
</tr>
<tr>
<td>Yates</td>
<td>Public Relations and Education Coordinator</td>
<td>Western Finger Lakes Solid Waste Authority</td>
</tr>
</tbody>
</table>
Eleven counties representing the New York City metropolitan area were excluded because of limited use and minimal knowledge of LDPE agricultural plastic film. In addition, eight counties did not respond.

6.1.1 LDPE Agricultural Plastic Film Management

Question: How is LDPE agricultural plastic film currently being managed in your county?

<table>
<thead>
<tr>
<th>LDPE MANAGEMENT PROCESS</th>
<th>NUMBER OF COUNTY RESPONDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfill</td>
<td>31</td>
</tr>
<tr>
<td>Landfill and incineration</td>
<td>9</td>
</tr>
<tr>
<td>Incineration</td>
<td>3</td>
</tr>
</tbody>
</table>

* NOTE: Respondents were allowed to respond to more than one answer category.

Thirty-one counties stated that they managed LDPE agricultural plastic film through landfilling exclusively. In addition, nine of the counties managed LDPE agricultural plastic film through landfilling and incineration, while three counties used incineration as the only form of managing LDPE agricultural plastic film. According to New York State law, all facilities in the state are required to accept LDPE agricultural plastic films, although recycling the material is not mandated. Landfilling offers the county an inexpensive and convenient method of managing solid waste. In addition, landfill space is the most available. Therefore, it has become the most widely used management process for LDPE agricultural plastic film.
6.1.2 Collection or Management by Other Entities

Question: Are you aware of any LDPE collection or management by any other entities?

<table>
<thead>
<tr>
<th>COLLECTION OR MANAGEMENT BY OTHER ENTITY</th>
<th>NUMBER OF COUNTY RESPONDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm disposal</td>
<td>39</td>
</tr>
<tr>
<td>Private haulers</td>
<td>27</td>
</tr>
<tr>
<td>Dealers</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>20</td>
</tr>
</tbody>
</table>

n=43

* NOTE: Respondents were allowed to respond to more than one answer category.

Thirty-nine counties stated that LDPE agricultural plastic film was managed on the farm through on-site landfiling and/or incineration. This high level of on-site farm disposal may be attributed to either lack of education about adverse effects of this type of management or the lack of incentives to use other forms of management. Twenty-seven counties used or were aware of private haulers to collect LDPE agricultural plastic film. However, the collection process does not include LDPE agricultural plastic film exclusively, since most of the material is collected as part of the general waste stream. All respondents stated there was much more LDPE agricultural plastic film being used in their area than the amount entering their facility. Nonetheless, none of the counties were able to specify the quantity of LDPE agricultural plastic film being used in their county. Other responses included: privately-owned landfills, privately-owned incinerators, out of state landfills or incinerators, and out-of-county landfills or incinerators.

6.1.3 Tipping Fee

Question: What is the tipping fee for landfiling, incineration, and/or recyclable materials?

<table>
<thead>
<tr>
<th>LDPE MANAGEMENT PROCESS</th>
<th>AVERAGE TIPPING FEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfiling</td>
<td>$57*</td>
</tr>
<tr>
<td>Incineration</td>
<td>$53*</td>
</tr>
<tr>
<td>Recyclable materials</td>
<td>$43*</td>
</tr>
</tbody>
</table>

* Average tipping fees for all facilities that charge.

Tipping fees effect the quantity of LDPE agricultural plastic film recovered by county authorities. For example, in table 6.1.2, 39 of the 43 counties were aware of on-site farm disposal. Therefore, tipping fees may inhibit the farmers' willingness to utilize the landfills or incineration facilities available through the county.
6.1.4 Collection Process of LDPE Agricultural Plastic Film

Question: Do you collect LDPE agricultural plastic film or is it brought to your facilities?

All counties stated that there was no collection process in place specifically for LDPE agricultural plastic film. However, all counties stated that LDPE agricultural plastic film was part of the waste stream or brought into their facilities. Because LDPE agricultural plastic film is not considered recyclable by New York state law, there is no incentive for private or public haulers to collect the material separately.

6.1.5 Physical State of the LDPE Plastic Film Entering the Facility

Question: In what physical state does the plastic enter your facility?

<table>
<thead>
<tr>
<th>STATE OF PLASTIC ENTERING FACILITIES</th>
<th>NUMBER OF COUNTY RESPONDENTS n=43*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contaminated</td>
<td>35</td>
</tr>
<tr>
<td>Loose</td>
<td>28</td>
</tr>
<tr>
<td>Cleaned</td>
<td>2</td>
</tr>
<tr>
<td>Baled</td>
<td>1</td>
</tr>
<tr>
<td>Not aware</td>
<td>4</td>
</tr>
</tbody>
</table>

* NOTE: Respondents were allowed to respond to more than one answer category.

Thirty-five counties stated that LDPE agricultural plastic film enters their facility in a contaminated state. In 28 counties, the material enters the facility in a loose state. In both cases, the county faces difficulties in recycling the material.
6.1.6 Difficulties in Managing LDPE Agricultural Plastic Film

Question: Are there any difficulties in managing the film that currently enters your facility?

<table>
<thead>
<tr>
<th>DIFFICULTIES IN MANAGING LDPE</th>
<th>NUMBER OF COUNTY RESPONDENTS n=43</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>6</td>
</tr>
<tr>
<td>No</td>
<td>24</td>
</tr>
<tr>
<td>Not aware</td>
<td>13</td>
</tr>
</tbody>
</table>

Twenty-four of 43 counties stated that they had no difficulty in managing LDPE agricultural plastic film and another 13 stated they were not aware of particular difficulties in managing LDPE agricultural plastic film. None of the counties surveyed separated LDPE agricultural plastic film from the waste stream, so it was difficult to determine particular management problems with this material. For counties that experienced difficulties using incineration, the problem was in achieving the correct proportion of LDPE agricultural plastic film to other waste. According to Erie and Onondaga counties, proper LDPE agricultural plastic film incineration requires a specific combination of LDPE and other solid waste to achieve optimal burning temperature levels. Chenango and Ulster counties stated their most significant challenge when landfilling was that wind made the material difficult to manage.

6.1.7 Tons of LDPE Managed in a Given Year

Question: How many tons of LDPE agricultural plastic film is managed by your facility in a given year?

<table>
<thead>
<tr>
<th>TONS OF LDPE MANAGED PER YEAR</th>
<th>NUMBER OF COUNTY RESPONDENTS n=43</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aware</td>
<td>12</td>
</tr>
<tr>
<td>Not aware</td>
<td>31</td>
</tr>
</tbody>
</table>

Thirty-one counties were not aware of how much LDPE agricultural plastic film was managed in a given year. The remainder were unable to provide accurate measurements.
6.1.8 Barriers to the LDPE Agricultural Plastic Film Management Process

Question: What barriers do you think affect the entire LDPE plastic management process?

<table>
<thead>
<tr>
<th>BARRIERS TO THE MANAGEMENT OF LDPE</th>
<th>NUMBER OF COUNTY RESPONDENTS n=43*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contaminated LDPE</td>
<td>23</td>
</tr>
<tr>
<td>Lack of collection procedures</td>
<td>21</td>
</tr>
<tr>
<td>Lack of end-markets</td>
<td>20</td>
</tr>
<tr>
<td>Lack of convenient options for farmers</td>
<td>17</td>
</tr>
<tr>
<td>Lack of educational programs</td>
<td>15</td>
</tr>
<tr>
<td>Improper storage</td>
<td>12</td>
</tr>
<tr>
<td>Lack of cost effective transportation</td>
<td>11</td>
</tr>
<tr>
<td>Other</td>
<td>16</td>
</tr>
<tr>
<td>Not aware</td>
<td>1</td>
</tr>
</tbody>
</table>

* NOTE: Respondents were allowed to respond to more than one answer category.

Twenty-three of 43 county representatives stated that contaminated LDPE was the most significant barrier to the recycling of LDPE agricultural plastic film, while 21 counties stated the lack of collection was the most significant barrier. Because a wide range of barriers to managing LDPE agricultural plastic film were identified, eliminating a single barrier may not have a significant impact on the improvement of the recycling. On the other hand, because some barriers are interdependent, eliminating one barrier may assist in alleviating others. For example, by developing a cost-effective cleaning process, the end-market demand for LDPE may increase.

6.1.9 Constraints on Capacity and/or Storage

Question: Are there any constraints on your current capacity and/or storage?

All counties with baling machines stated that their machines had excess capacity. Therefore, the processing of LDPE agricultural plastic film may be possible in the future at little incremental cost.

Although LDPE agricultural plastic film is not currently separated from the waste stream, it is perceived (by county representatives) that their facilities would have storage difficulties before processing because of the low incoming volume and the low LDPE turnover. County representatives also stated they may have difficulty in determining storage constraints after processing because of the sporadic arrival of LDPE agricultural plastic film.
6.1.10 Adaptation Needed for Current Facilities to Better Manage LDPE

Question: What would be needed to adapt the local facility to better manage LDPE plastic film?

<table>
<thead>
<tr>
<th>ADAPTATIONS NEEDED TO BETTER MANAGE LDPE</th>
<th>NUMBER OF COUNTY RESPONDENTS n=43*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>13</td>
</tr>
<tr>
<td>Labor</td>
<td>9</td>
</tr>
<tr>
<td>Storage</td>
<td>8</td>
</tr>
<tr>
<td>Cost</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
</tr>
<tr>
<td>Not aware</td>
<td>25</td>
</tr>
</tbody>
</table>

* NOTE: Respondents were allowed to respond to more than one answer category.

Thirteen county representatives stated that equipment was needed to adapt their facilities in order to more effectively manage LDPE agricultural plastic film. Nine of the counties believed that additional labor would be necessary in order to adapt their facilities. Twenty-five county representatives were unaware of adaptations needed for their facility to better manage LDPE agricultural plastic film. Moreover, county representatives stated that their facilities were currently capable of managing LDPE agricultural plastic film.

6.1.11 Government Requirements for Management of LDPE

Question: Are there any government requirements at the local, county, or state level for management of the LDPE plastic film?

LDPE agricultural plastic film is not considered a recyclable material by law. In order for any material to be considered recyclable, its processing costs must be at or below the end market price for the processed material. Only one county representative (Oneida-Herkimer) indicated that there was a local government requirement for the management of LDPE agricultural plastic film. The local regulation bans open burning or the burying of solid waste or recyclable materials on private property. The two counties are included in the North Country cluster.
6.1.12 Recommendations to Encourage Management of LDPE

Question: Do you have any recommendations that would help encourage management of LDPE plastic film?

<table>
<thead>
<tr>
<th>RECOMMENDATIONS TO ENCOURAGE MANAGEMENT OF LDPE</th>
<th>NUMBER OF COUNTY RESPONDENTS n=43*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Find an end-market</td>
<td>16</td>
</tr>
<tr>
<td>Increase education</td>
<td>13</td>
</tr>
<tr>
<td>Economic incentive for farmer</td>
<td>13</td>
</tr>
<tr>
<td>Convenience for farmers</td>
<td>12</td>
</tr>
<tr>
<td>Close the LDPE recycling loop</td>
<td>12</td>
</tr>
<tr>
<td>Regulations</td>
<td>4</td>
</tr>
<tr>
<td>Government subsidies</td>
<td>3</td>
</tr>
<tr>
<td>Regional collection to increase volume</td>
<td>3</td>
</tr>
<tr>
<td>Lower tipping fee</td>
<td>1</td>
</tr>
<tr>
<td>Not aware</td>
<td>6</td>
</tr>
</tbody>
</table>

* NOTE: Respondents were allowed to respond to more than one answer category.

The top recommendation by 16 recycling coordinators and solid waste managers was to find an end market for recycled LDPE agricultural plastic film. The next three recommendations focused on the farmer and concerned education, incentives, and convenience. Thirteen county representatives recommended that education be focused on management options available through the county such as landfilling and incineration, reuse of the material, and the consequences of on-site disposal. Economic incentives were recommended by 13 counties in order to gain more cooperation and participation by the farmers. Twelve respondents recommended a more convenient county-controlled method of collecting LDPE agricultural plastic film, in order to gain farmers’ support.

Twelve counties mentioned the need for the recycling loop to be closed. The need for the recycling loop to be closed is represented by a cooperative effort by the manufacturer, dealer, farmer, and management facility in which the LDPE agricultural plastic film is processed into products for agricultural use. The success of a recycling coordinator or a solid waste manager depends on the volume of recyclables recovered. Therefore, if farmers are restricted to county-controlled management options, and if end markets are created, the volume of recyclables may increase. However, six respondents were not aware of any recommendations to encourage management of LDPE agricultural plastic film.
6.1.13 Knowledge of Pilot Programs in the Field of LDPE Plastics

Question: Are you aware of pilot programs or studies in this field?

<table>
<thead>
<tr>
<th>AWARE OF STUDIES/ PILOT PROGRAMS</th>
<th>NUMBER OF COUNTY RESPONDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>16</td>
</tr>
<tr>
<td>No</td>
<td>27</td>
</tr>
</tbody>
</table>

Twenty-seven respondents were not aware of studies and/or pilot programs concerning LDPE agricultural plastic film. If sufficient education programs are currently in place, it is not being communicated adequately to the manufacturer, dealer, farmer, recycling coordinators, and/or other recyclers. It was perceived that once the plastic becomes more of a visible problem, more studies and pilot programs will be initiated.
7.0 COUNTY CLUSTER SUMMARY

7.1 North Country Cluster

The counties in this cluster include: Clinton, Essex, Franklin, Fulton, Hamilton, Herkimer, Jefferson, Lewis, Oneida, Saratoga, St. Lawrence, Washington, and Warren. Herkimer and Oneida counties are managed by one facility. Hamilton County is not represented within the sample since there is not a significant number of farms within this county.

- Lewis County stated that LDPE agricultural film plastic was brought in by the farmers and separated from other waste. After baling the plastic, it is transferred to Richard Vancour, an Ag-Bag Dealer in Evans Mills, New York.

- All respondents indicated that on-site disposal of LDPE agricultural plastic film is a serious concern in the North Country.

- The North Country cluster has the highest awareness of LDPE agricultural plastic film among the six clusters in New York state.

- Improper storage is perceived as a significant barrier because of the greater volume of LDPE agricultural plastic film brought into the facilities relative to other clusters.

- Of all the clusters, the North Country was the only one to recommend government subsidies as a way to encourage the management process of LDPE agricultural plastic film.

7.2 Genesee Valley Cluster

The counties included in this cluster are: Broome, Chemung, Monroe, Ontario, Schuyler, Seneca, Tioga, Tompkins, Wayne, and Yates. The Western Finger Lakes Solid Waste Authority includes Wayne, Yates, and Seneca Counties.

- All counties within this cluster only have the option of landfilling available for management of LDPE agricultural plastic.

- Wayne, Yates, Seneca, Monroe, Tompkins, and Broome Counties utilize private landfill options available through Seneca Meadows and/or High Acres landfills. Broome County also uses landfills in Pennsylvania.

- Currently, efforts are being made to expand education to include not only consumers but also private haulers.
• This cluster’s top recommendation for encouraging management of LDPE agricultural plastic film was to increase education. Out of the thirteen counties that recommended increased education, seven were from the Genesee Valley cluster.

7.3 Western Cluster

The counties included in this cluster are: Allegany, Cattaragus, Chautauqua, Erie, Genesee, Livingston, Niagara, Orleans, Steuben, and Wyoming. Genesee, Livingston, Orleans, and Wyoming are included in GLOW. Niagara county did not participate.

• While the majority of New York state counties (31 of 43) landfill exclusively, the Western cluster manages LDPE agricultural plastic film through both incineration and landfill.

• The abundance of landfills and waste-to-energy facilities has led to a lower tipping fee relative to other New York state counties. This lower tipping fee has encouraged farmers to better manage their plastic through county facilities.

• Pilot programs have been attempted for recycling LDPE agricultural plastic film, however no program has ever been established because of the changing demands of the end market used in the pilot programs.

• County representatives in this cluster observed that money allocated towards education programs have steadily decreased over the years. This may be because of the perception that education about waste management has been completed and is no longer necessary.

7.4 Central Cluster

The counties included in this cluster are: Albany, Cayuga, Chenango, Cortland, Madison, Onondaga, Oswego, Otsego, Schenectady, Schoharie. MOSA Solid Waste Authority includes Montgomery, Otsego, and Schoharie counties. Albany and Madison did not participate.

• In the Central cluster, a study was conducted to find an end market for LDPE agricultural plastic film. However, because of the stringent requirements set by the counties’ recycling handler, Resource Recovery Systems, a sufficient end market could not be found.
7.5 Catskill Cluster

The counties included in this cluster are: Columbia, Delaware, Dutchess, Greene, Orange, Sullivan, and Ulster. Orange, Greene, and Columbia Counties were not familiar with LPDE agricultural plastic and therefore, did not participate in the study.

- There were no significant deviations from respondents in this cluster compared to New York state (Section 5.0).
8.0 CONCLUSIONS

The usage of LDPE agricultural plastic film is growing on farms throughout the United States and Canada. Although LDPE agricultural plastic film represents a small section of the overall waste stream, it is important to address the problem while it is still manageable. Awareness of waste problems associated with LDPE agricultural plastic film are low, both in New York State and throughout the country. However, pilot programs and research studies are being conducted. If more of the used LDPE agricultural plastic film can be recovered and more end-market uses identified, recycling will become more cost effective.

Within New York State, on-site landfilling and burning is prevalent. Only Lewis County has a program specifically for the management of LDPE agricultural plastic film, but farmer participation levels in this program are low. There are no collection programs strictly for LDPE agricultural plastic film in the state, so most of this material enters management facilities as part of the waste stream. Before key issues can be addressed, it is important to examine the problems associated with proper recovery of LDPE agricultural plastic film.

8.1 Barriers

There are barriers to the effective management of LDPE agricultural plastic film. Some are closely related to one another, so addressing one barrier may alleviate another. For example, having an efficient management process that creates a demand for the used plastic would help in developing an end market. Barriers to recovering LDPE agricultural plastic film concern collection, contaminants, alternative disposal methods, storage, educational programs, transportation, and end markets.

8.1.1 Lack of Collection Procedures

Collection refers to the process of removing the LDPE agricultural plastic film from the farm. This process must be convenient for farmers since many do not have the time to transport used LDPE agricultural plastic film to the collection facility or the time required for preparing the material for processing. Preparation activities may include washing, bundling, and uniform slicing. In addition, the process must be free of monetary costs to the farmer because there exists little margin for imposing fees on farmers for agricultural plastics management. This creates a situation where the solid waste facility may bear the majority of the responsibility for collecting used LDPE agricultural plastic film. The facility may incur a substantial expense to implement and maintain a collection process while obtaining the cooperation of the farmer.
8.1.2 Contaminants

The contamination of used LDPE agricultural plastic film presents another barrier to recovery and recycling. The plastic contains a high level of contamination from ultraviolet damage, dirt, mud, hay, silage, and pesticides. Ultraviolet damage decreases the strength of the plastic, thus rendering the plastic unsalvageable. Dirt, mud, hay, and silage increase the costs associated with management processing. Washing the plastic may produce an unwanted by-product (contaminated water). Pesticide contamination presents two different types of problems: the recycler may perceive the plastic as being contaminated although pesticides may not be present, and therefore, may refuse to accept the material. The other problem is the lack of cost-effective technology to wash plastics that are contaminated with pesticides. There is currently research being conducted to analyze the actual levels of contamination, and the harmfulness of the remnants of pesticides on the plastic. Results should be available in Summer 1996.

8.1.3 Lack of Options for Farmers

Currently, it is more cost effective for the farmer to dispose of the plastic on-site through landfilling or burning. In order to discourage these practices, solid waste coordinators suggest that regulations be established. Further, waste management alternatives need to be proven as a cost-effective method of disposal for the farmer. If the alternative to waste disposal on the farm involves paying a tipping fee, there will be less incentive for farmers to properly dispose of used LDPE agricultural plastic film.

8.1.4 Storage

Storage is difficult at all stages of the loop because the LDPE agricultural plastic film is light-weight and loose. The high storage time associated with this plastic is due to the slow rate of plastic arriving at the collection facilities, therefore, limiting the efficiency of the processing machinery. When LDPE agricultural plastic film enters the facility in a loose state, additional storage costs are incurred.

8.1.5 Lack of Educational Programs

Due to budget constraints and lack of knowledge, there is little current education on the management of LDPE agricultural plastic film. Many county representatives surveyed were unaware of LDPE and the particular problems associated with its recovery.
8.1.6 Lack of Cost-effective Transportation

Transportation includes the removal of the LDPE agricultural plastic film from the farm to the collection facility and trucking from the collection facility to the end market. Transportation costs are another barrier to recycling due to the wide geographic scope of the farm locations and the low volume of LDPE agricultural plastic film. With larger volumes of LDPE agricultural plastic film, transportation and collection will become more cost effective.

8.1.7 Lack of End Markets

The high costs of transportation, collection, and processing currently reduces the end-market demand for recycled LDPE agricultural plastic film. However, if other barriers are reduced or eliminated, costs for recycling LDPE agricultural plastic may decrease, thus creating more demand in the end-market.

8.2 Current Management Practices

Current practice throughout the state of New York is to use landfills and incinerators to process waste. The combination of collection difficulties and high tipping fees has discouraged recovery of used LDPE agricultural plastic film. Contamination levels have also been a determinant in poor reclamation programs, and in developing or finding a suitable end-market. Current regulations allow farmers to landfill waste on their property, or use burning barrels. Oneida/Herkimer County are the only counties surveyed that prohibited farmers from landfilling and burning waste on their property. Overall, management for LDPE agricultural plastic film is still in its infancy regarding education and process management.
9.0 KEY ISSUES

LDPE Agricultural Plastic Film Recycling "Loop"

There is a need for more of the used LDPE agricultural plastic to stay within the recycling loop. This would require a cooperative effort by the manufacturer, dealer, farmer, and management facility in which the LDPE agricultural plastic film is processed into products for agricultural use. The advantages of the LDPE agricultural plastic film recycling loop may be lower costs and a secure end-market. With a guaranteed end market, many of the barriers such as a lack of collection procedures, cost-effective transportation, and the obvious lack of an end market may be overcome.
The management of LDPE agricultural plastic film needs to be a cooperative effort among all participants in the management process. The participants in the management process include: manufacturers, dealers, farmers, waste recovery managers, and end-market producers. These participants need to be aware of the peculiar difficulties presented in attempting to recover and recycle LDPE agricultural plastic film.

Education can be facilitated through involvement of cooperative extension systems such as the Cornell Cooperative Extension. However, they cannot be solely responsible for this education. Manufacturers can educate dealers, dealers can help to educate farmers, and cooperative extensions can aid counties in finding end-markets for LDPE agricultural plastic film. The cooperative extension may also play a large role in the education of the farmers in their areas. Farmers play a critical role in the management process because of the need to properly use and store the LDPE agricultural plastic film since much of the contamination takes place on the farm. With proper use and storage of this material, contamination levels can be significantly reduced, thus easing recycling and managing efforts. Education targeted towards the problems associated with farmers' on-site disposal may increase overall awareness of the need for changes in the management process.

Changes in the management process may require the support of state and local government since most current regulations allow farmers to dispose of waste on their own property. Incentives are needed to encourage farmers to retain used agricultural plastics rather than dispose of them on the farm. This will allow waste recovery facilities access to a greater supply of used LDPE agricultural plastic film, making recovery more cost effective. In order to overcome volume and capital requirements for the establishment of a reclamation facility, the creation of one central facility may make a reclamation process more cost effective. This facility might be located in a region with open access to multiple states and provinces.

Finally, a deposit/refund system could be developed to encourage farmers to return their LDPE agricultural plastic film to a recovery site. The incentive rate could be based on the number of pounds purchased, thus making it possible to recover the deposit as a certain quantity is returned. Total waste disposal costs would be decreased because landfill tipping fees would be awarded.

The most effective management process for LDPE agricultural plastic film depends on many factors. The decision to emphasize a particular management process such as county-controlled incineration, landfilling, or recycling, depends on the geographic and economic conditions specific to each county or group of counties. For example, it might be more effective to landfill LDPE agricultural plastic film in an area where there is an abundance of land available.
APPENDIX A
Cornell Survey
Hello, my name is __________________, I am calling from the Canadian US Consulting Service at Clarkson University. Currently we are working with Cornell Cooperative Extension and the Cornell Waste Management Institute to determine current practices being used for the disposal of agricultural plastic film. We would like to take a few minutes of your time to employ your expertise in this area.

MANAGEMENT OF LDPE PLASTIC FILM

1. How is LDPE currently being managed of in your county? (Can answer more than one of the following):

   [ ] WE ACCEPT AND IT IS REMOVED BY OTHER ENTITY
   [ ] BALED AND STORED
   [ ] INCINERATED
   [ ] LANDFILLED
   [ ] RECYCLE
   [ ] OTHER
   [ ] DO NOT KNOW (FIND CORRECT CONTACT)
2A. Are you aware of any LDPE collection or management by any other entities?
[ ] DISPOSED OF AT FARM
[ ] PRIVATE HAULERS
[ ] DEALERS
[ ] MANUFACTURERS
[ ] OTHER LANDFILLS (where) ____________________________
[ ] OTHER INCINERATORS (where) ____________________________
[ ] OTHER

3. What is the tipping fee for:
[ ] LANDFILLING ____________________________
[ ] INCINERATOR ____________________________
[ ] RECYCLABLE MATERIALS ____________________________

4. Do you physically collect LDPE agricultural plastic or film, or is it brought to your facilities?
[ ] COLLECT
[ ] BROUGHT IN

5. What does your management process for LDPE include? (More than one may apply):
[ ] COLLECTION
[ ] ACCEPTANCE
[ ] BALING
[ ] STORAGE: AVG. LENGTH OF TIME ______________________
[ ] SEPARATING FROM OTHER FORMS OF WASTE
[ ] DISPOSAL

6. Are there any difficulties in managing the film that is currently brought to you?
7. In what physical state does the plastic enter your facility (More than one may apply):
   [ ] CLEANED
   [ ] CONTAMINATED
   [ ] BALED
   [ ] LOOSE

8. Does this physical state of the plastic present any difficulties?

9. How many tons of LDPE is managed by your facility in a given year? __tons/year

10. What barriers do you think affect the entire LDPE management process?
    A. COLLECTION
    B. STORAGE
    C. RIDDING OF CONTAMINANTS
    D. TRANSPORTATION
    E. EDUCATIONAL PROGRAMS
    F. EASE OF ALTERNATIVES TO FARMERS
    G. OTHER CONSIDERATIONS
11. Are there any constraints on your current:
   A. [ ] CAPACITY OF BALING MACHINES CAN THEY RECYCLE TYPE 4 PLASTIC
       
       IS THERE EXCESS CAPACITY?
       
       B. [ ] STORAGE OF LDPE BEFORE PROCESSING
       
       AFTER PROCESSING
       
12. What would be needed to adapt the local facility to better manage LDPE film plastics?
   A. [ ] EQUIPMENT
       
       B. [ ] COSTS
       
       C. [ ] LABOR
       
13A. Are there any government requirements at the local, county, or state level for management of the LDPE film plastics?
    [ ] YES
    [ ] NO
13B. If YES, What are they: (Ask for documentation)
[ ] UV PROBLEMS
[ ] VOLUME
[ ] CONTAMINATION LEVELS
[ ] OTHER

14. Do you have any recommendations that will help to encourage managing of LDPE? (Ask for documentation):

15. Are you aware of pilot programs or studies in this field?
RECYCLERS OF LDPE FILM

1. Which LDPE agricultural plastic do you accept?
   [ ] MULCH
   [ ] WRAPS
      BRAND _____________________________________________
   [ ] BLACK W/ WHITE
   [ ] GREEN W/ WHITE
   [ ] YELLOW W/ WHITE
   [ ] WHITE
   [ ] GREENHOUSE
   [ ] OTHER

2. What are the annual current costs to your facility of recycling LDPE:
   A. COLLECTION _______________________________________
   B. STORAGE __________________________________________
   C. TRANSPORTATION ___________________________________
   D. EDUCATIONAL PROGRAMS _____________________________
   E. BALING ____________________________________________
   F. OTHER CONSIDERATIONS ______________________________

3A. Where is your market for LDPE film plastic?
    NAME ____________________________
    PRODUCT _________________________
    PHONE NUMBER ___________________

3B. Are you aware of any alternative markets that you may not be currently using?
____________________________________________________
____________________________________________________
INCINERATION

1. Is your incinerator permitted to burn LDPE film plastic?
   [ ] YES
   [ ] NO

2. Are there any physical/capacity constraints on the ability of your current incinerator to manage LDPE?

3. In your incineration process, what barriers are experienced in the following areas?
   A. COLLECTION
   B. STORAGE
   C. TRANSPORTATION
   D. EDUCATIONAL PROGRAMS
   E. EASE OF ALTERNATIVES
   F. OTHER CONSIDERATIONS
DEMOGRAPHICS

1. How many square miles is your recycling area?

2A. Of your total annual budget, what dollar amount is allocated to recycling?

2B. What amount is allocated to educational programs?

3. Please describe your job responsibilities

4. Do you know any other people that we can contact for further information?
   Name
   Title
   Company
   Phone Number

   Name
   Title
   Company
   Phone Number
General Comments

[ ] Check if they want a future update.

THANK YOU VERY MUCH FOR YOUR TIME!
APPENDIX B
County Demographic Information
<table>
<thead>
<tr>
<th>County</th>
<th>Square Miles</th>
<th>Recycling Budget</th>
<th>Educational Budget</th>
<th>Landfill Tipping Fee</th>
<th>Incinerator Tipping Fee</th>
<th>Recycling Tipping Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albany</td>
<td>524</td>
<td>90,000</td>
<td>12,800</td>
<td>TAX</td>
<td>N/A</td>
<td>TAX</td>
</tr>
<tr>
<td>Allegany</td>
<td>1030</td>
<td>1,100,000</td>
<td>200,000</td>
<td>40</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>Broome</td>
<td>707</td>
<td>1,100,000</td>
<td>200,000</td>
<td>40</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>Cattaraugus</td>
<td>1310</td>
<td>-</td>
<td>-</td>
<td>47.5</td>
<td>N/A</td>
<td>15.25</td>
</tr>
<tr>
<td>Cayuga</td>
<td>693</td>
<td>200,000</td>
<td>100,000</td>
<td>72</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>Chaotaqua</td>
<td>1062</td>
<td>250,000</td>
<td>15,000</td>
<td>43.5</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>Chemung</td>
<td>408</td>
<td>2,000,000</td>
<td>30,000</td>
<td>N/A</td>
<td>60</td>
<td>N/A</td>
</tr>
<tr>
<td>Chenango</td>
<td>894</td>
<td>224,000</td>
<td>4,750</td>
<td>50</td>
<td>N/A</td>
<td>0</td>
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<tr>
<td>Clinton</td>
<td>1039</td>
<td>600,000</td>
<td>10,000</td>
<td>79</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>Columbia</td>
<td>636</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Cortland</td>
<td>500</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Delaware</td>
<td>802</td>
<td>2,000,000</td>
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</table>

Tax: Comes Out of County Taxes
* No separate budget. Comes out of recycling budget.
# R.A.R.E. (Canadian Waste Management Firm) takes care of all other costs.
▲ Includes Household Hazardous Waste Program
Hauler: Prices Determined By Hauler
Need Basis: Educational § Given On Need Basis
MKT: Prices Determined By Market
N/A: Not Applicable to County
Note: Some information Not Available Or Not Known By Respondents
APPENDIX C
Survey Respondents
SURVEY RESPONDENTS

Allegany County
Gretchen Gary
Recycling Coordinator
Department of Public Works
(716) 268-9230
Fax: (716) 268-9648
Job Responsibilities: All marketing of materials, responsible for collection of recyclable materials.

Broome County
Lisa Folie
Materials Recovery Manager
Broome County Division of Solid Waste
P.O. Box 1766
Binghamton, NY 13902-1766
(607) 788-6182
Fax: (607) 778-2395
Job Responsibilities: Responsible for the recycling program, the household hazardous waste program, long term planning for division.

Broome County
Kevin Mathers
Environmental Issues Agent
Broome County Cornell Cooperative Extension
840 Upper Front Street
Binghamton, NY 13905
(607) 772-8953 X130
Fax: (607) 723-5951
Job Responsibilities: Responsible for assistance of the Broome County recycling program through educational programs and assistance with administrative issues.

Cattaraugus County
Richard Preston
Recycling coordinator
Cattaraugus County Department of Public Works
214 Main Street
Little Valley, NY 14755
(716) 938-9121
(716) 938-9049
Job Responsibilities: Negotiates contracts with the private waste haulers, coordinates the transfer stations, permit and operating compliance.

Cayuga County
Bruce Natale
Program Administrator
Cayuga County Solid Waste Management Program
160 Genesee Street
Auburn, NY 13021
(315) 253-1203
Fax: (315) 253-1586
Job Responsibilities: Long term planning for solid waste and recycling issues.

Chautauqua County
Ted Osbourne
Recycling Coordinator
Chautauqua County Division of Solid Waste
3889 Towerville Road
Jamestown, NY 14701
(716) 985-4785
Fax: (716) 985-4981
Job Responsibilities: Responsible for the marketing of the recycled material. Attain the best prices in order to turn a profit.
SURVEY RESPONDENTS

Chemung County
Vincent Nykiel
General Manager
Chemung County Solid Waste Management District
1690 Lake Street
P.O. Box 588
Elmira, NY 14902
(607) 737-2980
(607) 737-2967
Job Responsibilities: Responsible for the recycling program, solid waste disposal, and educational programs.

Chenango County
Donna Brunell
Recycling Coordinator
Chenango County Recycling Center
RD #2 Box 3468
Norwich, NY 13815
(607) 337-1790
Fax: (607) 337-1791
Job Responsibilities: Responsible for education, awareness, research and marketing of recyclable materials, and coordinates special projects.

Chenango County
Carl Conley
Waste Station Operator
Chenango County Recycling Center
RD #2 Box 3468
Norwich, NY 13815
(607) 337-1790
Fax: (607) 337-1791
Job Responsibilities: Responsible for operations and administration issues at the center.

Clinton County
Laura Hilple
Recycling Coordinator
Clinton County Recycling Center
P.O. Box 209
Morrisonville, NY 12962
(518) 563-81565
Fax: (518) 563-5598
Job Responsibilities: Coordinator; oversees materials recycling facility; marketing of recyclables, education programs; and budgeting/annual reports.

Delaware County
Sue McIntyre
Solid Waste Coordinator
Delaware County Department of Solid Waste
P.O. Box 311
Delhi, NY 13753
(607) 746-2128
Fax: (607) 746-7212
Job Responsibilities: Management of the recycling and solid waste programs within the county.

Dutchess County
Eileen McGuire
Recycling Coordinator
41 Sanduck Road
Poughkeepsie, NY 12601
(914) 486-3990
Fax: (914) 452-3720
Job Responsibilities: Public education, operational and administrative duties.
SURVEY RESPONDENTS

Essex County
Geoff May
Recycling Coordinator
Serkil, Limited Liability Company
P.O. Box 60
Lewis, NY 12950
(518) 873-6650
Fax: (518) 873-9249
Job Responsibilities: Generalist from landfill to recycling, running the Materials recovery facility, education programs, marketing the recyclables, budgeting.

Franklin County
Jack Legault
Recycling Coordinator/ Solid Waste Director
Rt. 1 Box 300
Constable, NY 12926
(518) 483-8270
Fax: (518) 483-4880
Job Responsibilities: Coordinator; executive director for solid waste in county; education programs.

Fulton County
Cindy Livingston
Recycling Coordinator
Fulton County Recycling Center
P.O. Box 28
Johnston, NY 12095
(518) 762-0301
Fax: (518) 762-2859
Job Responsibilities: Coordinator; promotional efforts; marketing of recyclables; budgeting; contracting; educational programs, giving tours of facilities; producing and marketing recycling video.

Genesee, Livingston, Orleans, and Wyoming Counties
Edwin H. Marr
Recycling Coordinator
GLOW Regional Solid Waste
26 Harvester Avenue
Batavia, NY 14020
(716) 396-4482
Fax: (716) 344-4037
Job Responsibilities: Administrative, program development, and education.

Jefferson County
Michael Kaskan
Director of Solid Waste
Department of Public Works
175 Arsenal Street
Watertown, NY 13601
(315) 785-3223
Fax: (315) 785-5070
Job Responsibilities: Director of entire department; runs transfer station and recycling center; performs billing for solid waste; marketing the recyclables; any educational programs; and budgeting.

Lewis County
Pete Wood
Solid Waste Supervisor
Lewis County Solid Waste and Recycling
Court House Road
Lowville, NY 13667
(315) 376-5101
Fax (315) 376-5874
Job Responsibilities: Managing materials recovery facility; handling incoming recyclables and solid waste; marketing recyclables; weighing and charging for waste; finding end markets.
SURVEY RESPONDENTS

Montgomery, Otsego, Schoharie
Gilbert Chichester
Executive Director
MOSA Montgomery, Otsego, Schoharie
Solid waste Management Authority
P.O. Box 160 Rt. 7
Howes Cavern, NY 12092
(315) 592-2120
Fax: (315) 296-8937
Job Responsibilities: Administrative issues for the Authority, deals with the private haulers and Resource Recovery Systems.

Monroe County
Lynn Schramel
Monroe County Solid Waste Program Coordinator
Monroe County Department of Environmental Services
350 East Henrietta Road
Rochester, NY 14620
(716) 274-7756
Fax: (716) 274-7734
Job Responsibilities: Educational and technical assistance.

Monroe County
Jonathan Pitts
Environmental Facility Manager
Monroe County Department of Environmental Services
350 East Henrietta Road
Rochester, NY 14620
(716) 292-3908
Fax: (716) 274-7734
Job Responsibilities: responsible for operations and maintenance of the county landfill, transfer stations, and closed landfill.

Oneida / Herkimer Counties
David Lupinski
Director of Recycling
311 Turner Street Suite 401
Utica, NY 13501
(315) 733-1224
Fax (315) 733-2305
Job Responsibilities: Marketing of recyclables; education programs; operations; enforcement; future planning.

Onondaga County
Susan Lalond
Recycling Coordinator
Onondaga County Resource Recovery System (OCRRA)
Onondaga County
100 Elwood Davis
N. Syracuse, NY 13219
(315) 469-6971

Onondaga County
Andy Bringham
Public Information Officer
Onondaga County Resource Recovery System
Onondaga County
100 Elwood Davis
N. Syracuse, NY 13219
(315) 469-6971

Putnam County
Gordon Maxwell
Recycling Coordinator
Putnam County Division of Solid Waste
40 Gleneida
Carmel, NY 10512
(914) 255-3644
Fax: (914) 225-0294
Job Description: Manages all waste in Putnam County and the recycling or disposal of waste.
SURVEY RESPONDENTS

Rockland County
Rhea Frankl
Recycling Coordinator
Rockland County Solid Waste Management Authority
4 Route 340
Orangeburg, NY 10962
(914) 364-2745
Fax: (914) 365-6692
Job Responsibilities: coordinates all activities within the facilities, such as the programs and administrative issues.

Saratoga County
Joseph Miranda
Recycling Coordinator
Department of Public Works
3654 Galway Road
Ballston Spa, NY 12020
(518) 885-2235/1805
Fax: (518) 885-8809
Job Responsibilities: Administration of entire recycling program, marketing the recyclables, employee management, education and public programs, invoicing/billing, and tracking recyclables.

Schuyler County
Elaine Dalrymple
Cornell Cooperative Extension Agent
Schuyler County Recycling Program
Broadway
Montour Falls 14865
(607) 535-7161
(607) 535-6270
Job Responsibilities: Education, coordination, administration, promotion of county’s recycling program. Also works with the private haulers used throughout the county.

Seneca, Wayne, and Yates Counties
Marjorie Haizlip
Western Finger Lakes Solid Waste Authority
Public Relations and Education Coordinator
9 Pearl Street
P.O. Box 36
Lyons, NY 14489
(315) 946-5650
Fax: (315) 946-5657
Job Responsibilities: Planning unit, administration coordination and supervision of all three counties and Wayne county’s recycling program.

St. Lawrence County
Craig Ballard
Recycling Coordinator/ Compliance Officer
St. Lawrence Solid Waste Authority
127 N. Water Street
Ogdensburg, NY 13669
(315) 393-7889
Fax: (315) 393-0724
Job Responsibilities: Coordinator / Compliance Officer; education programs, maintaining of statistics, helping farmers and businesses.

Steuben County
Bonnie Caster
Recycling Coordinator
Steuben County Department of Public Works, Solid Waste Division
3 East Pulteney Square
Bath, NY 14810
(607) 776-9631
Fax: (607) 776-4646
Job Responsibilities: Responsible for recycling program and administrative issues.
SURVEY RESPONDENTS

Sullivan County
Bill Cutter
Recycling Coordinator
Sullivan County Division of Solid Waste
P.O. Box 5012
100 North Saint Monticello, NY 12701
(914) 794-3000
Fax: (914) 794-3459
Job Responsibilities: Marketing of materials, education, negotiating, personnel management, waste stream assessment, public relations, and hazardous waste issues.

Ulster County
Manna Jo Greene
Recycling Coordinator
1266 Ulster Ave.
Kingston, NY 12401
(914) 366-0600
Fax: (914) 366-4129
Job Responsibilities: Management of the educational programs, marketing of the recycled materials, program development, and any other programs that are promoted through the facility.

Tompkins County
Barb Hotchkiss
Recycling Coordinator
Tompkins County Solid Waste Manager
122 Commercial Ave.
Ithaca NY 14886
(607) 273-5700
Fax: (607) 275-0000
Job Responsibilities: Main focus of responsibilities are the household hazardous waste program, recycling program, and administrative issues.

Warren County
Brian Humphrey
Plant Manager
Warren County Recycling Center
299 Lower Warren Street
Queensbury, NY 12864
(518) 798-0847
Fax (518) 792-6522
Job Responsibilities: Recycling Coordinator/Director; budgeting, educational programs, scheduling of manpower and trucking, marketing the recyclables, and finding end markets.

Tioga County
Cindy Bibinski
Solid Waste Manager
Tioga County Solid Waste Division
(607) 565-8130
Fax (607) 569-3671
Job Responsibilities: Responsible for administrative issues and management of the transfer stations.

Washington County
William Munoff
Recycling Coordinator
383 Broadway
Ft. Edward, NY 12828
(518) 746-2440
Fax (518) 746-2441
Job Responsibilities: Coordinator; managing an existing recycling program, establishes which materials to collect, developing markets and marketing the recyclables.
SURVEY RESPONDENTS

Westchester County
Abby Popper
Program Administrator
Westchester County Department of
Environmental Facilities
270 North New Rochelle, NY 10801
(914) 637-3030
Fax: (914) 637-3076
Job Responsibilities: Supervises the facility
and the educational programs and promotion
of the services.

Westchester County
Jim Hogan
Director of Resource Management
Westchester County Department of
Environmental Facilities
270 North New Rochelle, NY 10801
(914) 637-3030
Fax: (914) 637-3076
APPENDIX D
Economics of Alternative Forage Storage Methods
Economics of Alternative Forage Storage Methods
Prepared by Colleen A. McKeon - Extension Educator, Agriculture
Cornell Cooperative Extension of Sullivan County

INTRODUCTION

Because of the current economic constraints in today's dairy industry, farmers are continuously searching for more efficient and economical methods of feeding and storing forage for their dairy livestock. Producers continue to look for more efficient management tools which will minimize cost while maximizing labor efficiency in their farm business, including forage production and storage.

For the purpose of this economic analysis on agricultural plastics, three alternative types of storage facilities will be discussed: upright silos, horizontal or "bunker" silos, and round bale wrappers. These three storage facilities are most frequently used by farmers in Sullivan County, New York; therefore, discussion will be limited to their economic viability. Three Sullivan County farmers have been using "Ag Bags" to ensile forage. The majority of "Ag Bag" usage in Sullivan County has been temporary. Farmers often use "Ag Bags" to hold forage while constructing a permanent storage facility after an expansion has taken place.

GENERAL TRENDS IN THE NEW YORK STATE DAIRY INDUSTRY

Although the number of dairy milk cows in New York State has decreased steadily, milk produced per cow has continued to rise with greater economic efficiencies. One type of efficiency has been the production of high quality forage. As cow numbers per farm increase and the demand for increased labor and production efficiency becomes greater, farmers have shifted from more traditional methods of storing forage to alternative methods discussed below to meet their needs in harvesting, storing, and feeding forage (see Appendix A).

In many parts of the state, there has been an increase in the use of bunker silos, "Ag Bags", and round bale wrapping systems. As the number of these storage alternatives increase, the amount of agricultural plastics have and will continue to increase. Plastic is used to cover horizontal silos, ensile "balage" (round bales wrapped with plastic), and ensile haylage in "Ag Bags". Although all three methods are viable, efficient alternatives for storing forage, one issue remains after the forage is fed out - disposal of plastic.

ANALYSIS OF STORAGE FACILITIES

This analysis of alternative storage facilities involves the construction of an economic budget for an upright silo, a horizontal or "bunker" silo, and a round bale wrapper. All capital and operating costs incorporated in these budgets are typical for Sullivan County Dairy Farms and may vary statewide. All storage facilities incorporated in these economic budgets have capacity to hold approximately 146 tons of haylage. All forage tonnage is
calculated on a dry matter basis to compensate for differences in moisture content which may occur.

UPRIGHT SILO

The upright silo has been a traditional method of storing dairy forages. The following budget has been constructed for a 20’ by 60’ upright silo, which holds approximately 146 tons of haylage on a dry matter basis.

Economics Of An Upright Silo
20’ x 60’, 146 Tons Dry Matter

<table>
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<th>Item</th>
<th>Cost</th>
<th>Life (years)</th>
<th>Annual Cost</th>
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<td></td>
<td>37,000</td>
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<td>2685.00</td>
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<td>Total Fixed Costs</td>
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<td>2685.00</td>
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Operating Costs
- Repairs: 400.00
- **Insurance: 50.00
- *Interest: 1295.00
- Utilities (Electricity): 200.00
- Fuel (Blowing in Silo): 350.00

Total Operating Costs: 2295.00

Total Estimated Cost: 4980.00
x 18% Waste Factor: 1.18

Final Cost: 5876.00

*Interest \[\frac{37,000 \times 0.07}{2} = 1295\]

Assuming 7% Interest
** Percentage of total farm insurance ($1800)

As this budget shows, fixed costs necessary for constructing an upright silo are high because of initial capital investment in erecting the structure and installing the unloader. When the cost of installing the silo and unloader are put on an annual basis, total fixed costs are $2685.00.
Operating costs including annual repairs, electricity, and fuel (necessary to blow haylage into the silo) are also higher for the upright silo than they are for alternative methods of storage discussed. However, assuming the silo is properly sealed, less waste will occur if forage is fed out of an upright silo versus another storage alternative.

HORIZONTAL OR "BUNKER" SILO

In comparing the annual costs of a concrete 10' x 20' x 100' bunker silo with those of the upright silo in this example, the bunker silo is a more economical means of storing haylage. Although forage waste increases to 30%, both annual fixed and operating costs are less for a bunker silo. As cow numbers increase per farm, the bunker silo also provides the farmer with an easier, faster, more efficient means of feeding forage.

Economics of a Bunker Silo
10' x 20' x 100', 150 Tons Dry Matter

<table>
<thead>
<tr>
<th>Fixed Costs</th>
<th>Item</th>
<th>Cost</th>
<th>Life</th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bunker Silo</td>
<td></td>
<td>17,000</td>
<td>20</td>
<td>$ 850.00</td>
</tr>
<tr>
<td>Total fixed costs</td>
<td></td>
<td>850.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Operating Costs:
- Repairs: 100.00
- **Insurance: 50.00
- Interest: 595.00
- Fuel (Packing Haylage): 200.00

Total Operating Costs: $ 945.00

Total Estimated Cost:

x 30 % Waste Factor: 1.30

Final Costs: $2334.00

*Interest

\[
\frac{17,000 \times 0.07}{2} = \$595
\]

Assuming 7% Interest

**Percentage of total farm insurance ($1800)

Several farmers seek to lower their fixed cost by building an earthen bunker silo in the side of a hill or piling forage. If a farmer does this, his fixed costs are minimal, however the percent of forage spoilage would also increase (see table at top of next page).
Harvest, Storage, and Feeding Losses for Dry Hay, Haylage, Corn Silage, and Corn Grain for Alternative Storage Systems

<table>
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<th>Feed and Storage Type</th>
<th>Harvest Losses</th>
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<th>Feeding Losses</th>
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<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Piled</td>
<td>25</td>
<td>4</td>
<td>8</td>
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<td>Haylage-hay crops silage</td>
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<td>5</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Bunker or trench</td>
<td>5</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>Piled and covered</td>
<td>5</td>
<td>22</td>
<td>7</td>
</tr>
<tr>
<td>Corn Silage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sealed storage</td>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Cement stave&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Bunker or trench</td>
<td>5</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Piled and covered</td>
<td>5</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>Corn Grain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry</td>
<td>5</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>High moisture, sealed storage</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>High moisture, not sealed storage&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>High moisture, bunker or trench</td>
<td>5</td>
<td>15</td>
<td>5</td>
</tr>
</tbody>
</table>

<sup>a</sup> All losses are based on yield in the field, (example, dry hay stored in the barn will lose approximately 8% of the yield in the field throughout feeding)

<sup>b</sup> These storage losses are used in the basic enterprise budgets.


**ROUND BALE WRAPPER**

Round bale wrappers are a newer technology farmers can use to ensile hay (called "balage"). After hay is baled, a wrapper will encase the hay in plastic and cause it to ensile (ferment). The round bale wrapper has several advantages. A wrapper can substantially reduce the risk of weather damage to the forage. Many times, a farmer can cut, bale, and wrap balage in one day, whereas it will take two to three days to harvest dry hay.
The wrapper has a lower fixed cost than an upright silo; it also eliminates the need for a storage structure.

Along with its advantages, a round bale wrapping system has some disadvantages. First, maintaining airtight storage at the proper moisture content of 50-60% can be a problem. If balage is not wrapped well, there may be incomplete fermentation, resulting in unstable silage. Additional spoilage can occur if wildlife such as deer or birds tear holes in the plastic breaking the airtight seal. Several farmers in Sullivan County have reported up to a 40% loss due to spoilage. In the budget below which shows the annual costs of a round bale wrapper for 649 one thousand pound bales ensiled at 55% moisture (146 tons dry matter), waste is estimated at 35%.

**Economics Of Bale Wrapper**

649 1000 lb. bales (55% Moisture)

<table>
<thead>
<tr>
<th>Fixed Costs</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>Cost</td>
<td>Life (years)</td>
<td>Annual Cost</td>
</tr>
<tr>
<td>Wrapper</td>
<td>13,000</td>
<td>7</td>
<td>$1857.00</td>
</tr>
<tr>
<td>Total Fixed Costs</td>
<td></td>
<td></td>
<td>$1857.00</td>
</tr>
</tbody>
</table>

**Operating Costs**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repairs</td>
<td>$200.00</td>
</tr>
<tr>
<td><strong>Insurance</strong></td>
<td>$25.00</td>
</tr>
<tr>
<td>*Interest</td>
<td>$455.00</td>
</tr>
<tr>
<td>Wrap (649 1000 lb. bales @ $2.50/bale)</td>
<td>$1623.00</td>
</tr>
<tr>
<td>Twine (45 bales/roll @ $22/roll)</td>
<td>$317.00</td>
</tr>
<tr>
<td>Fuel (Wrapping &amp; Transporting)</td>
<td>$50.00</td>
</tr>
<tr>
<td>Total Operating Costs</td>
<td>$2670.00</td>
</tr>
</tbody>
</table>

Total Estimated Cost  
$4527.00  
× 35% Waste Factor  
1.35

**Final Costs**  
$6111.45

* *Interest  
\[
\frac{13,000 \times 0.07}{2} = \$455
\]

Assuming 7% Interest  
** Percentage of total farm insurance ($1800)
Although annual costs of a round bale wrapper are less expensive than those of an upright silo, they are more expensive than those of a bunker silo. Substantial waste also occurs when the airtight seal is broken in a wrapped round bale. However, farmers have lowered the annual fixed costs of a round bale wrapper by sharing wrapping equipment with a neighboring farm. It should be noted that sharing equipment does limit the ability of the farmer to harvest forage in a timely manner. A round bale wrapping system is ideal for farmers who harvest an excessive amount of forage for storage facilities available on their farms and do not want to make an additional capital investment in another permanent structure.

CONCLUSION

Economically, there is incentive for farmers to shift from traditional methods of storage to alternative storage facilities discussed above. These alternative feed storages involve the use of a large volume of plastic. The disposal of this plastic is a challenge which must continually be addressed. As the volume of agricultural plastics increases, all agriculturalists, including dairy producers, will need to utilize a more environmentally sound and convenient method of plastic removal.
Appendix A

New York Dairy Situation and Outlook

<table>
<thead>
<tr>
<th>Item</th>
<th>Year</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of milk cows (thousand head)</td>
<td>727</td>
<td>718</td>
</tr>
<tr>
<td>Milk per cow (lbs.)</td>
<td>15,702</td>
<td>15,905</td>
</tr>
<tr>
<td>Total milk production million lbs.</td>
<td>11,415</td>
<td>11,420</td>
</tr>
<tr>
<td>Blended milk price ($/cwt.)</td>
<td>12.61</td>
<td>12.98</td>
</tr>
</tbody>
</table>

* New York-New Jersey blend price, 201-210 mile zone, 3.5 percent fat, this price excludes any premiums or assessments. The effective blend price after milk price assessments is $12.68 for 1992; $12.46 for 1993, and $12.82 for 1994, assuming no refund.

Dairy Cow Numbers

<table>
<thead>
<tr>
<th>Year</th>
<th>New York Milk Cows, Annual Average</th>
<th>New York Milk Cows, January</th>
<th>New York Heifers, January</th>
<th>Heifers as Percent of Cow Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-thousand head</td>
<td></td>
<td></td>
<td>percent</td>
</tr>
<tr>
<td>1985</td>
<td>914</td>
<td>910</td>
<td>425</td>
<td>46.7</td>
</tr>
<tr>
<td>1986</td>
<td>894</td>
<td>925</td>
<td>388</td>
<td>41.9</td>
</tr>
<tr>
<td>1987</td>
<td>822</td>
<td>855</td>
<td>355</td>
<td>41.5</td>
</tr>
<tr>
<td>1988</td>
<td>794</td>
<td>816</td>
<td>290</td>
<td>35.5</td>
</tr>
<tr>
<td>1989¹</td>
<td>769</td>
<td>780</td>
<td>302</td>
<td>38.7</td>
</tr>
<tr>
<td>1990¹</td>
<td>755</td>
<td>760</td>
<td>324</td>
<td>42.6</td>
</tr>
<tr>
<td>1991¹</td>
<td>745</td>
<td>750</td>
<td>322</td>
<td>42.9</td>
</tr>
<tr>
<td>1992¹</td>
<td>735</td>
<td>740</td>
<td>312</td>
<td>42.2</td>
</tr>
<tr>
<td>1993¹</td>
<td>727</td>
<td>730</td>
<td>329</td>
<td>45.1</td>
</tr>
<tr>
<td>1994¹</td>
<td>718</td>
<td>725</td>
<td>325</td>
<td>44.8</td>
</tr>
<tr>
<td>1995²</td>
<td>703</td>
<td>710</td>
<td>285</td>
<td>40.1</td>
</tr>
<tr>
<td>1996³</td>
<td>695</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹Revised ²Preliminary ³Projected

Source: New York Agricultural Statistics
BIBLIOGRAPHY


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Rogers, Glenn F. "Agriculture Plastics Recycling Program." University of Vermont Extension System, 1992