Virginia Animal Waste Management Project

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Virginia Animal Waste Management Project

by

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ABSTRACT

A portion of the waters of the Chowan River drainage basin within the state of Virginia has been classified as "nutrient enriched". Ultimately this nutrient enrichment has negative impacts upon water quality within the Albemarle-Pamlico estuary. One source of nutrients in surface waters in this region is the prevalence of swine production operations with little or no waste utilization planning. The purpose of this project was to demonstrate the benefits of waste management to the program participants and their community. Five new animal waste storage systems were constructed in six southeastern counties at a 75% cost-share rate. Seventeen existing storage systems received cost-share assistance to encourage the proper land application of the wastes to adjacent cropland. Nutrient management plans were developed for all participants and management agreements signed to insure proper maintenance of the new systems. These plans resulted in the management of 48,037 tons of manure. This represents approximately 240,185 lbs. of nitrogen and 288,222 lbs. of phosphate being more efficiently utilized. In addition, thirteen demonstration and test plots were established with the cooperators in the program. These will be used for tours and other educational activities. The uncertainty of the future market for hogs and high installation costs discouraged many producers from constructing a system, even with 75% cost-sharing. Providing cost-share for the construction of new storage systems is felt to be a more important step in improving waste management than providing funds for its application to the land. The waste application, however, was important for the demonstration of nutrient management and the economic value of the effluent from storage systems. More work is needed in the region to promote proper application of the wastes in existing storage facilities.
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Additional recognition is deserved by those individuals and field staff who made this project both possible and successful. Most of the credit goes to Harry O. Dalton, regional Nutrient Management Specialist for the Division of Soil and Water Conservation (DSWC). He was responsible for most of the coordination of projects, field reporting and the development of the necessary nutrient management plans. DSWC managers Mike Skinner and Sam Bailey also provided essential assistance in monitoring and reporting on project activities. Finally, the work could not have been completed without the assistance of the personnel of the other water quality agencies working in the region. Our thanks to the staff of the Peanut and J. R. Horsley Soil and Water Conservation Districts, the Soil Conservation Service and Virginia Cooperative Extension Service. Without their combined cooperation, this project would not have been possible.
Introduction

Water quality within the Albemarle-Pamlico Sound drainage area has become of increasing concern as the general health of this ecosystem has steadily declined. Among the many factors contributing to this deterioration are nutrient enrichment and pathogenic contamination.

The tributaries of northeastern North Carolina contributing fresh water to the sound also carry substantial nutrient loads. Under certain conditions, this can lead to explosive algal blooms. In addition to blocking sunlight for submerged aquatic vegetation, these blooms cause significant reductions in the concentration of dissolved oxygen in the water when the algae die and begin to decompose. Bacteria responsible for this decomposition utilize the available oxygen leaving little if any for other desirable inhabitants of the sound. The entire food chain of this system is affected by these blooms, which can have severe adverse affects, particularly on non-mobile creatures such as clams, oysters and mussels. These inhabitants of the sound are unable, when faced with anoxic conditions, to move to an area more favorable to their survival.

The nutrient enriched conditions also are strongly suspected to contribute to generally elevated environmental stress upon both finfish and shellfish populations. The development of the "red sore" and ulcerative mycosis diseases in menhaden and the shell lesions of blue crabs are believed related to the overall state of water quality in the sound. The occurrences of MSX and Dermosystidium in oysters also seem to be linked to environmental quality.

In order to improve water quality within the sound, it is necessary to identify the source of water quality problems in each of its tributaries. Among these tributaries is the Chowan River drainage area. Its headwaters originate in Virginia with the Meherrin, Nottoway and Blackwater rivers (Fig. 1). These waters have been designated as "nutrient enriched" by the Virginia State Water Control Board (VSWCB). Work has been done by the VSWCB to characterize land use within the Chowan drainage area and the possible sources of its water quality problems.

In a study published by the VSWCB in 1986, it was shown that 75% of the Chowan drainage's 4900 square miles lies within the state of Virginia. At that time, this area was characterized as being 83.2% forest and wetland, 16.2% agricultural and only 0.6% urban (Fig. 2). The VSWCB project reported several significant findings. In the small watersheds studied, those areas with greater concentrations of livestock had significantly higher levels of both nitrogen and phosphorus measured in surface water samples. Though the presence of other agricultural activities was associated with higher nutrient levels above that observed in a watershed with

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USGS HYDROLOGIC UNIT NUMBERS
CHOWAN-PASQUOTANK RIVER BASINS
PARTS OF NORTH CAROLINA AND VIRGINIA

Figure 1. Project Location
The Chowan Basin in Virginia
Major Landuse Types

Figure 2. Landuse within the Region

Table 1. Impacts of landuse on water quality in a VSWCD watershed study.

<table>
<thead>
<tr>
<th>Watershed</th>
<th>% Agriculture Land</th>
<th>Livestock Density (animals/acre)</th>
<th>N Concentration (mg/liter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Buckthorn Swamp</td>
<td>54%</td>
<td>.90</td>
<td>1.64</td>
</tr>
<tr>
<td>Lower Buckthorn Swamp</td>
<td>45%</td>
<td>.60</td>
<td>1.31</td>
</tr>
<tr>
<td>Kottoway Swamp</td>
<td>40%</td>
<td>.19</td>
<td>1.32</td>
</tr>
<tr>
<td>Assamoosic Swamp</td>
<td>12%</td>
<td>.08</td>
<td>0.85</td>
</tr>
</tbody>
</table>
little agricultural activity, the density of livestock was also correlated with significantly higher nutrient loads (Table 1). Since livestock concentrations seem to be significant contributors to elevated nutrient levels in the region's waters, efforts to improve animal waste management may reasonably be expected to improve water quality in the Chowan tributaries.

Based upon the Virginia agricultural census data\(^2\), the Commonwealth of Virginia produced a total of 380,000 hogs in 1987. Of this total, approximately 159,700 (or 42\%) were produced within the Chowan river basin. Following a decline in the early 1980s, the total number of hogs produced in the state has nearly returned to a 1983 high of 550,000, with 450,000 reported produced in 1989. During this time the size of the operations involved has grown significantly. The livestock produced in 1983 were raised on 15,000 individual farms. In 1989, that figure had been reduced to only 5,500 farms. The trend is clearly toward larger, more concentrated production facilities which will have even greater potential impacts upon water quality.

To a limited degree, state water quality regulations are already beginning to address this trend. The VSWCB has enacted regulations requiring all confined animal production operations of over 300 animal units to have a Virginia Pollution Abatement (VPA) permit. An approved nutrient management plan is an enforceable portion of that permit for those over 1,000. Smaller facilities, however, and those not using a confinement system are not currently required to have a permit and thus are not subject to its regulatory requirements.

Observations by field staff of various resource management agencies in the Chowan region indicate two types of problems in animal waste management which need to be addressed. The first is the lack of manure collection and storage systems in many swine production operations. Hogs are still commonly run on bare ground with no attempt to manage the manure produced. This condition can result in significant movements of nutrient laden runoff during storm events. Some form of storage is essential to effective management. Such operations also are often subject to high soil loss rates due to a lack of adequate ground cover in the hog lots. This may further contribute to the elevated nutrient level in surface waters.

The other significant water quality problem observed in animal manure management was the poor utilization of manure, even where storage facilities do exist. There is a generally poor understanding of the nutrient value of lagoon and pit effluent. Most producers feel it has no value and treat it accordingly. This results in the over application of nutrients to cropland receiving treatment with animal manures.

In some extreme cases, it has been observed that manure storage systems are pumped out infrequently if ever. This usually leads, in time, to an overflow condition of the system. When that occurs, little water quality benefit has been gained by storing the waste products.

The Virginia Animal Waste Management Project (Project) was designed to try to address these specific areas of concern. By providing funds to assist farmers with proper animal manure management, two goals were pursued. The first was to improve the management practices of those actual recipients of cost-share funds. The second was to use these practices as local demonstration opportunities to educate other producers in the region and influence them to improve their level of management.

**Project Design**

**Location**

To implement this demonstration project, the Chowan river portions of the J. R. Horsley and Peanut Soil and Water Conservation Districts (SWCDs) were chosen as the geographical area to be covered. These two districts encompass Greensville, Sussex, Southampton, parts of Surry and Isle of Wight counties and the city of Suffolk. These counties and city constitute most of the headwaters of the Chowan River and much of that area in Virginia involved in intensive hog production. In 1987, these counties produced 137,500 hogs which was 36% of the total for the state. The Commonwealth of Virginia currently is supporting a state cost-share program in this area through the SWCDs. The options offered in this demonstration project were planned to complement those found in the state program.

**Manure Storage**

Two key practices were offered as a part of this demonstration. The first was the animal manure storage facility (WP-4). The storage facility is an essential and often expensive component of a manure management system. Without storage, proper utilization of manure for its full nutrient value is extremely difficult. In the Project proposal $65,000 was allocated for the construction of five new storage systems at a 75% cost-share rate. The 75% rate is the standard for the current state wide cost-share program. The 25% funding commitment by the landowner is felt to be an important investment that insures future maintenance of the facility. It was hoped that this high rate with no set ceiling on the cost-share assistance provided would be an effective incentive for producers to participate.

Two types of storage facility are normally used in hog production. The least expensive is an earthen lagoon. Where conditions permit, these are excavated to be gravity fed (or pumped) systems for the storage of manure generated by the confined production facility (see Fig. 3.). Available space, height of the water table and other considerations may make an earthen lagoon unfeasible. Under such conditions, concrete pits must be
Figure 3. Earthen Lagoon Manure Storage

Figure 4. Concrete Pit Manure Storage
constructed underneath the facility to store the manure (see Fig 4.). Such a facility may cost 5-10 times the investment for an earthen lagoon of the same storage volume.

Manure Application

The second key element of this project was to provide cost-share assistance for the land application of lagoon and pit wastes. Farmers could receive cost-share funds at the rate of $4.00/1,000 gallons of manure applied by tractor drawn equipment (see Fig. 5.) or $2.00/1,000 for manure applied with a traveling gun irrigation system (see Fig. 6.). Hauling the manure one tank load at a time with a tractor is a slow and time consuming business, especially considering the relatively low nutrient content of lagoon wastes. Manure from pit storage systems usually has a higher nutrient content but a travelling gun system is still the most cost effective means of application currently available.

Project plans called for pumping twenty five manure systems using cost-sharing. The objective of these pump downs was to demonstrate the fertilizer value of this effluent when properly applied. While many farmers empty their pits and lagoons periodically, few give proper consideration to timing and application rates. Their application of the manure is more a waste disposal effort than for nutrient utilization. The cost-sharing was intended to offset the costs of better managing the cropland application of the manure.

In addition to these two central practices, other best management practices needed for the support of these activities were also available. Each of these are currently supported by the statewide Virginia Agricultural BMP Cost-Share Program. The full list of practices offered for this project is found in Table 2.

<table>
<thead>
<tr>
<th>Best Management Practice</th>
<th>Unit</th>
<th>Cost-Share Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Storage Facility</td>
<td>System</td>
<td>75%</td>
</tr>
<tr>
<td>Land Application - Reel system</td>
<td>1,000 gal.</td>
<td>$2.00</td>
</tr>
<tr>
<td></td>
<td>Honey Wagons</td>
<td>$4.00</td>
</tr>
<tr>
<td>Legume Cover Crop</td>
<td>Acres</td>
<td>$25/A</td>
</tr>
<tr>
<td>Grazing Land Protection</td>
<td>Acres</td>
<td>75%</td>
</tr>
<tr>
<td>Stream Protection</td>
<td>Feet</td>
<td>75%</td>
</tr>
<tr>
<td>Water Control Structure</td>
<td>Structure</td>
<td>75%</td>
</tr>
<tr>
<td>Sod Waterways</td>
<td>Acres</td>
<td>75%</td>
</tr>
</tbody>
</table>
Figure 5. Application of lagoon wastes utilizing a pulled tank or honeywagon.

Figure 6. Manure application using a traveling gun irrigation system.
Nutrient Management Plans

All options in the Program required the development of a nutrient management plan. Components of a nutrient management plan are generally farm maps, soil productivity information, field specific recommendations and a plan narrative explaining its use. An example plan is provided in Appendix 7. All plans were authored by the DSWC's nutrient management specialist for that region. Assistance with the necessary field work was provided by the SWCDs and the other cooperating agencies.

The process of plan development required first determining the crop rotations being used and the specific fields they would be grown upon. Yield potentials for the soils present were determined by using a combination of field history, Soil Conservation Service soils information and university accepted yields for the soil productivity groups involved. Knowing these values, the nutrient needs for that level of production could be determined. How those needs were met was decided only after sampling both the cropland soils being farmed and the manure being produced for the nutrients present. This provided information on available plant nutrients. Based on these, recommendations were made for application rates to the fields receiving manure. The rates recommended were designed to meet plant needs without leaving excessive amounts of nitrogen or phosphorous which could be lost from the field and enter surface or ground waters. Any remaining crop nutrient deficiencies were compensated for by the recommendation of appropriate amounts of mineral fertilizer.

As a component of each demonstration, the nutrient management plan was extremely important. To receive assistance, cooperators were required to sign an agreement to both maintain the practice and follow the management plan (Example in Appendix 3). These assured a long term beneficial effect on those farms cooperating in the Project.

To maximize the demonstration benefits of the Project, six test plots also were planned on sites where the lagoon wastes were applied to cropland. These would allow the comparison of fields receiving manure to those without, showing its efficiency and value as a fertilizer. Utilizing these test plots, field days were to be planned to show both the new storage systems and the test plot results to other area producers. The hope was that these tours would encourage increased local adoption of both manure storage and proper land application techniques.

Project Implementation

Participant Selection

The first phase of the project was the selection of program participants. An initial meeting was held of government agency personnel involved in agriculture. The meeting, held on July 17, 1989 included the Virginia Cooperative Extension Service (VCES), USDA Soil Conservation Service (SCS), Agricultural Stabilization and Conservation Service (ASCS), the Division of Soil and Water Conservation (DSWC) and representatives of the two SWCDs. During
this meeting a list of potential candidates from each locality was
developed. These were individuals with a recognized need for
assistance who also were believed to be willing to cooperate.

Following this initial effort, further field work was done to
assess the actual needs of the individuals on the list. Factors
considered were the presence of live streams in the existing feed
lot, the number of animals, proximity to water supplies, presence
of erosion problems and total acres of cropland farmed. This
information was used to compare the potential water quality
benefits of the competing projects in each county. A point system
originally developed for servicing Rural Clean Water Project (RCWP)
requests was adopted for this task (Appendix 5.). The scores
provided by this point system helped determine who was contacted
first in each county for possible participation in the program.

Once a relative ranking was determined, the landowners were
contacted to request their participation. Those indicated as being
the highest priority did not always wish to participate. It was
necessary to move down the list contacting more individuals until
interested participants could be found. This resulted in an
initial group of applicants being established by October 1989. All
of these individuals signed a Nutrient Management Agreement at that
time as well as a cost-share request form (Appendix 4.). The list
of participants was completed by December 1st with six signed up
for construction of new storage systems and twenty requesting pump
downs.

Practice Installation

After program participants were identified, the first task was
to develop nutrient management plans for each. In addition to the
DSWC nutrient management specialist, technical assistance was also
rendered by SCS, VCES and District personnel. In support of this
effort, $3750 of the Project's funds were used by the J. R. Horsley
District to hire a part time technical employee. This assistance
was particularly critical in collecting the necessary soil and
manure samples. Without the information these provide, effective
plans could not have been written. Following this field work,
twenty seven actual plans were authored by the DSWC nutrient
management specialist.

While management plans were being written during the fall of
1989, designs also were being drawn up for the new storage systems.
Due to the time required for design and the late start in the year,
little of the actual construction was able to begin until the
spring of 1990. At that time the new constructions were begun.
Completion of the final system occurred in September 1990.

Initial plans had also called for some of the first pump downs
to be completed in the fall of 1989. An early freeze and heavy
snows, however, prevented these applications from being made. The
first pump downs were not begun until March of 1990, and were
carried out through the spring and summer on various crops. The
final application was completed in August 1990.

To support the timely reimbursement of cooperators, the DSWC
advanced the necessary funds to the districts based upon the
estimated costs reported on the request forms. This amount was then reimbursed by the State of North Carolina to the Commonwealth. A total of $71,934.72 was spent in cost-share for storage systems and $18,064.52 for pump downs. Including the funds used for technical assistance, the total A/P Study funds provided for the Project came to $93,749.24.

During the course of the project, efforts were made to promote the Project activities within the local agricultural community. To maximize the educational impact of the project, thirteen demonstration and test plots were established on fields where the lagoon or pit nutrients were applied. These applications involved such crops as corn, grain sorghum, peanuts, soybeans, cotton, small grain and also pasture and hay land. The plots allowed the comparison of fields receiving various types and amounts of manure nutrients to those without manure and with various fertilizer treatments. These plots demonstrated the efficiency of properly applied manure effluent as a nutrient resource and its economic value in producing crops and forages. Follow up will continue on these plots with deep soil testing for residual nutrients and also study of the next crop in the rotation. Also, field trips will be conducted next year to demonstrate the new storage facilities after they are operational. It is felt that these demonstrations will encourage increased interest, participation, use of manure storage and proper land application as a nutrient resource (see Appendix 8. for Demonstration and Test Plot descriptions). News releases are also being used to further publicize the project (Appendix 6.).

Summary and Conclusions

The perceived instability of the future in the hog market made the commitment of cooperators very difficult to obtain. Many were interested in participating but reluctant to commit the necessary funds, particularly for new constructions. Of the original six cooperators who signed up to build new storage systems, only five actually completed construction. An additional seven also cancelled out after initially expressing some degree of interest. Reasons included changes in future business plans, lack of an environmentally acceptable site and personal health problems. The two final cooperators recruited for the Project were not secured until well into the spring of 1990. Their late entry into the program resulted in their projects not being completed until early in the fall. This also resulted in significant extra work in developing nutrient management plans for those additional farms. Ultimately, two lagoons, one holding pond and four pits were constructed as components of five storage systems.

The pump downs proceeded more smoothly with the limiting factors being the weather, expense and number of available contractors. Snow and freezing weather prevented beginning the pump downs in the fall as originally planned. This caused scheduling problems getting all the work done the following spring. These were exacerbated by a general lack of contractors to do the
work. The cost of the pump downs and the total volumes involved were also higher than originally expected. All these factors worked together to reduce the actual number of pump downs completed. Instead of the planned twenty five we were only able to complete seventeen system pump downs. Specifically, eight pit storage facilities were pumped and twenty four lagoons with a total storage of 8,717,179 gallons. While still a success, this was somewhat fewer than hoped for when the project was planned.

A suggestion often made in the past for the Virginia Agricultural BMP program has been the inclusion of manure application as a cost-share option. The philosophy has always been to provide assistance for the construction of the storage system only. The problem made obvious in this region was that even those producers with storage systems weren't managing them efficiently. Having storage would seem to commit one to application but it was not a guarantee of good management.

The most significant shortcoming discovered during this project was the lack of local contractors or equipment for the proper application of the liquid manure. Even producers interested in doing so had limited opportunities if they did not own the equipment. The lack of equipment is likely to remain a limiting factor in proper manure management in the region and needs to be addressed further.

It was also discovered that some of the older lagoons had sludge accumulations to near the minimum operating level. This has both reduced their storage volume and the anaerobic treatment. This material is very difficult to remove without special and expensive agitation and pumping equipment.

A significant finding in this project was that the real need of the producer with animal manure is a nutrient management plan to show him the fertilizer value of his manure and how to best utilize it. Given that information, the producer has a much greater incentive to utilize that resource. Demonstration plots are one very effective tool for helping to reinforce that point. Of the thirteen plots installed for this Project, eight involved corn production. Crop failure prevented the collection of useable yield data on three of these but on the other five, manure applications demonstrated the ability to effectively replace mineral fertilizer (Appendix 8). In some cases this represented a potential savings of $43-53/acre without a reduction in crop yield.

This demonstration project also provided experience in considering several of the issues being addressed in the evaluation of the current state wide cost-share program. Changes and additions which have been previously suggested for the state program were evaluated in this demonstration.

One of these was the method by which cost-share funds are allocated. The state program has a computerized signup process which uses the soil loss rates or tons of manure managed by potential practices to determine the relative cost effectiveness of each. Funds are then allocated strictly upon this basis. Very little allowance is made for local judgement. Though not perfect,
this mechanism makes it possible to objectively compare all practices in the program for their potential benefit.

The approach taken in the demonstration was different. Because of the limited size and scope of the project, it was believed it might be possible to allow the selection process to be driven more by the judgement of the local technical agencies. Using their professional opinion, we had hoped to quickly develop a list of cooperators most in need of assistance and with the greatest possible water quality benefits. Selective recruitment would also eliminate the need for some type of formal signup period.

This proved to be a far more unwieldy process than originally thought. To differing degrees, individuals were either unwilling or unable to provide this type of information. There was considerable concern expressed about showing favoritism to particular producers. Most of the agencies represented preferred to have a more objective set of criteria for selecting cooperators. Though the actual methods used were different, the general technique was analogous to that employed in the state program.

The nature of the sign-up also worked to simulate a continuous sign-up for the program. This also has often been requested. What was discovered was that the lack of firm dates for program commitment contributed to excessive participant turnover. Getting all the available funds obligated this way was much more difficult than expected. While continuous sign up is of benefit to the applicants, it poses significant administration problems, particularly with projects having funding for a limited period of time.

Contributing to this management difficulty was the elimination of individual caps in the demonstrations. This made it very difficult to project available funds until near the completion of a specific practice. Both the storage systems and pump downs cost more on average than was expected. In some cases, both the existing and needed storage facilities in that region were larger than anticipated. Generally, the cost of new constructions was also greater than originally expected. The average cost-share paid was $14,386 versus the $13,000 budgeted per construction.

While this administrative difficulty was a real one, it is balanced by the needs of the producer. For many operations, the current state cost-share limit of $7,500 is too small an incentive. This is particularly true for those livestock facilities operating in areas with shallow water tables. In such a case, an earthen lagoon is not a viable option. In these cases, hog houses must be constructed with pits underneath. The cost for such buildings can easily exceed $50,000. The economic benefits of an enclosed confinement system are not generally adequate to justify this large an expense.

Demonstration projects of this type provide opportunities to have both immediate and long term positive water quality impacts. The individual practices installed in themselves have considerable water quality benefits in the year they are implemented. Probably of more importance, however, is the educational impact they have
upon the agricultural community. By instituting improvements in farm management, over time, nutrient loadings originating with agriculture can be substantially reduced. The project was successful in helping to move that educational process forward.

As an outcome of the demonstrations completed an additional 48,037 tons of swine manure were brought under management. The nutrient management plans implemented on these farms will help assure that the manure is properly stored and applied only in amounts which can be utilized by the crops. Based upon typical values for swine lagoon waste, this represents 240,185 lbs. of nitrogen brought under management and 288,222 lbs. of phosphate. With improved management, these nutrients will not be lost to ground and surface waters to contribute to the region's nutrient loading problems.

Recommendations

The cost of installing waste storage facilities and the weak agricultural economy indicates a continuing need to provide cost-share assistance for their construction. Producers should be provided an ongoing opportunity for assistance where they are willing to share in the cost of the necessary improvements. The construction of storage facilities is generally the greatest single expense of a manure management system. Because storage seems most often to be the limiting factor in achieving good management, it should continue to be the first priority for the utilization of the state's limited cost-share dollars.

Despite that conclusion, it is recognized that further support needs to be developed to promote the proper application of lagoon effluent. Though not as high a priority as providing storage, proper application is still a vital part of the management of these nutrients. A significant problem seems to exist in the region in getting all of these wastes properly applied. The shortage of necessary equipment or contractors to do the work indicates that additional avenues to promote proper application should be evaluated. Some alternatives to explore might include encouragement of SWCD's to provide the needed equipment on a rental basis. Similar services are already provided by some districts renting no-till cultivators and dry manure spreaders. General promotional activities in association with local rental might also help in developing a market which would attract other independent contractors to do this type of work.

Part of the promotion of better application of the wastes must continue to include a strong support for nutrient management planning. The information contained in a nutrient management plan is a significant incentive to better utilize an existing manure resource. Demonstration plots will need to continue to be a selling tool used in encouraging full adoption of the plan. They illustrate the reality of potential financial benefits of manure management outlined in the plan. The training of additional personnel in other agencies to provide this planning assistance should also be pursued. District employees in particular should
be given the necessary training to be able to render this type of service.

In administering this type of program, a compromise in participant selection is needed between using pure cost-effectiveness and recruitment based upon subjective opinions. A clear set of water quality objectives will be necessary in any future programs to guide the process of identifying candidates for program recruitment. Basic elements of these guidelines should probably begin with the designation of high priority areas which are already known to exist. Factors to then be considered should be the size and severity of the individual problem, its proximity to surface (or ground) water and the potential benefits of the project being considered. The actions then taken should be guided by a comprehensive conservation plan for the site. Without proper planning, there is little assurance that the appropriated practices are being implemented.

The benefits of the continuous sign up evaluated in this program are significant. To be workable, it requires close monitoring of ongoing projects. As a beginning, definite completion dates need to be set for all projects. Commitments to provide project funding cannot extend beyond the calendar limits of the funding for the larger program. Management of the money under these conditions also requires that there be understood practice funding limits before any work commences. While project cost estimates do often come in too low, making full utilization of the funds without established caps is virtually impossible. Given that these controls can be instituted, some form of continuous sign up or recruitment should be pursued for the state cost-share program.
Appendix 1. Final Budget Summary  
Virginia Animal Waste Management Project

<table>
<thead>
<tr>
<th>Practice</th>
<th># Systems</th>
<th>Tons Manure Managed</th>
<th>Total Cost</th>
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<tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Land Application of Existing Lagoon Wastes</td>
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<td>30,063</td>
<td>$18,064.52</td>
</tr>
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<td>B. New Animal Manure Storage Systems</td>
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<td>$71,934.72</td>
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<td>C. Technical Assistance</td>
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<td>Total A/P Study Funds</td>
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State Matching Funds Applied in J. R. Horsley SWCD

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<th>Practice</th>
<th># Systems</th>
<th>Tons Manure Managed</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. BMP Allocation</td>
<td>N/A</td>
<td>N/A</td>
<td>$29,167.00</td>
</tr>
<tr>
<td>B. Technical Assistance</td>
<td>N/A</td>
<td>N/A</td>
<td>$2,081.00</td>
</tr>
<tr>
<td>Virginia Total Matching Funds...</td>
<td></td>
<td></td>
<td>$31,250.00</td>
</tr>
</tbody>
</table>

Total Project Funds............................................. $124,999.24
### Appendix 2. List of Participants

<table>
<thead>
<tr>
<th>Name</th>
<th>Practice</th>
<th>County</th>
<th>Tons Managed</th>
<th>Cost-Share $</th>
</tr>
</thead>
<tbody>
<tr>
<td>W. Young</td>
<td>Pit</td>
<td>Southampton</td>
<td>550</td>
<td>$11,770.00</td>
</tr>
<tr>
<td>J. Lowe</td>
<td>Lagoon</td>
<td>Southampton</td>
<td>3054</td>
<td>$14,100.00</td>
</tr>
<tr>
<td>W. Carr</td>
<td>Lagoon</td>
<td>Isle of Wight</td>
<td>1045</td>
<td>$15,089.72</td>
</tr>
<tr>
<td>C. Fowler</td>
<td>Pits</td>
<td>Suffolk</td>
<td>1045</td>
<td>$17,100.00</td>
</tr>
<tr>
<td>R. Parson</td>
<td>Lagoon</td>
<td>Surry</td>
<td>1341</td>
<td>$13,875.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Subtotal</td>
<td>$71,934.72</td>
</tr>
<tr>
<td>P. Roberts</td>
<td>Pump down</td>
<td>Greensville</td>
<td>2537</td>
<td>$1,203.79</td>
</tr>
<tr>
<td>Fajna Brothers</td>
<td>Pump down</td>
<td>Greensville</td>
<td>2135</td>
<td>$1,053.51</td>
</tr>
<tr>
<td>C. Hawkins</td>
<td>Pump down</td>
<td>Greensville</td>
<td>4255</td>
<td>$1,660.00</td>
</tr>
<tr>
<td>G. Allen</td>
<td>Pump down</td>
<td>Greensville</td>
<td>964</td>
<td>$472.00</td>
</tr>
<tr>
<td>J. Clements</td>
<td>Pump down</td>
<td>Greensville</td>
<td>3217</td>
<td>$1,543.15</td>
</tr>
<tr>
<td>D. Wheeler</td>
<td>Pump down</td>
<td>Sussex</td>
<td>632</td>
<td>$510.00</td>
</tr>
<tr>
<td>W. Young</td>
<td>Pump down</td>
<td>Southampton</td>
<td>772</td>
<td>$306.58</td>
</tr>
<tr>
<td>R. Drake</td>
<td>Pump down</td>
<td>Southampton</td>
<td>4136</td>
<td>$820.79</td>
</tr>
<tr>
<td>H. Vincent</td>
<td>Pump down</td>
<td>Southampton</td>
<td>4612</td>
<td>$1,958.26</td>
</tr>
<tr>
<td>P. Branch</td>
<td>Pump down</td>
<td>Southampton</td>
<td>526</td>
<td>$304.44</td>
</tr>
<tr>
<td>L. Whitley</td>
<td>Pump down</td>
<td>Southampton</td>
<td>3219</td>
<td>$1,544.00</td>
</tr>
<tr>
<td>J. Newsom</td>
<td>Pump down</td>
<td>Southampton</td>
<td>3096</td>
<td>$1,485.00</td>
</tr>
<tr>
<td>R. Holland</td>
<td>Pump down</td>
<td>Isle of Wight</td>
<td>3110</td>
<td>$1,192.00</td>
</tr>
<tr>
<td>W. Daniels</td>
<td>Pump down</td>
<td>Suffolk</td>
<td>3000</td>
<td>$1,439.00</td>
</tr>
<tr>
<td>E. Felton</td>
<td>Pump down</td>
<td>Suffolk</td>
<td>715</td>
<td>$320.00</td>
</tr>
<tr>
<td>H. King</td>
<td>Pump down</td>
<td>Surry</td>
<td>2667</td>
<td>$1,135.00</td>
</tr>
<tr>
<td>J. Appel</td>
<td>Pump down</td>
<td>Surry</td>
<td>1366</td>
<td>$617.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Subtotal</td>
<td>$18,064.52</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total for all C·S</td>
<td>$89,999.24</td>
</tr>
</tbody>
</table>
Appendix 3. Nutrient Management Agreements

The following agreement was signed by all participants in the project. This statement establishes the necessity of now applying the nutrient management plans which were developed for each farm. It is understood that changes in cropping practices will require adjustments in this nutrient management plan. The intent is that the principles applied, particularly in the utilization of swine manure, be consistently continued. This aspect represents one of the most significant accomplishments of the Project.

Nutrient Management Agreement

The Undersigned hereby agrees to comply with the animal waste nutrient management plan developed for this farm with necessary revisions reflecting changes in crop rotations and manure compostation. Failure to comply will result in the reimbursement of the cost-share funds awarded.

William B. Daniel
Signature of Applicant

8-26-89
Date

Gary M. Needell
SWCD Representative

10-30-89
Title Date
Appendix 4. Cost-Share Agreements

The following agreement form used represents a contractual understanding between the landowners participating in the project and the two Soil and Water Conservation Districts handling the applications to receive cost-share assistance. These obligate those individuals receiving funds for the construction of new storage facilities for their proper maintenance for a period of ten years.

ANIMAL WASTE MANAGEMENT DEMONSTRATION
Appendix 5. Example Priority System Sheet

The following sheet was used as a means of objectively assessing the relative water quality impact of the potential projects being considered. This provided a means to choose between alternative projects within a county that would favor those providing the greatest water quality benefits.

<table>
<thead>
<tr>
<th>Ranking System for Chowan Project Candidates</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LANDOWNER</strong></td>
<td></td>
</tr>
<tr>
<td><strong>ANIMAL WASTE</strong></td>
<td></td>
</tr>
<tr>
<td>Live stream in feedlot</td>
<td></td>
</tr>
<tr>
<td>Number hogs or cows 0-100</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Distance to water supply lake or receiving blue line stream</td>
<td></td>
</tr>
<tr>
<td>Less than 1000 feet</td>
<td></td>
</tr>
<tr>
<td>1000 feet - 2500 feet</td>
<td></td>
</tr>
<tr>
<td>More than 2500 feet</td>
<td></td>
</tr>
<tr>
<td>50 points max.</td>
<td></td>
</tr>
<tr>
<td><strong>EROSION</strong></td>
<td></td>
</tr>
<tr>
<td>Gullies present</td>
<td></td>
</tr>
<tr>
<td>Distance to water supply lake or blue line stream</td>
<td></td>
</tr>
<tr>
<td>Less than 1000 feet</td>
<td></td>
</tr>
<tr>
<td>1000 feet - 2500 feet</td>
<td></td>
</tr>
<tr>
<td>More than 2500 feet</td>
<td></td>
</tr>
<tr>
<td>25 points max.</td>
<td></td>
</tr>
<tr>
<td><strong>PESTICIDES AND FERTILIZERS</strong></td>
<td></td>
</tr>
<tr>
<td><strong>A. Crop Rotation</strong></td>
<td></td>
</tr>
<tr>
<td>Corn (yes or no)</td>
<td></td>
</tr>
<tr>
<td>Soybeans (yes or no)</td>
<td></td>
</tr>
<tr>
<td>Peanuts (yes or no)</td>
<td></td>
</tr>
<tr>
<td>More than 100 Ac.</td>
<td></td>
</tr>
<tr>
<td>150 - 200</td>
<td></td>
</tr>
<tr>
<td>100 - 150</td>
<td></td>
</tr>
<tr>
<td>50 - 100</td>
<td></td>
</tr>
<tr>
<td><strong>B. Distance to lake or receiving blue line stream</strong></td>
<td></td>
</tr>
<tr>
<td>Less than 1000 feet</td>
<td></td>
</tr>
<tr>
<td>1000 feet - 2500 feet</td>
<td></td>
</tr>
<tr>
<td>More than 2500 feet</td>
<td></td>
</tr>
<tr>
<td><strong>C. Distance to non-blue line stream</strong></td>
<td></td>
</tr>
<tr>
<td>Less than 1000 feet</td>
<td></td>
</tr>
<tr>
<td>1000 feet - 2500 feet</td>
<td></td>
</tr>
<tr>
<td>More than 2500 feet</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
</tr>
<tr>
<td>60 - 100 points</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Less than 60</td>
<td></td>
</tr>
<tr>
<td>TOTAL SCORE</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 6. News Release Used

The following news release was provided to papers commonly subscribed to within the Project area. These included:

- The Suffolk News-Herald
- The Smithfield Times
- The Independent Messenger
- The Tidewater News
- The Sussex-Surry Dispatch
- The Southside Sun
DEMONSTRATION SEEKS TO ABATE ANIMAL WASTE POLLUTION

SUDDOLK - The safe storage and disposal of animal waste, particularly that of swine, has become a major concern of state officials and environmental groups in recent years. Such wastes, which include nutrients, have been linked to water quality decline in rivers and in the Chesapeake Bay.

A demonstration project initiated by the Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation (DSWC) seeks to help farmers find better ways of using animal waste. DSWC Environmental Planner Jim B. Lewis heads the project which features 30 sites.

"The most serious problem is waste storage. In a lot of swine operations, animals aren't confined so storage of the animals' waste is impossible," said Lewis. The demonstration project enables the Peanut and J. R. Horsley Soil and Water Conservation Districts to fund construction of animal waste lagoons in which waste is stored. The two districts
Take Two

encompass Greensville, Sussex, Southampton, Surry, and Isle of Wight Counties and Suffolk. The DSWC will pay 75 percent of the lagoons' construction costs.

The project also stresses the use of animal waste on cropland to supplement commercial fertilizer. Up to 25 farmers in these counties will be paid from $2 to $4 per acre to apply the swine waste, which includes nutrients vital to crop production but harmful to aquatic life.

The demonstration project requires a nutrient management plan from each participating farmer. According to Lewis, "The plan determines the fertilizer value of the animal waste and it insures that the waste is applied in proper amounts and at the proper time for crop uptake. This assures large crop yields while minimizing the chance that excess nutrients find their way into streams and groundwater."

The USDA Soil Conservation Service, the DWSC, the Virginia Cooperative Extension Service and local soil and water conservation districts help develop the plans. For more information, contact either district or call the DSWC at (804) 925-2470.
Appendix 7. Sample Nutrient Management Plan

The nutrient management plan provided here as an example is representative of the type of work done for all participants in the Project. Detailed plans of this type to direct the proper use of the swine manure produced on each farm are key to assuring a water quality benefit from each BMP installed.
Nutrient Management Plan
June 11, 1990

Dear Mr. Appel,

It is my pleasure to provide you with the enclosed Nutrient Management Plan. This Plan represents your decision to manage the farm's nutrient resource in the most economically and environmentally sound manner. The Plan is designed to meet your needs and current farming practices. If for any reason your operation should change please contact this office so the necessary revisions can be made. If I can be of any help with the implementation of this plan or if you have any questions please do not hesitate to call (tel. 804-925-2469).

Sincerely,

Harry O. Dalton
Nutrient Management Specialist

Enclosure
<table>
<thead>
<tr>
<th>Soil Name</th>
<th>Productivity Group</th>
<th>Yields for Common Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slagle (10)</td>
<td>2W</td>
<td>Corn 125 Bu.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peanuts 3500 lbs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wheat 45 Bu.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Soybeans 40 Bu.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pasture 9 Aum.</td>
</tr>
<tr>
<td>Yamassee (82)</td>
<td>2W</td>
<td>Corn 120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peanuts 3000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wheat 40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Soybeans 45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pasture 8</td>
</tr>
<tr>
<td>Craven (83) B</td>
<td>2W</td>
<td>Corn 115</td>
</tr>
<tr>
<td></td>
<td>3E</td>
<td>Peanuts 2900</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wheat 55</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Soybeans 45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pasture 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Yield Potential from:

* X SCS Soils 5
* Soil Survey
* Farm History

DCR/DSWC (11/89)
<table>
<thead>
<tr>
<th>Field</th>
<th>Acres</th>
<th>Crop Rotation</th>
<th>Yield Potential</th>
<th>Nutrient Needs (Soil Test) N - P - K</th>
<th>Manure (Nutrients Per/Loads) N - P - K</th>
<th>Other Sources (legume, etc.) N - P - K</th>
<th>N - P - K (Surplus) vs. Needed</th>
<th>Commercial N - P - K</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2,3</td>
<td>85</td>
<td>small grain</td>
<td>60 Bu.</td>
<td>100-60-60</td>
<td>Lagoon .5 in. 65-48-45</td>
<td>45-0-0 following peanuts</td>
<td>(10)-12-15</td>
<td>0-0-0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pits 3000 gal (3) 56-32-38</td>
<td></td>
<td>(1)-28-22</td>
<td>0-0-0</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>grain sorghum</td>
<td>100 Bu.</td>
<td>125-60-60</td>
<td>Lagoon 1 inch 131-96-90</td>
<td>0-0-0</td>
<td>(6)- (36)- (30)</td>
<td>0-0-0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pits 6000 gal 49-59-70</td>
<td></td>
<td>76- (1)- (10)</td>
<td>75-0-0</td>
</tr>
<tr>
<td>peanuts</td>
<td>3000 lbs.</td>
<td>0-0-0</td>
<td>0-0-0</td>
<td>0-0-0</td>
<td>0-0-0</td>
<td></td>
<td>0-0-0</td>
<td>0-0-0</td>
</tr>
</tbody>
</table>

*Notes 1. Based on application of lagoon effluent at planting or early growth stage on small grain at .5 inch / acre by irrigation following peanut rotation. If not following peanuts, can use .75 in. / acre.
2. Same as #1 except application of 3000 gals. / acre from pits immediately incorporated.
3. Based on application of lagoon effluent at planting or early growth stage for grain sorghum at rate of 1" per acre following small grain.
4. Same as #3 except application of 6000 gals. per acre from pits for no-till sorghum, with no incorporation. Pit manure is based on average values - test when ready to pump.
5. When no manure is used, follow soil or tissue test.
ANIMAL NUTRIENTS

This is a swine operation with 80 sows, farrow to finish. The confinement facilities consist of: a cargill floor and lagoon to accommodate 600 finish hogs; a farrow house with pit to accommodate 20 sows; a nursery with pit to accommodate 350 pigs. The lagoon and pits are designed for 180 days storage of 308,286 gallons between the minimum and maximum operating levels, and 47,932 gallons in the pits.

Twice per year the facilities will need pumping. The lagoon will be pumped by irrigation, and the pits with a honey wagon, in the fall on small grain and in the late spring on grain sorghum. The fall application can be incorporated but the spring application is applied to no-till sorghum. (See Manure Utilization Worksheet pages 1 and 2, Manure Composition and Values, and the Job Sheet.) Since the storage pits are new, the values used are averages. Manure samples should be taken and analyzed when ready to pump.

LEGUME RESIDUE

A credit for nitrogen should be given following the harvest of legume crops such as soybeans and peanuts. (See sheet on Legume Residue.)

COMMERCIAL FERTILIZER

Commercial fertilizer should be used to supplement manure and legume residue sources of plant nutrients. Split applications of commercial fertilizers, side dressing, top dressing, and timing applications to meet plant needs are practices which should be used whenever possible.

ADDITIONAL CONSIDERATIONS

Some important factors in the management of this system are:

1. Utilize manure, soil and tissue test recommendations to guide management decisions.
2. Avoid or reduce nutrient applications near streams, wells, or environmentally sensitive areas.
3. Control erosion in fields receiving nutrient application.
4. Maintain proper pH levels for maximum plant utilization of applied nutrients.

Additional help can be obtained on erosion and other farm management objectives from your local SCS or Extension Service office.
Manure Composition and Values

Name: John Appel

Number of Animals: 1000
Type: swine
Total Manure Volume Produce per year: 712,500 gals. (L. 616572+P.95864)

Manure Composition and Value

<table>
<thead>
<tr>
<th>Nutrient Availability per: 1000 gals. (Tons or 1000 gal.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1 Content</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>P2O5</td>
</tr>
<tr>
<td>K2O</td>
</tr>
<tr>
<td>Residual N</td>
</tr>
<tr>
<td>YR 2</td>
</tr>
<tr>
<td>YR 3</td>
</tr>
<tr>
<td>YR 4</td>
</tr>
</tbody>
</table>

Values from - Manure test: X
Average Value:

Value per: 1000 gals. (Tons or 1000 gal.)

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>$/lb.</th>
<th>Total value / Nutrient</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>4.85</td>
<td>1.16</td>
</tr>
<tr>
<td>P2O5</td>
<td>3.54</td>
<td>0.92</td>
</tr>
<tr>
<td>K2O</td>
<td>3.31</td>
<td>0.53</td>
</tr>
</tbody>
</table>

Total value of Manure: $ 2.61 / 1000 gals.

27,150 gals. x $2.61 = $70.86/acre

Manure Utilization

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield Potential</th>
<th>Acres</th>
<th>Quantity Manure/acre</th>
<th>Total Manure Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEE MANURE UTILIZATION WORKSHEETS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Potential Utilization of Manure: 2,375,500
Total Manure Produce: 712,500
Remainder (if any): (-1,663,000)

DCR/DSWC (11/89)
I AMOUNT OF MANURE  308,286 (gallons)/180 days 1 time (tons) (lagoon)

II MANURE ANALYSIS 1 lbs/1000 gals.

<table>
<thead>
<tr>
<th>N</th>
<th>NH4-N</th>
<th>P2O5</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.70</td>
<td>5.14</td>
<td>5.06</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>K2O</th>
<th>Ca</th>
<th>Mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.73</td>
<td>2.05</td>
<td>0.81</td>
</tr>
</tbody>
</table>

III NUTRIENT AVAILABILITY

A. Immediate Incorporation

\[ N = \left( \frac{1}{2} \times \text{inorganic } N \right) + \left( 0.5 \times \text{organic } N \right) + \text{ (residual) } \]

\[ P = \left( \frac{1}{2} \times \text{total } P2O5 \right) \]

\[ K = \left( \frac{1}{2} \times \text{total } K2O \right) \]

B. Delayed Incorporation ( \( \geq 7 \) days) Irrigated

\[ N = \left( \frac{1}{2} \times \text{inorganic } N \right) + \left( 0.5 \times \text{organic } N \right) + \text{ (residual) } \]

\[ \left( \frac{1}{2} \times 5.14 \right) + \left( 0.5 \times (9.70 - 5.14) \right) \]

\[ P = 0.70 \times \text{total } P2O5 \]

\[ K = 0.70 \times \text{total } K2O \]

IV RESIDUAL, N

Second Year \( 0.12 \times (9.70 - 5.14) = 0.55 \) lbs/1000 gal.

Third Year \( 0.05 \times " = 0.23 \) lbs/1000 gal.

Fourth Year \( 0.02 \times " = 0.09 \) lbs/1000 gal.

V APPLICATION

<table>
<thead>
<tr>
<th>Type of applicator</th>
<th>Irrigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of applicator</td>
<td>( N ) 13 lbs</td>
</tr>
</tbody>
</table>

Amount/Acre  1" or 27,150 gals.

Acres Needed \( 308,286 \div 27150 = 11.4 \) acre

Acres Available  50 small grain and grain sorghum
MANURE UTILIZATION
WORKSHEET

Sheet 2 of 2

I AMOUNT OF MANURE 95,864 (gallons) / year _________ (tons) new pits

II MANURE ANALYSIS 1 lbs/1000 gals. (average)

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Amount (lbs/1000 gals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>26.8</td>
</tr>
<tr>
<td>NH₄-N</td>
<td>21.2</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>14.0</td>
</tr>
<tr>
<td>K₂O</td>
<td>16.7</td>
</tr>
<tr>
<td>Ca</td>
<td>8.6</td>
</tr>
<tr>
<td>Mg</td>
<td>5.1</td>
</tr>
</tbody>
</table>

III NUTRIENT AVAILABILITY

A. Immediate Incorporation

\[
N = \left( \frac{.75 \times \text{inorganic N}}{\text{.75} \times 21.2} \right) + (0.5 \times \text{organic N}) + \text{(residual)}
\]

\[
P = \frac{.75 \times \text{total P₂O₅}}{14.0}
\]

\[
K = \frac{.75 \times \text{total K₂O}}{16.7}
\]

B. Delayed Incorporation ( > 7 days)

\[
N = \left( \frac{.25 \times \text{inorganic N}}{.25 \times 21.2} \right) + (0.5 \times \text{organic N}) + \text{(residual)}
\]

\[
P = \frac{.70 \times \text{total P₂O₅}}{14.0}
\]

\[
K = \frac{.70 \times \text{total K₂O}}{16.7}
\]

IV RESIDUAL N

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount (lbs/1000 gals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second Year</td>
<td>0.67</td>
</tr>
<tr>
<td>Third Year</td>
<td>0.28</td>
</tr>
<tr>
<td>Fourth Year</td>
<td>0.11</td>
</tr>
</tbody>
</table>

V APPLICATION

<table>
<thead>
<tr>
<th>Type of applicator</th>
<th>Honeywagon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of applicator</td>
<td>1000 gals.</td>
</tr>
</tbody>
</table>

Immediate Nutrients per load

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Amount (lbs/1000 gals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>18.7</td>
</tr>
<tr>
<td>P</td>
<td>10.5</td>
</tr>
<tr>
<td>K</td>
<td>12.5</td>
</tr>
</tbody>
</table>

Amount/Acre 5000 gals. (N= 94 lbs, P= 53 lbs, K= 63 lbs.)

Acres Needed 95,864 \div 5000 = 20 acres

Acres Available 50 small grain and grain sorghum
LEGUME RESIDUE

Fertilizer applications on crops following a legume crop, or grass/legume mixture, should reflect the nitrogen fixing ability of the legume. The following are some standard guidelines for determining the amount of nitrogen provided by a legume:

Alfalfa - 40 lbs for grass/alfalfa stand plus 1 lb. for each percent of alfalfa (i.e. a 50% stand would contribute 90 lbs. of N).

Clover - 40 lbs. for grass/clover stand plus 3/4 lb. for each percent of clover.

Soybeans - 1 lb. per bushel of soybean yield (not to exceed 40 lbs.).

Peanuts - 30 lbs. per ton of peanut yield (full credit is given to small grain, and 55% credit is given to corn).

The Management Plan Table reflects this N credit by reducing other nitrogen applications.

COMMERCIAL

Commercial fertilizer should be used to supplement manure and legume supplied nutrients (see Management Plan Table for recommendations). Split applications of commercial fertilizer, side dressing, and timing applications to meet plant needs are practices which should be used when ever possible.

ADDITIONAL CONSIDERATIONS

Some important factors in the management of this system are:

(1) Utilize manure, soil and tissue test recommendations to guide management decisions.

(2) Avoid or reduce fertilization near streams, wells or environmentally sensitive areas (see plan map).

(3) Control erosion on all fields receiving any type of fertilizer (contact the local Conservation District Office for assistance with erosion control needs).

(4) Maintain proper pH levels for maximum plant utilization of applied nutrients.
Appendix 8. Demonstration and Test Plots

The following list describes the types and locations of test plots and demonstrations established as a part of the Virginia Animal Waste Management Project. The summary table is followed by a brief report on each individual demonstration.

<table>
<thead>
<tr>
<th>Crop</th>
<th>County</th>
<th>Cooperator</th>
<th>Test</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>Greensville</td>
<td>Clements</td>
<td>Manure/Fertilizer</td>
<td>Comparable yields</td>
</tr>
<tr>
<td>Corn</td>
<td>Greensville</td>
<td>Fajna</td>
<td>Manure/Fertilizer</td>
<td>(no yield data due to crop failure)</td>
</tr>
<tr>
<td>Corn</td>
<td>Southampton</td>
<td>Drake</td>
<td>Manure/Fertilizer</td>
<td>Same yield for $43.60/A less.</td>
</tr>
<tr>
<td>Corn</td>
<td>Southampton</td>
<td>Branch</td>
<td>Manure/Fertilizer</td>
<td>(no yield data due to crop failure)</td>
</tr>
<tr>
<td>Corn</td>
<td>Sussex</td>
<td>Wheeler</td>
<td>Manure/Fertilizer</td>
<td>Comparable yields</td>
</tr>
<tr>
<td>Corn</td>
<td>Surry</td>
<td>King</td>
<td>Manure/Fertilizer</td>
<td>(no yield data available)</td>
</tr>
<tr>
<td>Corn</td>
<td>Suffolk</td>
<td>Felton</td>
<td>Manure/Fertilizer</td>
<td>Comparable yields,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Manure value $47.68/A</td>
</tr>
<tr>
<td>Corn (no-till)</td>
<td>Suffolk</td>
<td>Daniel</td>
<td>Manure/Fertilizer</td>
<td>Comparable yields,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Manure saved $53.70/A</td>
</tr>
<tr>
<td>Peanuts</td>
<td>Greensville</td>
<td>Roberts</td>
<td>Manure only</td>
<td>No yield response.</td>
</tr>
<tr>
<td>Peanuts</td>
<td>Isle of Wight</td>
<td>Holland</td>
<td>Manure only</td>
<td>No yield response.</td>
</tr>
<tr>
<td>Cotton</td>
<td>Greensville</td>
<td>Hawkins</td>
<td>Manure/Fertilizer</td>
<td>No yields available.</td>
</tr>
<tr>
<td>Grain sorghum</td>
<td>Surry</td>
<td>Roberts</td>
<td>Manure/Fertilizer</td>
<td>No yields available.</td>
</tr>
<tr>
<td>Bermuda grass</td>
<td>Southampton</td>
<td>Whitley</td>
<td>Manure only</td>
<td>No yields available.</td>
</tr>
</tbody>
</table>
**Cowan Demonstration Project**

Department of Conservation and Recreation  
Division of Soil and Water Conservation

**Nutrient Management Test Plot**

********************************************************************************

**Study:** Application of lagoon effluent for nutrients on no-till corn comparing to fertilizer.

**Summary:** Response to lagoon effluent is apparent but the water content is also obvious. Next year compare the effluent with clean water irrigation.

**Year:** 1990  
**Crop:** Corn

**Description:** 2 fields adjacent to lagoon. Field 6 (4 acres) received 1" effluent @ 1" applications. Field 5 received 1" application with various fertilizer application along with check plot.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Average Yield</th>
<th>Ferts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Starter, sidedress, manure (3&quot;) (265N)</td>
<td>127.4 bu</td>
<td>25.64</td>
</tr>
<tr>
<td>2. Starter + manure (3&quot;) (205 N)</td>
<td>109.1 bu</td>
<td>11.24</td>
</tr>
<tr>
<td>3. Sidedress + manure (1&quot;) (107 N)</td>
<td>93.5 bu</td>
<td>10.08</td>
</tr>
<tr>
<td>4. Starter, sidedress, manure (1&quot;) (177N)</td>
<td>81.7 bu</td>
<td>35.72</td>
</tr>
<tr>
<td>5. Starter, sidedress, no manure (112 N)</td>
<td>46.4 bu</td>
<td>35.72</td>
</tr>
</tbody>
</table>

**Physiographic Region:** Coastal Plains  
**Soil Type/Productivity Level:** Slagle II

**Climatic Factors:** Average except dry and hot in July

**Data Collected By:** H. Dalton 9-12-90

**Cooperator/County:** Jeffrey Clements Greensville

**Comments:** Plot 1 & 2 received lagoon effluent in three 1" applications at planting, at 18" high and early July. Plots 3 & 4 received 1" applications in early July.

**Backup Data Available:** Soil samples, manure samples

**Audience:** Individuals and community farmers
**CHOWAN DEMONSTRATION PROJECT**

Department of Conservation and Recreation
Division of Soil and Water Conservation

**NUTRIENT MANAGEMENT TEST PLOT**

**STUDY:** Application of swine manure from pits at pre-plant and injected at 18" high with starter fertilizer and without starter. Also with sidedressing and without, and also with regular fertilizer application with no manure.

**SUMMARY:** Yields from various treatments were comparable but treatment costs were variable.

---

**YEAR:** 1990  
**CROP:** Corn (Pioneer 3389)

**DESCRIPTION:** (36 Rows with 36 inch width) 4 rows with starter and manure; 8 rows with manure only; 12 rows with sidedressing and manure, and balance with no manure with regular application of starter and sidedress nitrogen. Each manure treatment had 4000 gals. broadcast at pre-plant and 2000 gals. injected at 18" high.

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>AVERAGE YIELD</th>
<th>COMM FERT COST</th>
</tr>
</thead>
</table>
| A. Manure + starter  
79-29-41 + 27-69-120 + 30-0-0 from vines  
Total N = 136 lbs. | 125.2 bu/ac | $43.60 |
| B. Manure only  
Total N = 109 lbs. | 120 bu/ac | $0.00 |
| C. Manure + sidedress  
79-29-41 + 45-0-0 + 30-0-0 Total N = 15 lbs. | 118 bu/ac | $10.80 |
| D. Starter + sidedress  
Total N = 157 lbs. Coastal plain Chowan watershed | 124 bu/ac | $67.62 |

**SOIL TYPE/PRODUCTIVITY LEVEL:** Slagle Class IIW Prod-Level 2

**CLIMATIC FACTORS:** Average rainfall for growing season

**DATA COLLECTED BY:** Harry Dalton

**COOPERATOR/COUNTY:** Roger Drake  
Southampton Co.

**COMMENTS:** 6000 gallons of manure gave comparable yield at less cost per acre.

**BACKUP DATA AVAILABLE:** Soil and manure test analysis

**AUDIENCE:** Individuals and community farmers.
**NUTRIENT MANAGEMENT TEST PLOT**

**STUDY:** Application of lagoon effluent from swine lagoon to supply nutrients for no-till corn and compare to regular fertilizer use.

**SUMMARY:** Yield was somewhat better from the effluent application, but the additional water probably made the difference at a very hot and dry period.

**YEAR:** 1990  
**CROP:** Corn (no-till)

**DESCRIPTION:** A total of 2 inches of lagoon effluent was irrigated on corn with no commercial fertilizer applied on half of field; compared to balance of field with no manure and regular fertilizer treatment.

**TREATMENT**

<table>
<thead>
<tr>
<th>Plot 1</th>
<th>All lagoon effluent Total N=132 lbs. 102-54-163 + 30-0-0 from vines</th>
<th>AVERAGE YIELD</th>
<th>FERT COST/AC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>98.3 bu/ac</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plot 2</th>
<th>Starter 250 lbs 6-18-36 + 100 lbs N sidedressed + 90-0-0 from vines Total N=145 lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>93.7 bu/ac</td>
</tr>
</tbody>
</table>

**PHYSIOGRAPHIC REGION:** Coastal Plain  
**SOIL TYPE/PRODUCTIVITY LEVEL:** Eurol o, Suffolk  
**CLIMATIC FACTORS:** Average except hot and dry in July

**DATA COLLECTED BY:** Harry Dalton  
**COOPERATOR/COUNTY:** William Daniel, Suffolk

**COMMENTS:** Yield was reduced due to dry and extremely hot in July. Second inch of effluent was applied in July helped.

**BACKUP DATA AVAILABLE:** Soil and manure test analysis

**AUDIENCE:** Individuals and community farmers.
Department of Conservation and Recreation
Division of Soil and Water Conservation

NUTRIENT MANAGEMENT TEST PLANT

STUDY: Application of swine manure from Farrow Nursery Pit and anaerobic lagoon on corn.

SUMMARY: The 3 plots were about the same yield comparing effluent from the lagoon or pit to check plot with only fertilizer.

YEAR: 1990
CROP: Corn

DESCRIPTION: 36 row plots had: (1) applied 7000 gals. effluent from pit, (2) 7000 gals. from lagoon, (3) no manure-lime
(Manure plots received 25 lbs. N. sidedressing)

TREATMENT
1. 7000 gals. manure lagoon + 25 lbs. N N=104 lbs. N 116.5 bu/ac $ 6.00
2. 7000 gals. manure pit + 25 lbs. N N=105 lbs. N 122.9 bu/ac $ 6.00
3. No manure, 130 N, 60P, 60 K N=130 lbs. N 121.3 bu/ac $56.40

Average Yield: 119.4 bu/ac Fertilizer Cost: $ 6.00

PHYSIOGRAPHIC REGION: Coastal Plain
Chowan watershed

SOIL TYPE/PRODUCTIVITY LEVEL: Eunola II

CLIMATIC FACTORS: Average rain for growing season (Short dry period July)

DATA COLLECTED BY: H. O. Dalton Suffolk

COORDINATOR/COUNTY: E. L. Felton Suffolk

COMMENTS: Manure was applied and incorporated prior to planting. Previous crop peanuts (30 lbs. N)

BACKUP DATA AVAILABLE: Soil tests, manure tests

AUDIENCE: Individuals and community farmers
**Cowan Demonstration Project**

Department of Conservation and Recreation  
Division of Soil and Water Conservation  

**Nutrient Management Test Plot**

**Study:** Application of swine lagoon effluent for cotton as nutrient source at rate of 1" or 27,150 gals/ac. compared to commercial fertilizer.

**Summary:** Lagoon effluent was applied by commercial applicator later than desired (late July). No apparent yield difference in treatment.

**Year:** 1990  
**Crop:** Cotton

**Description:** Approximately half of field (14 acres) received 1" of effluent in late July along with starter fertilizer at planting. The balance of field received normal fertilizer application.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Average Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter + sidedress Total = 80-54-108</td>
<td>(Unable to check yields)</td>
</tr>
<tr>
<td>(no manure)</td>
<td></td>
</tr>
<tr>
<td>Starter + 1&quot; manure Total = 78-74-123</td>
<td></td>
</tr>
</tbody>
</table>

**Physiographic Region:** Coastal plain Cherokee watershed  
**Soil Type/Productivity Level:** Emporia Group 2  
**Climatic Factors:** Average rain except dry period in August

**Data Collected By:** Harry Dalton  
**Cooperator/County:** Glen Hawkins Greensville Co.

**Comments:** Interested in trying test next year with early application to plot with no commercial fertilizer.

**Backup Data Available:** Soil and manure test analysis

**Audience:** Individual and community farmers (Farm supply dealer)
**Cowan Demonstration Project**

Department of Conservation and Recreation  
Division of Soil and Water Conservation

**Nutrient Management Test Plot**

*Study:* Application of swine lagoon effluent to grain sorghum following barley compared to plot with sidedress nitrogen.

*Summary:* Yield looked good but no apparent response to response to additional N.

**Year:** 1990  
**Crop:** Grain Sorghum

**Description:** 12 rows with manure and 30 lbs. N sidedressed. Balance of field received 1" application of manure only.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Average Yield</th>
</tr>
</thead>
</table>
| 1. 12 rows with 30 lbs. nitrogen  
Total N = 161 lbs. Sidedress + 1" manure (131-96-90) | No yield data |
| 2. Manure 1" application (131-96-90) with no fertilizer  
Total N=131 lbs. | |

**Physiographic Region:** Coastal Plains  
**Chowan watershed**

**Soil Type/Productivity Level:** Slagle, Yamassee Level 2

**Climatic Factors:** Average season

**Data Collected By:** H. Dalton

**Cooperator/County:** John Appel  
**Surry**

**Comments:** Will check for residual N on next crop in rotation

**Backup Data Available:** Soil and manure test analysis

**Audience:** Individuals and community farmers
NUTRIENT MANAGEMENT TEST PLOT

* STUDY: Application of swine lagoon effluent on peanuts to determine yield response.

* SUMMARY: No yield response was apparent.

YEAR: 1990 CROP: Peanuts

DESCRIPTION: Long rows in field received .5" of effluent with remainder of field normal treatment.

TREATMENT AVERAGE YIELD
1. 10 ac. with .5 effluent (41-17-39) No yield data
2. Balance of field no fertilizer

PHYSIOGRAPHIC REGION: Coastal Plains Chowan watershed

SOIL TYPE/PRODUCTIVITY LEVEL: Slagle Level 1 Peanuts

CLIMATIC FACTORS: Average

DATA COLLECTED BY: H. Dalton

COOPERATOR/COUNTY: Perry Roberts Greensville Co

COMMENTS: Treatment B is standard practice for peanuts with P & K applied to previous crop. (Corn)

BACKUP DATA AVAILABLE: Soil and manure analysis

AUDIENCE: Individuals and community farmers
COWAN DEMONSTRATION PROJECT

Department of Conservation and Recreation
Division of Soil and Water Conservation

NUTRIENT MANAGEMENT TEST PLOT

* STUDY: Application of 3000 gallons swine manure from farrow-nursery pit vs. chemical fertilizer.

* SUMMARY: Same yield from both plots. No response to manure

YEAR: 1990 CROP: Corn

DESCRIPTION: Application of manure and without manure. Each received 400 lbs. 6-18-36 starter plus 80 lbs. sidedress N.

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>AVERAGE YIELD</th>
<th>FERTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 104 lbs. N fert + 29 lbs. from manure + 30 lbs. N from bean vines.</td>
<td>112.3 bu.</td>
<td>66.72</td>
</tr>
<tr>
<td>2. 104 lbs. N fert + 30 lbs. N (soybean vines) 134 N</td>
<td>112.3 bu.</td>
<td>66.72</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PHYSIOGRAPHIC REGION: Coastal Plains Chowan watershed

SOIL TYPE/PRODUCTIVITY LEVEL: Mattaponi II

CLIMATIC FACTORS: Average rain except dry in July

DATA COLLECTED BY: H. Dalton

COOPERATOR/COUNTY: David Wheeler Sussex

COMMENTS: Given time would like to use more manure and less fertilizer for plots. (Maybe next year)

BACKUP DATA AVAILABLE: Soil Samples, manure samples

AUDIENCE: Individuals and community farmers
COWAN DEMONSTRATION PROJECT
Department of Conservation and Recreation
Division of Soil and Water Conservation

NUTRIENT MANAGEMENT TEST PLOT

* STUDY: Apply manure to corn plots from lagoon, farrow pit and finish pit at various rates to compare each and with commercial fertilizer.

* SUMMARY: Corn looked good until July when very hot and dry period at critical time reduced yields to failure status on entire field.

YEAR: 1990  CROP: Corn

DESCRIPTION: (13 rows = 1 ac) 1 plot with 5000 gallons effluent from finish pit, 1 plot with 5000 gallons from farrow pit and 1 plot using 1" lagoon irrigated on (Balance of field).

TREATMENT  AVERAGE YIELD
1. Finish Pit Manure + 30-0-0 (vines) No yield data
   Total N = 132 lbs. 102-79-42
2. Farrow Pit manure + 30-0-0 (vines)
   Total N = 132 lbs. 102-79-42
3. Lagoon manure + 30-0-0 + 20 lbs. N sidedress
   Total N = 126 lbs. 76-93-132

PHYSIOGRAPHIC REGION: Coastal Plains  Chowan watershed

SOIL TYPE/PRODUCTIVITY LEVEL: Emporia  Level 2

CLIMATIC FACTORS: Very dry and hot July critical period

DATA COLLECTED BY: H. Dalton

COOPERATOR/COUNTY: Pajna Brothers  Greensville

COMMENTS: Dry weather at critical period reduced yields in entire field. Too poor to check yields.

BACKUP DATA AVAILABLE: Soil and manure test analysis

AUDIENCE: Individuals and community farmers
**Cowan Demonstration Project**

Department of Conservation and Recreation
Division of Soil and Water Conservation

**Nutrient Management Test Plot**

**************************************************
**STUDY:** Application of swine effluent from lagoon, farrow pit and finish pit at different rates on no-till corn to compare yields with normal fertilizer program.

**SUMMARY:** Due to extreme dry and hot weather at critical growth period, the corn was very poor, therefore, no yield check was done.

**************************************************

**Year:** 1990  
**Crop:** Corn

**Description:** (See Treatments)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Average Yield</th>
</tr>
</thead>
</table>
| 1. Lagoon at 6600 gals/ac 32-42-29 +90 lbs  
  Sidedress N  
  Total N = 122 lbs. | No yield data |
| 2. Farrow pit at 6600 gals/ac 37-15-41 +  
  55 lbs. Sidedress N + 30 lb vines  
  Total N = 122 lbs. |               |
| 3. Finish pit at 3300 gals/ac 71-145-53 +  
  50 lbs. Sidedress N. Total N = 121 lbs |               |
| 4. Balance field at normal fert.  
  Total N = 120 lbs. (120-25-50) |               |

**Physiographic Region:** Coastal Plains  
**Chowan watershed**

**Soil Type/Productivity Level:** Slagle  
**Level 2 Rumford Level 4**

**Climatic Factors:** Very dry and hot July

**Data Collected By:** H. Dalton

**Cooperator/County:** Branch Brothers  
**Southampton**

**Comments:** With adequate rainfall this would have been a good demonstration utilizing various types and rates of manure.

**Backup Data Available:** Soil and manure analysis

**Audience:** Individuals and community farmers
COWAN DEMONSTRATION PROJECT

Department of Conservation and Recreation
Division of Soil and Water Conservation

NUTRIENT MANAGEMENT TEST PLOT

*****************************************************************

STUDY: Application of swine lagoon effluent to peanuts to no-till corn comparing to fertilizer test for yield response.

SUMMARY: For this test, there was no noticeable yield response to effluent and no apparent detrimental effect.

*****************************************************************

YEAR: 1990  CROP: Peanuts

DESCRIPTION: Half of field received .5 inch of lagoon effluent compared to half of field with no effluent and no fertilizer.

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>AVERAGE YIELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. With manure .5&quot;</td>
<td>14.3 - 32</td>
</tr>
<tr>
<td>2. Without manure</td>
<td>(no fertilizer)</td>
</tr>
</tbody>
</table>

PHYSIOGRAPHIC REGION: Coastal Plains  Chowan watershed

SOIL TYPE/PRODUCTIVITY LEVEL: Slagle  Prod Level 2

CLIMATIC FACTORS: Average

DATA COLLECTED BY: H. Dalton

COOPERATOR/COUNTY: Ray Holland  Isle of Wight

COMMENTS: Will check the response to residual nitrogen to the following corn rotation.

BACKUP DATA AVAILABLE: Soil samples, manure test analysis

AUDIENCE: Individuals and community farmers
CHOWAN DEMONSTRATION PROJECT

Department of Conservation and Recreation
Division of Soil and Water Conservation

NUTRIENT MANAGEMENT TEST PLOT

**STUDY:** Application of swine lagoon effluent to Tifton 44 Bermuda grass with solid set irrigation system for intensive grazing program.

**SUMMARY:** Bermuda was planted in early June and irrigation system was installed in May, prior to planting. Lagoon effluent was irrigation applied at .25 inch rate for a total of 2.5 inches/year to supply nutrients and supplemental water for establishment of the grass. A stand was established and looked good at the end of summer.

YEAR: 1990

**CROP:** Bermuda Grass (Tifton 44)

**DESCRIPTION:** 10.5 acre field on Highway 642. 2.5 inches applied per year equals approximately 400 lbs. of N per acre.

**TREATMENT**

<table>
<thead>
<tr>
<th>10.5 acre field</th>
</tr>
</thead>
</table>

**AVERAGE YIELD**

<table>
<thead>
<tr>
<th>N/A this year</th>
</tr>
</thead>
</table>

**PHYSIOGRAPHIC REGION:** Coastal plain

**SOIL TYPE/PRODUCTIVITY LEVEL:** Tetotum, Suffolk Level 1 (Bermuda)

**CLIMATIC FACTORS:** Below normal rainfall for summer

**DATA COLLECTED BY:**

| Harry Dalton |

**COORDINATOR/COUNTY:**

| Larry Whitley  | Southampton Co |

**COMMENTS:** This field will be cross-fenced and intensively grazed next year with surplus cut for hay.

**BACKUP DATA AVAILABLE:** Soil and manure test analysis.

**AUDIENCE:** Individuals, community farmers and field day