

# **Pasture Management on Sheep Farms: A Summary of Eight Case Studies**

**by Kate Duesterberg, Sarah Flack, and Chet Parsons  
The Center for Sustainable Agriculture,  
The UVM Extension System,  
and participating farmers**

**University of Vermont and State Agricultural College  
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The University of Vermont Extension System and U.S. Department of Agriculture, cooperating, offer education and employment to everyone with regard to race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or familial status.

## Acknowledgements




This study was conducted over a period of four years, beginning in 1994. The Northeast Region of the Sustainable Agriculture Research & Education program funded the project in its entirety.

Primary researchers were Sarah Flack, University of Vermont Center for Sustainable Agriculture (UVM/CSA); and Chet Parsons and Rick Wackernagel, UVM Extension System. Kate Duesterberg, from the UVM/CSA, coordinated the project. Roger Clapp, formerly with the Vermont Department of Food and Agriculture, helped facilitate the marketing portions of the study. Betty LaMothe and Lalasa Patterson (UVM/CSA) are responsible for the design and layout of the publication.

The farmers who participated in the case study contributed extensive effort and time in helping design and implement the project. Without their help and expertise, this project would not have been possible. We would like to thank all of them for their contributions.

## EXPANDING PROFITS FOR SHEEP PRODUCTION THROUGH INTENSIVE PASTURE MANAGEMENT

In 1994, a research team was formed to work with ten sheep producers to assist them in adopting an efficient record-keeping system and to test and demonstrate more effective pasture utilization methods. **Our goal was to increase profitability for producers through lower cost production methods, alternative marketing, and cooperative learning.** Production methods and financial data were collected and analyzed to address the following questions.

-  *Can producers make a profit by more effectively utilizing the pasture resource?*
-  *What management and/or planning tools are effective for meeting economic and lifestyle goals of sheep producers?*
-  *Does a cooperatively managed research and outreach program produce more readily usable information for agricultural producers?*

The participating farms served as demonstrations for a wider audience of producers. Farm walks, discussion groups and workshops were organized to disseminate the information we obtained to sheep producers throughout the state. The marketing component of this project was designed to create opportunities for producers to sell their grass-fed lambs to new outlets developed throughout the course of the project.

### Objectives

- I. Investigate the economic feasibility and production capacity of finishing lambs on pasture.
- II. Test the applicability of management systems, specifically the Standardized Performance Analysis (SPA) and Holistic Resource Management (HRM).
- III. Identify, evaluate, and develop potential alternative lamb markets as an addition to commercial lamb sales.
- IV. Implement a model for cooperative research and information dissemination.



# METHODOLOGY

## Research Team

- 10 sheep producers participating as on-farm testing and demonstration cooperators
- Kate Duesterberg and Sarah Flack, UVM Center for Sustainable Agriculture
- Chet Parsons and Rick Wackernagel, UVM Extension and research faculty members
- Roger Clapp, Vermont Department of Agriculture marketing specialist
- Members of the Vermont Sheep Breeders Association

## Production and Management

Livestock and farm management Extension specialists Chet Parsons and Rick Wackernagel and pasture consultant Sarah Flack worked with the ten cooperator farmers to gather data through the SPA (Standardized Performance Analysis) program, including the number of ewes/acre, raised or purchased feed/ewe, lambs born /ewe lambing, number and weight of lambs weaned, lbs. weaned/acre utilized, income and profit (loss)/ewe. The data was analyzed and used to help each producer formulate his or her own management plan to obtain more return from the pasture resource.

The producers involved in the project were committed to raising sheep on grass. They had achieved some degree of success by experimenting with different production methods on their own. However, they all felt they could further reduce their input



costs. They believed that exchanging ideas with other producers and working closely with Extension & research faculty, Department of Ag specialists and industry associations would enable them to modify their production methods and improve net profits.

The producers involved were also committed to developing model systems for raising sheep on pasture that showed reasonable rates of return, so that other producers could see what was possible and incorporate cost-cutting practices on their own operations.

The following data collection activities were identified as important areas that could help address the objectives:

### Pasture Management:

- a) Analyze current pasture performance and make changes to increase effectiveness through forage analysis, soil testing, and tracking rotational schedules.
- b) Evaluate winter feeding techniques by stockpiling grass for lambs and ewes.
- c) Work with one to three dairy farmers (documenting changes, gathering data) interested in grazing sheep following dairy.

### **Animal Management and Genetics:**

- a) Weigh lambs throughout the grazing season to calculate average daily gain;
- b) Track each producer's lambs through carcass evaluation to identify sheep with superior finishing qualities on grass diets;
- c) Gather and compare data on lambing techniques, such as lambing on pasture vs. in the barn, for the purpose of reducing labor required at lambing time;
- d) Identify each producer's method of predator control, documenting successful alternatives;

### **Management:**

- a) Facilitate better record keeping and continue using SPA to measure profitability;
- b) Monitor reductions in feed purchases as an indicator of more efficient grass utilization.

### **Marketing:**

Evaluate the requirements and returns for each of the following markets:

- ◆ Finished lambs to marketing coops or feedlots;
- ◆ Finished natural lamb for the local freezer trade and farmers' markets;
- ◆ Easter "hothouse" lamb markets;
- ◆ Ethnic markets and other markets as they develop.

### **Outreach**

The research team felt that a vital component of the project would be to analyze and disseminate information as it became available. The project included meetings and pasture walks to give farmers and other research team members an opportunity to exchange ideas and information on marketing, management, and production methods.

The research team also disseminated information through on-going forums such as the Vermont Sheepposium, the Sheep & Wool Festival (educational meetings for sheep producers organized every year by UVM Extension and the Vermont Sheep Breeders' Association), the Sustainable Agriculture Conference, and other similar workshops.



## PROJECT RESULTS

By the third year of the project, the ten farms in Vermont and New Hampshire included 620 breeding ewes. During last year of the project, two farms had to drop out of the study due to personal reasons so we have complete data on eight of the farms. On each farm we measured pasture species composition, soil fertility, and forage quality at least once per year. We weighed lambs a minimum of twice a year on each farm in order to measure average daily gains, and we collected flock production and financial information on an annual basis using the SPA program.

There was a lot of variability among the 10 farms in many characteristics, including farm size (land used for the sheep ranged from 17 to 78 acres), breed and number of sheep (flock size varied from 23 to 115). Farms also varied in their management and marketing styles.

This variation in styles gave farmers a great deal of subject material to discuss with each other as they each considered the best way to run their own farms.

### **Management styles included:**

- ◆ Lambing dates from late winter through late spring pastured lambing;
- ◆ Some grain feeding to zero grain feeding;
- ◆ Very intensive grazing management to simple pasture rotations through larger areas;

- ◆ No vaccinations and no deworming to routine vaccinations and de-worming;
- ◆ Extended grazing into fall and winter months with less hay feeding to more reliance on hay feeding starting in the fall months.

### **Marketing styles included selling:**

- ◆ Lambs to auction;
- ◆ Freezer lambs;
- ◆ Breeding stock;
- ◆ Value added meat and wool products to restaurants and stores;
- ◆ Whole carcasses to restaurants.

The results of the data collection process are included with in the case studies of this report. In addition, we have included extensive comments from the producers. Their comments outline their goals for participating in this project. In addition, producers provide their own analysis of their farm after changing management practices to cut input costs through more efficient use of their pastures.





## OVERVIEW OF THE DATA COLLECTED

### Introduction

To determine if there is a change in a sheep operation, it is first necessary to find out where the operation is by collecting base line data. This was done on all of the farms the first year they were involved in the study. In addition to providing base line data for the study, this also provides real numbers for producers or potential producers to use for budgeting purposes or for comparison purposes.

Daily rates of gains were determined by weighing lambs at least twice during their growth and calculating their average weight gain per day. Soil fertility was determined by selecting two pasture paddocks that were representative of the overall pastures. A soil sample was taken and sent to the Vermont Testing Lab for analysis.

Nutritional value of the pastures was estimated by having forage samples analyzed from the representative pastures selected. Pasture species composition was determined by separating the forage samples into clover, grass and other (referred to as forbs or weeds).

Production and financial data was gathered and recorded on a computer program (called SPA, Standardized Performance Analysis), supplied by the American Sheep Industry. This program was developed to standardize data collection and enable the comparison of one sheep farm to another.

### Average Daily Gain of Lambs

Average daily gain is an important tool to compare how lambs are growing. This can

be used to compare lambs to each other for such purposes as selecting breeding stock, or it can be used to compare growth from one year to the next. When making these comparisons, it is necessary to keep in mind that many factors determine the growth rate of a lamb. The milking ability of the lamb's mother and the quality of the pastures and concentrate feeding can make a considerable difference on the daily weight gain of lambs.

During the 4-year period of our study, average daily gain varied from .34 lbs. per day to .76 lbs. per day. As expected, higher gains occurred when lambs were younger, before weaning. The rate of gain was lower after weaning, as lambs grew larger. *Several of the farms attained satisfactory rates of gain with no supplemental grain feeding while doing very intensive grazing management.* (For example, during the years of the study, Farm 001 went from .50 to .54 lbs./day and Farm 004 from .51 to .54 lbs./day) Farms that practiced less intensive grazing management and also fed no grain tended to have somewhat lower rates of gain. (For example, Farm 003 went from .34 to .40 lbs./day, Farm 005 from .34 to .43 lbs./day, and Farm 006 from .35 to .44 lbs./day). Lambs on farms feeding grain had rates of gain which were sometimes, but not consistently, higher. (Farm 007 went from .48 to .61 lbs./day and Farm 009 from .38 to .39 lbs./day).

Some of the farms showed improvements in rates of gains during the study as they improved management. Farmer 003 had steadily increasing carcass weights and rates of gain as he improved pasture quality and grazing management. Parasite problems decreased rates of gains on some farms, particularly in 1998, which was a wet

summer with higher than usual parasite problems.

## Soil Fertility

It was beyond the scope of this project to do a comprehensive study of the soil fertility on the participating farms. However, in an effort to identify any aberrations in the soil fertility on participating farms, and to provide readers with what might be typical of Northeast soil fertility, soil tests were done on an annual basis. The complete results can be found in the appendix.

Soil on the eight participating farms ranged from good quality valley soils to low fertility stony and steep hill farm pastures. Some of the farms with relatively poor soil fertility were able to make improvements during the study. For example, Farm 001 has raised the fertility of one field by applying manure, winter hay feeding, lime, and rock phosphate. This change is reflected in the soil test results for Farm 001 (specific results from soil tests are included in the appendices). Farm 009 used “mob-stocking” to clear and improve some brushy pastureland, and this is also reflected in the soil test results. However, many of the participating farmers who improved management, pasture quality, and animal performance on their farms commented that the soil tests did not seem to reflect the same level of improvement.

## Forage Analysis

The nutrient content of any forage is dependent on the composition of plants and the maturity of the plants. Forage samples were taken to give the participants and readers an idea of what a forage analysis of a typical sheep pasture would be. The complete results can be found in the appendix.

Results from the laboratory analysis of the soils varied with the stage of maturity of the pasture at the time of sampling. Dry matter content varied from 15.1% to 28.6%, and crude protein varied from 13.8% (in a brushy pasture) to 30%. The information on protein content was useful to farmers as they were able to switch to lower protein (less expensive) grains.

Note: Of the data collected, several farmers commented that the *forage analysis* was the least useful in the long run. It was, however, helpful in the first season for the farmers to see what the nutritional analysis of their pastures was and to use that information to decrease the amount of grain they fed.

## Pasture Species Composition Data

Results from analysis of pasture species composition were useful in generating discussion between farmers and researchers. Since the sampling areas were so small, they didn't always reflect the changes going on as pasture quality improved. *However, on several farms, improved pasture management did change the species composition, and this was both observed by the farmers and researchers, and reflected in the species composition data.* For example: The Ridge Pasture on Farm 001 showed an increase in clover content from 16% to 28.8%. Farm 002's Landing Pasture showed an increase in clover from .3% to 16.4%, and the Hovencamp Pasture showed a decrease in forbs (weeds) from 44.8% to 7.6%. Farm 007's Hillside Pasture showed a decrease in forbs (mostly smartweed) from 49% to 20.3%. These changes occurred in pastures where grazing was intensive or increasingly intensive, and pre-grazing heights were in some cases lowered to decrease shading of smaller plants. On another farm, a decrease in stocking rate and

intensity of grazing of one field seemed to result in less clover growth (the percentage of clover went from 14.5% to 1.2%).

## SPA Program Data


The SPA or *Standardized Performance Analysis* is a computer program that was used to analyze the production and financial data from each farm. In the beginning of the study, it was a bit of a challenge to be able to sort out the input to obtain meaningful output. For


example, cost of feed to keep a ewe included purchased hay, but it also included the cost of making hay (if produced on the farm), and other costs such as taxes and fences for pastures. As more data was entered, we were more confident that the output was meaningful and accurate.

The one factor that we did not try to calculate for each operation was labor. Although labor plays an important role in the expense of an operation, we felt that it could vary so much from operation to operation that it would be best to leave it out.


An unexpected finding from the SPA data was the level of diversification and its impact on profitability. The farms which included other livestock and crops were often more profitable than less diversified farms.

Information collected and analyzed through the SPA program provided valuable ways for farmers to look at their own farm operation during the study. The examples below show improvements in management that are reflected in the SPA data.

 Several farmers decided to try to decrease the amount of stored hay they fed, and, over time, were able to make significant reductions. Pounds of feed fed per ewe on Farm 003 decreased from 2161 to 1225. Farm 004 went from 654 to 449, while Farm 005 went from 1440 to 800, and Farm 007 went from 1216 to 840.

 Decreased use of stored hay fed and decreased or eliminated grain supplementation reduced feed costs per ewe on some farms. Farm 001 feed costs went from \$81 to \$28 per ewe, and Farm 003's costs went from \$206 to \$64. Feed costs were often related to other factors such as repairs to haying equipment or fluctuations in feed costs and weather, so most farms showed variations in feed cost from year to year.

 Income after expense per ewe varied considerably from farm to farm, and sometimes from year to year on the same farm (for example, \$91 per ewe to -\$252 per ewe). Farms showing mostly positive (profitable) numbers include the farms with both the largest and smallest flock size, farms selling lambs mostly to auction, farms selling value added products, farms feeding no grain and one farm which fed a small amount of grain to lambs. Farms that were able to keep feed costs relatively low with good grazing management and extended grazing seasons were more likely to be profitable.

 Due to the complexity and cost of fencing for sheep when compared to cattle fencing, no dairy farms joined the study to look at grazing sheep following dairy cows. However, several of the participating sheep farms added cattle to their operations during the study, and found the added diversification helpful in parasite control and overall farm profitability.



## REPORT ON RESULTS FROM THE MARKETING OBJECTIVE

Our goal for the marketing objective was to evaluate the producers' current market and to identify and develop alternative markets for grass fed lamb. Each year, we organized one or two activities to a) enhance the market for grass-fed lamb; or b) help producers understand how to "sell" the qualities of grass-fed lamb to potential customers.

During the first year of the project, we focused on working with chefs at the New England Culinary Institute (NECI) so that both chefs and the producers could learn more about the differences in carcass quality between grass and grain finished lamb.

One significant potential market for grass finished lamb is the restaurant/tourist market. Roger Clapp had stated at the time that, "It will always be difficult for Vermont and New England lamb to compete with western or New Zealand lamb at the retail grocery level because we simply cannot produce it as cheaply as they can." So, we decided to try to get chefs to recognize the culinary advantages of locally raised, grass finished lamb.

NECI helped us by testing grass vs. grain vs. grass & grain finished lamb. The tests were done in the "fine dining" class and the "taste and flavor" class. Students and instructors compared the two lambs for taste, tenderness, and "desirability of the different varieties."

The results for this first test were inconclusive. Unfortunately, the lambs differed considerably in size and were not the same breed. However, the results were reported at the November 1996 Sheepsposium for discussion purposes. The instructors for

the fine dining class stated, "There were subtle differences in the flavors, depending on the cut of meat. It was very difficult to determine an outright winner, as opinion was mixed throughout the testing. Texture was a more defined issue, with the blend and grain fed lamb being more tender and consistent."

The instructor who coordinated the test stated, "I believe that the weight of the carcass, and the size of the eye in the rack and loin, will be crucial in getting acceptance in the market, and that the differences in flavor and yield will be less important, if the original price per pound to the restaurant is close. Size of eye and carcass weight will be less important to the retail customer."

At one of the research team meetings, producers identified their primary marketing problem in the restaurant market as not being able to sell the entire carcass. Restaurants that serve Vermont-raised lamb tend to be the upper end, white-table cloth establishments. Many prefer to serve only the better cuts; e.g. racks, loin medallions and sometimes leg meat.

In June 1997, the Vermont Department of Agriculture, the Vermont Fresh Network (a collaboration of chefs and farmers), and our research team co-sponsored a whole lamb carcass cutting and utilization demonstration for chefs. The program was arranged with NECI chef instructor Brad Koehler both breaking and preparing finished cuts of lamb.

The Whole Lamb Cutting Demonstration was attended by 20 participants. The demonstration was videotaped and

supplemented by the Vermont Whole Lamb Cookbook published by the Vermont Lamb Promotion Board. Several new customers for grass-fed lamb were cultivated after seeing how using lesser cuts of lamb from the legs and shoulder can be used to actually lower per plate costs. This message was strengthened by a Vermont Fresh Network/Vermont Lamb promotion kicked off at the Vermont Sheep and Wool Festival on October 3 and 4 at Killington, which was attended by over 3,500 people.

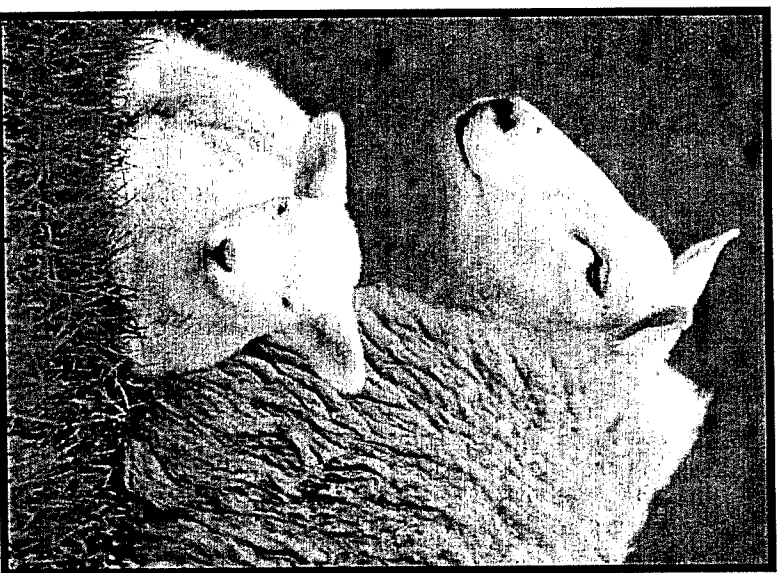
In October of 1998, we held a lamb carcass evaluation and meat-cutting workshop on the campus of the New England Culinary Institute (NECI) in Montpelier. Producers from the project attended, as did other Vermont lamb producers and students from NECI. The goal of the workshop was to provide producers with the knowledge to better recognize desirable characteristics of a highly marketable lamb carcass.

Dr. Dwight Barney, a meat scientist from the University of New Hampshire, conducted the carcass evaluation. Three lamb carcasses were evaluated - one that was primarily grass-finished, one was primarily grain finished, and the last was mixed grass-grain finished. Having the three carcasses allowed Dr. Barney to compare and contrast the differences between the three methods of production. He talked a lot about what attributes the market was looking for (for example, amount of fat content, etc.) and discussed different slaughter and storage techniques.

A chef/instructor from NECI, Chef Paul Malcolm, demonstrated how to cut up a lamb carcass, discussing each piece in terms of what chefs looked for and how the different pieces were used. The workshop participants were very enthusiastic about

getting in-depth information and instruction on both carcass evaluation and cutting.

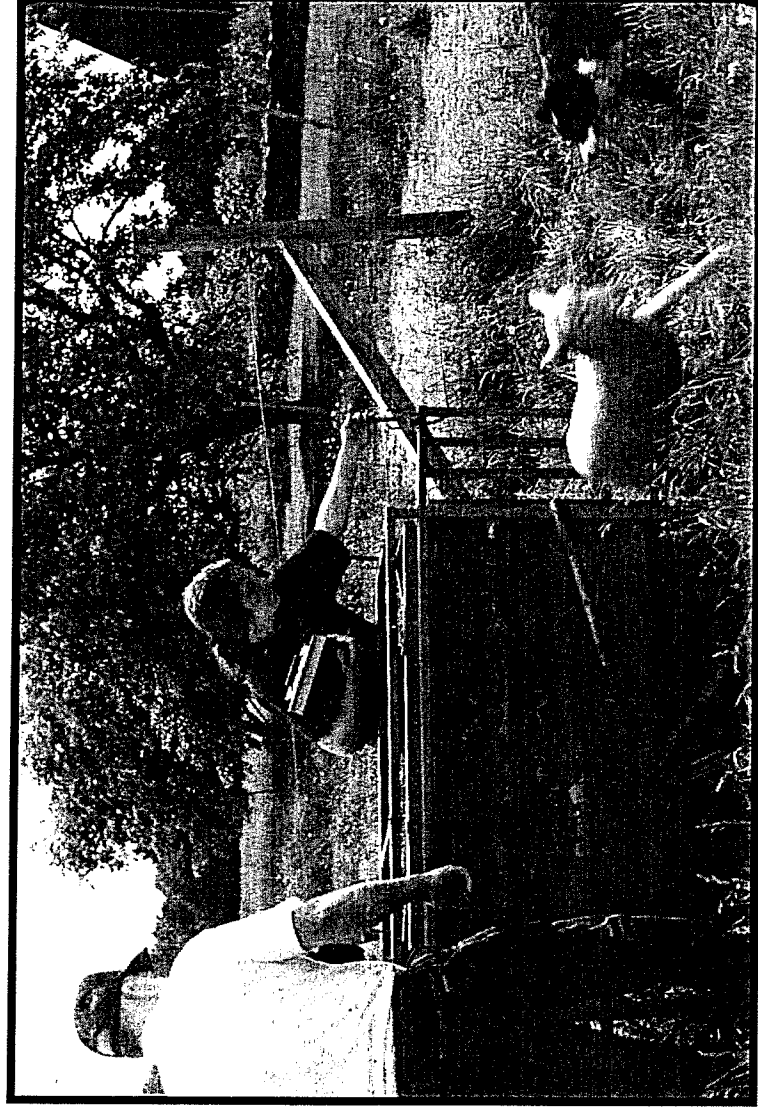
The participating producers use many different marketing techniques. Data collected through our SPA program indicated that the farms that were showing some net profit were those selling lambs mostly to auction *and* selling value added products. Of course, there is no one answer to how to raise sheep profitably. However, to strengthen opportunities to local restaurant sales, more education of chefs is needed.



## CASE STUDIES

Following are summary descriptions of each participating farm over the three years of the study. The study included four cooperating farms during the first year, ten (including the original four) during the second year, and eight in the third year. One of the first things we asked the participating farms to do was to fill out a “case study form” so we had baseline information on their farm. This included a description and history of the farm and a description of their goals for the farm, especially as they related to improving pasture management as a way to increase profitability. We asked each producer what he or she thought the barriers to profitability were, and these remarks are included in each of the case studies below. We also asked each producer to fill out a more detailed form regarding his or her particular management style, including grazing practices, health management, predator control, etc. An overview of this information is also included. During the course of the project, we held farm walks and meetings on various participants’ farms so that the producers had opportunities to provide suggestions and input to each other.

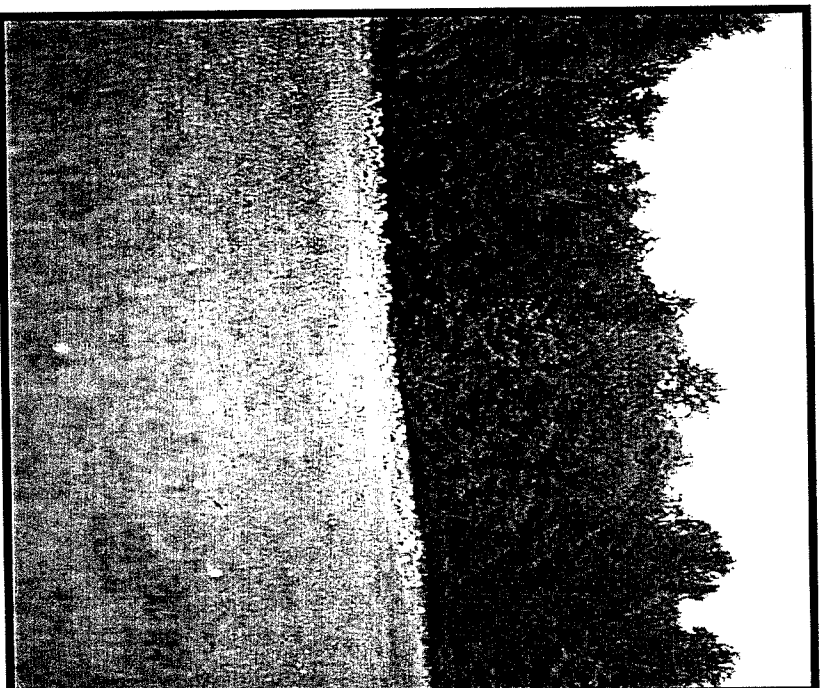
The data from each farm is included in tables in the appendices. During the last year of the study, we interviewed all participants so that we could get their interpretations of the data and their reflections of the changes they observed in their operations as a result of changes in management practices. We have included the producers’ comments in the case study descriptions.



## CASE STUDY 001

### Description of Farm

Farm 001 consists of about 65 acres of pasture and hay land. The farm is somewhat hilly, and the elevation is 900 feet. The flock size is now up to about 70 ewes. The sheep are mostly Montedale Leicester crosses. Grazing management is very intensive, using high tensile perimeter fences and subdivisions of poly wire and electric net fencing. They have reclaimed some brushy areas using mob stocking with the sheep. Many of the areas are harvested for hay during the summer, as well as being grazed. The sheep are moved to fresh pasture every 12 hours to 3 days. Lambs are finished entirely on pasture (no grain). This farm is now certified organic.



**Goal:** *Create a healthy, integrated, self-sustaining farm organism, connected to family, connected to community.*

### Production Objectives/ Management Strategies

**Production objectives at the beginning of the study:**

- ◆ Integrate sheep with cattle (neifers), more than in the previous year;
- ◆ Consider adding nurse cows with 3 or 4 calves on each;
- ◆ Observe how their parasite strategy continues to work without deworming chemicals;
- ◆ Continue their retail strategy for selling meat;
- ◆ Expand an herb growing and marketing business.



### **Management Style:**

The grazing season begins on Farm 001 normally between the 15th and 20th of April and goes until heavy snow. In 1997, this was November 17<sup>th</sup>, in 1996, it was December 26<sup>th</sup>. They stockpile pasture and outwinter mature ewes, and sometimes lambs are on pastures until the snow becomes too deep for the sheep to be able to move. Hay and round balage are fed to the sheep during the winter. In 1997 and 1998, a small amount of grain was fed to ewes (1/2 lb./day) for only about four weeks, two weeks before lambing until sheep were put out to pasture. A mineral mix of salt and kelp (with some added selenium pre-mix) is fed, as well as a block of mineral rock salt. In 1999, no grain was used before lambing, and this will be the practice in all future years. They do not plan to feed any grain to ruminant livestock in future years.

Their parasite control strategy is in transition. It currently includes selection for resistant animals and grazing a great diversity of plants including brush. Lambs are kept on clean (that is, free of internal parasite larvae) hayland at weaning, i.e., using harvesting to provide clean pastures. They also use cattle to clean up the sheep pasture. The flock was dewormed in August of 1995 and in August of 1998. No dewormers were used in 1996 or 1997. In the future, they plan to greatly diversify the farm and come to a better balance between sheep, cattle and poultry. Farm 001 does not vaccinate.

They lamb in early and mid April, although would prefer to lamb in late April if other work commitments permitted. The number of hours worked on the farm is minimal. There is off farm income. During the 1998-grazing season, Farm 001 had two interns.

Composted manure is spread on the pastures, as well as lime. Fertilizer is not used. They do not frost seed. Predator control is a five strand fence fit *exactly* to ground contour.

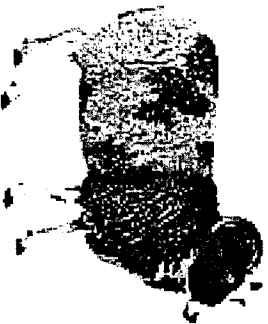
Farm 001's marketing strategy includes retailing cuts of lamb from the farm shop and auctioning light lambs in the summer. They have the USDA natural lamb label for fancy cuts and do sausage and cured summer sausage. Two restaurants and one food coop feature their lamb. They sell freezer lamb as well.

### **Changes in management practices to achieve better pasture utilization for increased profits (goal of the project).**

By the end of the study, this farm had diversified its livestock by adding cows, calves, heifers, and chickens to the grazing plan. The farm has continued to practice intensive grazing management and winter feeding hay on pasture with diverse livestock in order to improve pasture productivity and quality. In the 1998-1999 winter, ewes and heifers were fed on a barn bedded pack starting in late December. This will greatly increase the amount of compost for next year. Starting in 1996 and 1997, brushy areas on the farm were managed to remain brushy in order to provide feed diversity.

The number of breeding ewes was 32 at the beginning of the study; it dropped to 26 in the second year and then rose to 63 by the final year. The farm began marketing a significant amount of retail lamb in 1997, the same year it was first certified as organic.

In 1999, no grain was fed to ewes prior to lambing (they got hay and minerals only). They had very good results and plan to continue this zero grain practice in the future.



## **Information Gathered/Results**

### **Species Composition:**

To help gain a better understanding of what was growing on the farm over the course of the study, we picked two areas to look at soil fertility, species composition and take forage nutrition samples.

**Ridge Pasture:** This is a very high quality pasture that is also used as a hay field in most years for one or two cuts of hay. Over the course of the study, both the farmer and researchers observed that this pasture has had an increase in the amount of clover and a decrease in the amount of grass with about the same amount of forbs.

**Southeast Corner Pasture:** This area is much less productive than the ridge pasture. It is

in on a wetter, stonier soil and produces less dry matter and less palatable forage quality. Liquid manure was applied in 1996 to try to increase production. There was little noticeable change over the course of the study.

In addition to grazing management and animal impact, pastures were also affected by when the samples were taken (plant age), climatic variations and other factors. See Appendix A for percent species composition data which was collected by the clipped quadrat method.

### **Soil & Forage Tests:**

Grazing management, winter hay feeding and the application of lime, minerals (rock phosphate), and compost appear to have increased the pH and levels of phosphorus in the ridge pasture and the southeast corner pasture. See Appendices B and C for forage and soil test results, respectively.

### **Average Daily Gains:**

The lambs on this farm were born in April. They received no grain and were raised on intensively grazed pasture. No dewormers were used in 1996 or 1997. The flock was dewormed once in 1995 and once in 1998.

### Lamb Average Daily Gains

| Days of Age | 50-55        | 85-90        | 105-110      | 125-130      |
|-------------|--------------|--------------|--------------|--------------|
| 1995        | -            | .53 lbs./day | -            | -            |
| 1996        | -            | -            | -            | .51 lbs./day |
| 1997        | -            | .60 lbs./day | .50 lbs./day | -            |
| 1998        | .59 lbs./day | -            | .54 lbs./day | -            |

### SPA (Standardized Performance Analysis) Data

|                                  | 1993       | 1994 | 1995 | 1996 | 1997 | 1998 |
|----------------------------------|------------|------|------|------|------|------|
| Gross Revenue Per Ewe            | \$ 135     | 199  | 132  | 130  | 113  | 134  |
| Feed Cost Per Ewe                | \$ 81      | 52   | 87   | 57   | 62   | 28   |
| Total Operating Expenses Per Ewe | \$ 113     | 107  | 123  | 82   | 153  | 113  |
| Income After Expenses Per Ewe    | \$ 22      | 91   | 9    | 48   | -40  | 21   |
| Lambs Weaned Per Ewe Exposed     | Lambs 1.84 | 1.6  | 1.51 | 1.38 | 1.29 | 1.58 |
| Pounds of Lamb Per Ewe Exposed   | lbs. 111   | 171  | 92   | 130  | 99   | 88   |
| Pounds of Feed Per Breeding Ewe  | lbs. 1100  | 980  | 1100 | 850  | 939  | 903  |

The number of breeding ewes increased from 32 to 63 from 1993 to 1998.

The primary source of income from 1993 through 1996 was market lamb with a small freezer lamb trade. In 1997, the farm sold more than half of the lamb retail. Other sources of income were cull ewes, wool, sheepskins and sheep dog sales in some years.

Expenses related to the retail business included cut, wrap and labels. This raised expenses by almost \$4000 in 1997. Many frozen lamb cuts were also carried as inventory into 1998. This explains the

negative income after expenses per ewe in 1997.

Most feed was raised on the farm in the first several years of the study, but as the flock size grew, more winter hay was purchased. Some haying equipment and machinery is owned (and fully depreciated); some haying is custom hire. Repair bills varied from \$587 to \$810 per year. Lime was purchased in 1995, 1996, and 1997. Property taxes are also included in the feed costs. Other non-feed related costs included vet (varied from \$0 to \$226), supplies, shearing, sheep skin processing, insurance, dues and supplies.

## Farmer Observations

### Constraints & key elements to profitable lamb production as project begins:

*“Constraints to profitable lamb production included soil fertility and plant vitality, sheep genetics, sheep experience (how they are raised), producer vision, parasites (need for cattle and fallowing).”*

### Comments as the project wraps up:

*“I have come to a point of view that it is a mistake to have an individual animal promoted as profitable, as they are ALL marginal, especially by themselves. The complimentary nature of many kinds of livestock operates at all levels of the farm organism and farm economy. The obvious thing is that you should be integrating a lot of different types of livestock and working with smaller numbers of each. It is more realistic to promote diversified farming than just sheep. Also, unless a person is very dedicated to intensive grazing management, they won't be profitable*

*The biggest limitations on this farm are soil fertility and plant vitality. Hill farms are predictably not suitable to farm until a lot of work is done to improve them. If you want to just farm sheep, then find some bottomland and diversify with crops. You can raise just sheep on a hill farm, but only with a low stocking rate unless you like the idea of buying and using chemical dewormers.”*



## CASE STUDY 002

### Description of Farm

Farm 002 consists of 48 acres of hilly pasture, with several very steep areas. Elevation is 1500 feet. There are 115 ewes and 3 rams. Sheep move on a rotating system between four or five large pastures, with access back to the barn at night. Farmer 002 raises some hay and purchases the rest. Fence is a mixture of woven wire, high tensile and electric net. He has been building a lot more high tensile fence. There have been predator problems with both dogs and coyotes, and Farmer 002 has experimented with different types of guard animals. Lambs are born in late winter and spring in the barn.



**Goals:** *Farm 002's goals are to make enough money on the sheep to pay the property taxes and to improve the land.*

### Production Objectives/ Management Strategies

#### Production objectives at the beginning of the study:

- ◆ Raise 150 lambs;
- ◆ Take better care of the ewes/lambs;
- ◆ Have fewer health losses;
- ◆ Improve the barn layout;
- ◆ Improve the fence for predator control.

#### Strategies to achieve objectives:

- ◆ Improve pasture;
- ◆ Increase feed available in each paddock;
- ◆ Lengthen grazing season;
- ◆ Reduce purchased feed costs.
- ◆ Increase rate of gain for lambs.

#### Management style:

Farm 002's grazing season tends to go from about May 5th until about November 1st. They keep records by tracking the number of days and number of animals in each pasture. Some pasture is stockpiled for fall feeding and the livestock are wintered in the barn.

Small square bales serve as winter feed. Whole corn and starter pellets are fed to bottle lambs. Whole corn is fed to ewes in the last two weeks of gestation and after lambing until they get on to the pasture. They also feed a commercial mineral mix. Lambs are fed corn after weaning.

For parasites, they deworm ewes before lambing and before going on pasture. In addition, they deworm lambs 2-3 times per year. For predator control, they have used



donkeys (which appears to have been only marginally effective), and starting in 1998, a llama. Sheep are moved to the barn at night for additional protection. Farm 002 spreads manure on the fields. They limed the fields 5 years ago but do not use fertilizer, nor do they frost seed. Starting in 1997 all winter hay was purchased.

They lamb in mid-March because the weather is warmer and pastures will be ready when lambs are able to fully utilize them for feed. Farmer 002 works between 20 and 50 hours/week on the farm, does have off-farm income, and has help from his wife.

The marketing strategy for Farm 002 is mostly direct to feed lots and re-sellers.

**Changes in management practices to achieve better pasture utilization for increased profits (goal of the project):**

Predators continued to be a serious problem on this farm throughout the study. Sheep were generally moved back to the barn at night, and two donkeys stay with the sheep at all times. In 1998, a guard llama was added. The first one was not effective and was replaced by another llama, which does appear to be reducing the amount of coyote losses.

## **Information Gathered/ Results**

### **Species Composition:**

To help gain a better understanding of what was growing on the farm over the course of the study, we picked two areas to look at soil fertility, species composition and take forage nutrition samples.

The Landing Pasture tended to be understocked and therefore overgrown at the beginning of the study. Much of the legumes had been lost due to shading. Changing the grazing management so that the pasture was grazed shorter more frequently seems to have increased the amount of clover during the four years of the study.

The Hillside Pasture was low in both quality and quantity. In 1995, it was mostly “weeds” and some grass. In 1996 manure was spread, and grazing was managed so that regrowth periods were longer. Researchers and the farmer noted an increase in white clover and decrease in weed species by the end of the study.

In addition to grazing management and animal impact, pastures were also affected by when the samples were taken (plant age), climatic variations and other factors.

See Appendix A for percent species composition data which was collected by the clipped quadrat method.

## SPA (Standardized Performance Analysis) Data

|                                  | 1993       | 1994   | 1995   | 1996 | 1997   | 1998  |
|----------------------------------|------------|--------|--------|------|--------|-------|
| Gross revenue per ewe            | \$ 91      | 90.02  | 139.31 | 98   | 117.16 | 130   |
| Feed cost per ewe                | \$ 89      | 97.46  | 69.94  | 82   | 134.18 | 142   |
| Total operating expenses per ewe | \$ 163     | 122.66 | 128.64 | 152  | 204.47 | 210   |
| Income after expenses per ewe    | \$ -72     | -32.64 | 10.68  | -54  | -87.31 | -80   |
| Lambs weaned per ewe exposed     | lambs 1.29 | 0.88   | 1.6    | 1.35 | 1.24   | 1.33  |
| Pounds of lamb per ewe exposed   | lbs. 61    | 93     | 105    | 116  | 134    | 122   |
| Pounds of feed per breeding ewe  | lbs. 667   | 1108   | 631    | 1133 | 929    | 1681  |
| Return on assets: cost basis     | % -2       | -2.6   | 0.86   |      | -5.86  | -5.68 |

The primary source of income was from sale of lambs to feed lots and for re-sale. Other income included wool sales.

Feed costs included purchased hay, grain for ewes and lambs, property taxes and repairs.

Other costs included insurance, labor, supplies, utilities, veterinarian and interest expense. In 1993 through 1996, some hay was made and the remainder purchased. In 1997 and 1998, all the hay was purchased.

### Farmer Observations

#### Constraints & key elements to profitable lamb production as project begins:

*“Feed costs through the winter were a major barrier to profit. The number one reason for participating in this project is to reduce these costs. For Farm 002, predator losses have become a huge issue over the past few years. They have lost animals and this has had an impact on the pastures. The costs of the donkey, llama, and fencing are significant, and time spent dealing with the predator losses detracts from other management issues.*

*Where coyotes are a problem, they can mean the difference between a profitable operation and one that loses money. Would-be sheep producers may want to do a little research in the area they plan to farm in to determine if there is a history of coyote problems.”*

#### Comments as the project wraps up:

*“My pastures have clearly improved every year and are able to provide a lot more feed. The ewes start the winter in excellent condition. My winter feed costs remain a major issue, but I have made progress. Predator losses have become a huge issue. They impact income and management in many direct and subtle ways.*

*I am glad to have participated in the study, and although the data is discouraging, I have learned a lot.”*

## CASE STUDY 003

### Description of Farm

Farm 003 is a 140+ acre hill farm at 1593 feet of elevation. It has 56 acres; 38 acres cropland (hay); 40 acres pasture; and 6+acres of conservation land. The soil is mostly Buckham-Vershire, fairly well to well drained, south-facing hillside and rolling cropland and the soil pH stays at 6.2 to 6.4. There is a vein of ferrous limestone north to south and modest stream flows all year from northwest corner to southeast corner. The prevailing wind is from the northwest. The barn has hay storage for 5,000 bales and stable area for 250+ ewes. During the study, there were 60 to 100 Montadale/Merino ewes.



**Goals:** *To manage combined farm resources for sustainable, productive and profitable outcomes each year: the forage grass for pasture and hay; the woodlands for maple products, saw logs, firewood, and wildlife habitat; and the farm as a whole for invigorating family life.*

### Production Objectives/ Management Strategies

**Production objectives at the beginning of the study:**

- ◆ Produce pasture grass to market 100 lambs with a carcass averaging 45-50 lbs. hot weight;
  - ◆ Produce hay to winter feed 100 ewes;
  - ◆ Market 400#+ quality grease wool;
  - ◆ Market 15 quality pelts;
  - ◆ Sell yarn stocks plus new yarn to 100#;
  - ◆ Make 100 gallons of maple syrup;
  - ◆ Sell hay overstock and two guard dogs.
- 
- ◆ Complete organic certification;
  - ◆ Increase flock size to 100 ewes;
  - ◆ Purchase a new tested ram;
  - ◆ Intensive rotational grazing;
  - ◆ Add ten acres of fenced pasture;
  - ◆ Broaden marketing effort;
  - ◆ Advertise lamb and wool;
  - ◆ Winter feed on pasture as long as conditions permit;
  - ◆ Shear at the end of February;
  - ◆ Lamb at the beginning March;



- ◆ Return to pasture April;
- ◆ Turn in ram in October.

### **Management Strategies:**

Farm 003's lambs move to a fresh pasture every day during the grazing season. They start the grazing season in April or May and finish usually in December. They stockpile pasture and leave the sheep out at least until February 15th if snow permits. The main forage source fed in winter is hay; no grain is fed. A mineral mix of sweetlix 3 and 1# 698 is fed to lambs and ewes. Manure is spread on the fields, but no lime. They also use an organic fish solution as fertilizer.

They estimate that they work about 6-10 hours per week now, although it used to be more. Farm 003 has off-farm income, and the only other paid or unpaid labor is for shearing and other occasional help. They use a maramma dog for predator control.

They sell natural lamb, so they do few vaccinations (rabies), use no hormones, feed no grain, use no herbicides or pesticides. Sales are to freezer trade, restaurants, and auction. They also sell to customers who are chemically at-risk.

### **Changes in management practices to achieve better pasture utilization for increased profits (goal of the project).**

The farm has not been certified organic, but has continued to be managed organically. This farm increased the flock size and fenced in additional acres for grazing. The farm has continued to improve its practice intensive grazing management.

They increased the flock size during the course of the study but also added additional acres of pastures. There was significant

improvement of pasture quality and quantity, so there was often a feed surplus during the grazing season.

## **Information Gathered/ Results**

### **Species Composition:**

To help gain a better understanding of what was growing on the farm over the course of the study, we picked two areas to look at soil fertility, species composition and take forage nutrition samples.

This farm was previously continuously grazed with heifers at a low stocking rate, and sheep began grazing in 1983. The pastures have gradually improved from mostly grass with some woody weed species to better quality grass with more legumes.

Field #1: This is a very productive area near the barn which is primarily grass. Due to heavy manure buildup from livestock in past years there is a lot of rejected forage in this area, and grasses have tended to grow taller and shade out the legumes. During the course of the study, the farmer improved the grazing management, and both farmer and researchers noticed an increase in the clover content and a decrease in the problem weed (thistle) in this area.

Field #2: This is a hilly pasture which was not grazed as intensively as Field #1. As a result, the farmer and researchers noticed that the amount of clover decreased and grasses increased. Also, as the total acres and productivity of the pastures increased, the sheep were not able to keep up with the grass, and it

tended to be taller both before and after grazing.

In addition to grazing management and animal impact, pastures were also affected by when the samples were taken (plant age), climatic variations and other factors. See Appendix A for percent species composition data which was collected by the clipped quadrat method.

**Forage and Soil Tests:**

Some lime was spread in 1993 and 1998.

Manure (year-old, partly composted sheep manure) is spread on the hay land (which is not grazed). Fish emulsion fertilizer was spread on the hay fields in 1997 and 1998

along with an organic nitrogen source (nitramax).

See Appendices B and C for forage and soil test results, respectively.

**Average Daily Gains:**

The lambs on this farm received no grain and were raised on relatively intensively grazed pasture. Dewormers were not used, and scours were treated primarily by feeding hay. The farmer said that, "Average daily gain improved as pasture management improved, and carcass weights were steadily increasing as pasture management and quality improved over the length of the project."

**Lamb Average Daily Gains**

| Days of age | 110-115      | 150-160      | 170-180      | 190-200      |
|-------------|--------------|--------------|--------------|--------------|
| 1996        | -            | -            | -            | .34 lbs./day |
| 1997        | .47 lbs./day | -            | .37 lbs./day | -            |
| 1998        | .52 lbs./day | .40 lbs./day | -            | -            |

**SPA (Standardized Performance Analysis) Data**

|                                  | 1993       | 1994 | 1995 | 1996 | 1997    | 1998 |
|----------------------------------|------------|------|------|------|---------|------|
| Gross revenue per ewe            | \$ 147     | 110  | 104  | 51   | 113.7   | 113  |
| Feed cost per ewe                | \$ 206     | 74   | 114  | 89   | 144     | 64   |
| Total operating expenses per ewe | \$ 400     | 260  | 188  | 156  | 343     | 153  |
| Income after expenses per ewe    | \$ -254    | -151 | -71  | -105 | -229.33 | -40  |
| Lambs weaned per ewe exposed     | Lambs 0.92 | 0.81 | 0.82 | 0.45 | 1.02    | .55  |
| Pounds of lamb per ewe exposed   | Lbs. 64    | 49   | 58   | 371  | 66      | 25   |
| Pounds of feed per breeding ewe  | Lbs. 2161  | 2988 | 1541 | 1918 | 1750    | 1225 |

The primary source of income was lamb sales, but they also had significant income from sheep skins, wool, yarn, knitted products, sheep guard dogs, cull animals and a small amount of hay sales some years. Farm 003 purchased 20 Dorset ewes in 1996, contributing to the higher pounds of lamb/ewe in that year.

The decrease in the pounds of feed fed per ewe was directly due to stockpiling pastures and other benefits of improved grazing management to extend the grazing season.

The fluctuations in lambing rates were partially due to replacement ewes which were kept but were generally not bred in their first year.

There were no machinery repairs in 1998, but repair costs were high in 1993 and 1997. This farm owns all its own haying equipment and machinery, which contributes to overhead expenses in the form of repairs (this was often over \$1500/year), fuel, oil and depreciation. Non feed expenses included vet, utilities, insurance, supplies and building depreciation.

## **Farmer Observations**

### **Constraints and key elements to profitable lamb production as project begins:**

*“Some of the key elements to profitable lamb production are developing confidence in practices based on Northeast realities, intensive rotational grazing, not feeding to the national fat layer standard - finish lambs on grass, maintenance feeding for ewes, 80+ ewes (with hay machinery), value added strategy, niche market strategy, fencing; and assess, evaluate and change your plan at least annually.*

*An important profit from the project is the exchange of information and ideas, insights and experience, philosophy and attitudes among the participants. Increased technical knowledge is less evident at this point. I am confident that will come along in due course as more data is gathered.*

*Most sheep operations in Vermont are homesteaders; that is, a shepherd who just doesn't want to or need to reach profitable levels. And for them, western priorities remain the backbone of their operations. At the same time, and I believe largely because of the outreach of this project, for those who do want to reach profitable levels of sheep production, there is now a new standard and it will become increasingly more important as this project grows.*

*The heavy machinery investment on our farm was a personal choice because I wanted to make my own hay. It probably was not a good business decision, especially when hay was \$65/ton. Now hay is almost twice that.*

*The key elements to profitable production remain the same. Grass, good pasture, short paddock time (periods of occupation), good fencing means producer controls the sheep. I would make some changes in my husbandry regimen. I lost too many lambs during the first two weeks so I would go back to vaccinating ewes to protect lambs during first weeks after*

*lambling. That and maybe tetanus would be an acceptable lamb injection, though our tetanus losses were few."*

**Comments as project wraps up:**

*"This project was really worthwhile. Improvements on farms can't happen overnight. It takes years because we are dealing with the biological cycle of livestock. The hardest thing to do was to switch my intellectual focus from the animals to the grass.*

*The thing I relied on was the meetings with the other farmers, especially after the pasture walk when we were able to sit down together and talk. I felt like my colleagues were so honest it was exceptionally useful. After every meeting I would come back and go over everything (in my sheep operation).*

*I learned a lot about grass and the animals too. But I think that if I had concentrated on grass earlier it would have been better. I would have stockpiled more, had a faster rotation (shorter periods of occupation in each paddock), and better parasite control through grazing. After the sheep go through, they leave some grass behind. I would like to know why they leave what they do and what should/could be done. I should have built better electric fence earlier. First capital expenditure should be on controlling the sheep.*

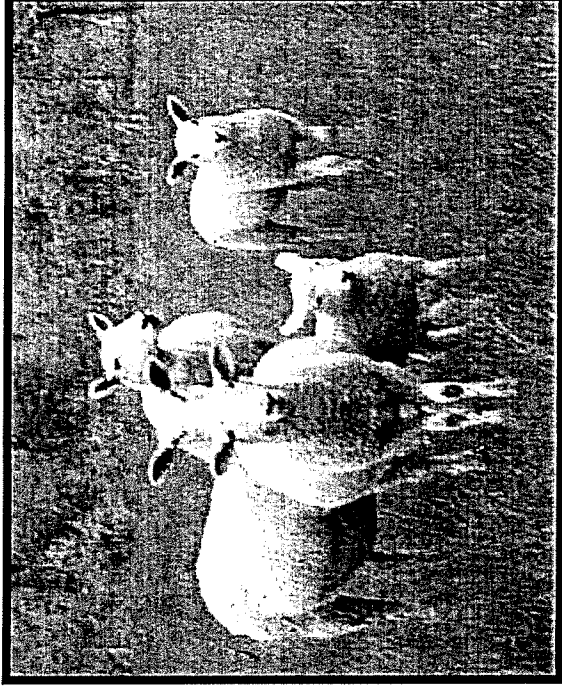
*Stockpiling pasture should be added to husbandry practices. Before starting this project we started grazing in mid-May and started feeding hay on pastures in mid November. With improved pasture and first year of stockpiling we pastured April 1<sup>st</sup> and hay fed on pasture December 9<sup>th</sup> at 25 bales/100 sheep per day. That is a significant improvement, and we didn't start that until the fourth year of the project! Why?*

*Vermont producers should introduce cross breeding. I started out thinking I wanted to sell wool, but wool price was too low. I was able to produce good wool and get prices well above average, but I should have found some 'old genetics' of sheep that are grazers! - maybe short legged, stocky and large rumen - move away from long legged show sheep and look for better meat characteristics."*

## CASE STUDY 004

### Description of Farm

Farm 004 is a 135-acre hilltop farm consisting of 87 acres woods, 17.5 acres grass, seasonal watercourses, with sand and gravel based soil. The soil is poorly drained and drought prone. During the project, they had between 26 and 45 breeding ewes each year, but the sheep on this farm are just one part of the whole farm. Grazing management is very intensive, with sheep moving every 2 hours to 3 days. Other livestock on the farm includes heifers, cows, calves, pigs and poultry. Fencing is a mix of high tensile, polywire and electric net. Lambs are born on pasture during May. Most winter hay is purchased, and no grain is fed to lambs or ewes. The farm is now certified organic. Current (sheep related) products are lamb, wool, and cull ewes that are sold through direct market, wholesale, commission sale, and wool pool.



**Goals:** *Continue to increase the conversion of sunlight into a marketable commodity, using diverse classes of livestock to control succession and improve the nutrient cycle. Leave large islands, corridors and brush borders for wildlife habitat and travel. Set the price for all farm products sold. Have healthy livestock on a profitable farm run by happy people.*

### Production Objectives/ Management Strategies

**Production objectives at the beginning of the study:**

- ◆ Maintain an average growth rate of 34 lb. dry matter/acre/day for 150 days without machine harvest or sacrifice of animal performance;
- ◆ Have the SPA program show a net profit per acre of at least \$1.30/acre;
- ◆ Healthy livestock and happy people.

**Strategies to achieve objectives:**

- ◆ Adding custom grazing of dairy replacements, pasture broiler production, suckler calves on brood cow -- all will increase dry matter demand;
- ◆ Adding 6 acres new ground with fence and winter water supply;
- ◆ Lamb and calve at onset of grass growth;
- ◆ Increase direct market.

### **Management style:**

Their grazing season is around 240 days - from mid April until “snow shuts us down,” usually in December. During grazing season, they move lambs sometimes three times a day, sometimes once in three days. *“We use sheep to manage the resource. They accelerate the nutrient cycle and alter succession.”*

A daily log of grazing, feed demand, and rotation length is kept and summarized at the end of the year. Producer does a pre-season graph of expected average cover for the season and then calculates the average cover every two weeks.

They stockpile pasture for winter feed. Sheep stay out all winter eating dry hay, no grain. Producer feeds a mineral mix of salt and kelp. Predator control includes constant movement of livestock, mixed species grazing (cattle and sheep), *hot* fence with *no* holes, adequate feed and cover for wildlife.

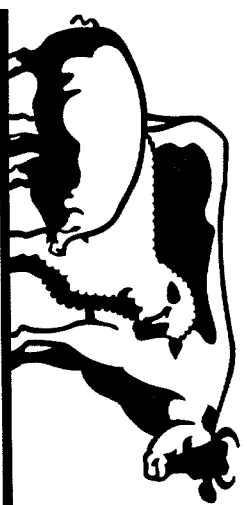
Marketing strategies include selling lamb at 13 months if pre-ordered and pre-paid in the previous fall; selling lamb at auction; selling wool at the wool pool, cull ewes at auction, and breeding stock by advertisement.

### **Changes in management practices to achieve better pasture utilization for increased profits (goal of the project).**

In 1996, the farm added heifers to the grazing plan. The farm also added cows, calves and poultry. The original flock of sheep bought in 1994 was gradually replaced with ewe lambs raised on the farm. This farm has continued to practice intensive grazing management and winter feeding hay on pasture with diverse livestock in order to improve pasture productivity and quality.

### **Information Gathered/ Results**

This farm was a dairy farm 30 years ago. Much of the land had been mostly abandoned or cut for hay once each year with little or no manure spread on it. Some of the land (around the barn, so it historically received more manure) was moderately productive when the farm was taken over. But much of the farm has been significantly improved with the use of grazing, manure and animal impact.



To help us get a better understanding of what was growing on the farm over the course of the study, we picked two areas to look at soil fertility, species composition and take forage nutrition samples. The Barn Pasture was chosen because it had a relatively high production (total pounds of dry matter per year). The Hillside Pasture was chosen because it produced less total dry matter per year and had a greater range of plant species (forbs).

**Hillside Pasture:** This pasture was a former hay field/pasture that had one cut of hay taken off of it for many years, received no manure, and was eventually abandoned. In 1995, it was grazed for the first time in many years. The species composition at that time was grass, sedges, bedstraw, dandelion, ferns and a small amount of clover.

In addition to grazing management and animal impact, pastures were also affected by when the samples were taken (plant age), climatic variations and other factors. See Appendix A for percent species composition data which was collected by the clipped quadrat method.

#### Average Daily Gains:

The lambs on this farm were born in May on pasture. They received no grain and were raised on intensively grazed pasture. None of the lambs or ewes were dewormed during any of the years that this farm participated in the study.

#### Lamb Average Daily Gains

| Days of Age | 55-60        | 75-80       | 85-90        | 135-40       |
|-------------|--------------|-------------|--------------|--------------|
| 1996        | .69 lbs./day | -           | -            | -            |
| 1997        | .62 lbs./day | -           | .54 lbs./day | -            |
| 1998        | -            | .6 lbs./day | -            | .51 lbs./day |

#### SPA (Standardized Performance Analysis) Data

|                                  | 1995   | 1996  | 1997   | 1998 |
|----------------------------------|--------|-------|--------|------|
| Gross revenue per ewe            | \$ 135 | 74    | 93.17  | 52   |
| Feed cost per ewe                | \$ 38  | 35    | 41.81  | 38   |
| Total operating expenses per ewe | \$ 101 | 53    | 78.2   | 69   |
| Income after expenses per ewe    | \$ 34  | 21    | 14.97  | -17  |
| Lambs weaned per ewe exposed     | 1.5    | 1.12  | 1.17   | 0.79 |
| Pounds of lamb per ewe exposed   | 115    | 81    | 61     | 44   |
| Pounds of lamb per acre          | 175    | 356   | 270.45 | 189  |
| Pounds of feed per breeding ewe  | 654    | 415   | 708    | 449  |
| Return on assets: cost basis     | % 6    | 8.73  | 4.92   | -5   |
| Return on assets: market basis   | %      | 17.28 | 5.19   | -5   |

This farm is a very diversified grass based operation with sheep only a part of the total income and expenses. The data presented here is only for the sheep enterprise. The primary source of revenue in this analysis

was lamb sales (direct and auction), although in some years income from sales of cull ewes was significant. No wool was sold in 1998 due to low wool prices.

Sheep on this farm were just part of the “whole farm” enterprise, which also included increasing numbers of heifers, cows, calves, pigs and poultry. This increasing diversity changed the way the sheep were grazed in the summer months and fed hay in the winter.

The majority of hay fed is purchased. The feed cost per ewe was kept relatively low by

not feeding any grain and keeping the pounds per ewe of hay fed low.

Management of the sheep flock on this farm includes unassisted lambing on pasture in the spring, which decreases the labor required while also maintaining very low lamb losses.

## **Farmer Observations**

### **Constraints and key elements to profitable lamb production as project begins:**

*“The biggest constraint to profitable lamb production is the belief that it’s not profitable. That leads to an inability to think outside the box, remain flexible, open to new ideas, and responsive to change. In the climate and geology of the Northeast, sheep are a powerful tool for resource management. In, at most, a few years of management intensive grazing with sheep, the nutrient cycle and energy flow of the resource can be accelerated well beyond the needs of any class of sheep except finishing lambs. If a farmer is interested in profit per acre, the improved resource becomes an attractive opportunity for a more demanding, and profitable, class of livestock than a ewe flock.*

*The key elements of profitable lamb production are:*

- ◆ *Minimize the expense of carrying a ewe through the zero energy income time of year*
- ◆ *Minimize the level of inflexible capital investment devoted solely to the sheep enterprise*
- ◆ *Focus on having lamb be the product of resource management with sheep, rather than an end in itself*
- ◆ *Ownership of market = improved profitability, and the smaller the operation, the more critical is marketing*

*However, as livestock, sheep are relatively low value. The individual ewe must be profitable in order that lamb production be size-neutral in comparative advantage to other enterprises.*

*In general, I think of the project as a collaborative effort to produce a solid demonstration of how valuable sheep can be to a diverse population of land owners and farmers.”*

### **Comments as the project wraps up:**

*“With regard to profitable production, constraints and key elements, I have not changed my opinion of four years ago. I would add that profitable is not a dirty word, but “industrial” might be, especially when agriculture attempts to mimic an industrial model. If an agricultural endeavor is judged profitable by industrial standards alone, the farmer will be sorely tempted to withdraw from a capital account made up of farm qualities such as species*

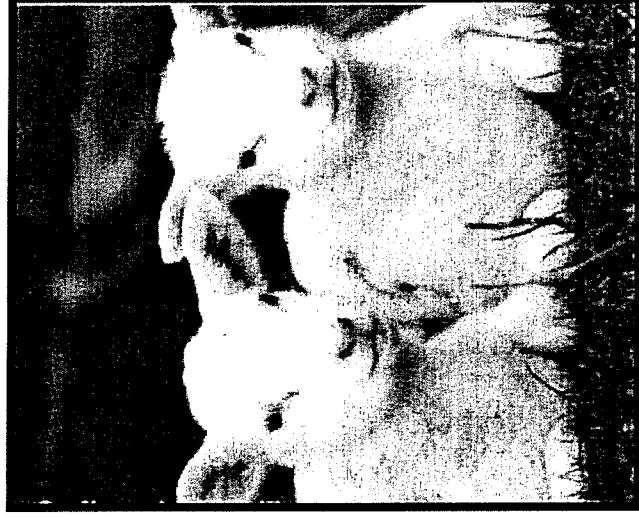


*diversity, fertility, water clarity, longevity, health, aesthetic pleasure and personal satisfaction. Resupplying the capital account is a present-day cultural dilemma brought on by an industrial model for agriculture.*

*This project... A couple of people have worked hard to draw shepherds together, collect information, and share ideas that can lead to better farming and better decision making. Chet and Sarah deserve much credit for the proposal and the effort required to follow through.*

*What is better and what have I learned as a result of this project? A better defined community of Vermont shepherds has developed in the time of this project, and in part due to this project. I have learned some nuances about profitably using sheep to help a farm express it's character and vitality. The scales and the SPA program specifically have made some facts out of thoughts and ideas. The project has given me more confidence to continue farm management along the lines that appear in the farm itself.*

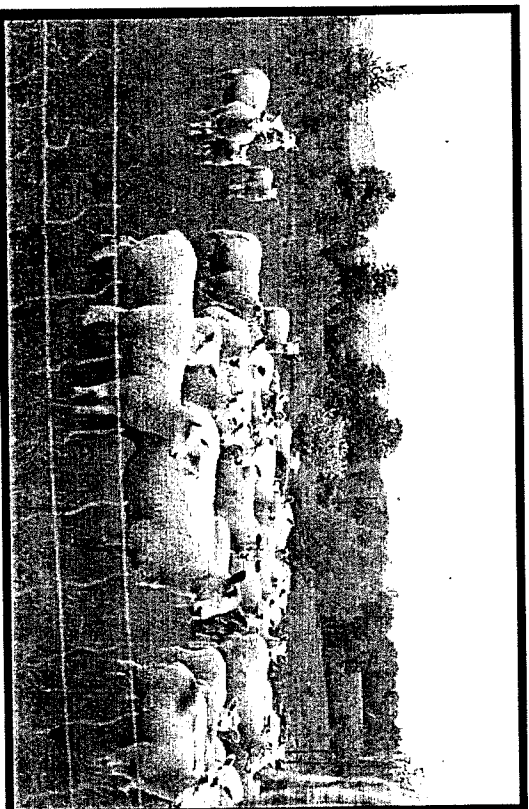
*This project is the first time that I know of that anyone has collected real information on a wide range of production and economic figures from a group of Vermont shepherds over several years."*



## CASE STUDY 005

### Description of Farm

The farm is 340 acres of primarily clay soils in the Champlain Valley. The land utilized is approximately 40 acres of mixed grasses and legumes in pasture and meadows, none of which have been tilled in about 13 years. Most of this would be plowed and planted to corn by any other farmer in Farm 005's immediate area. The flock size is now up to about 70 ewes. The sheep are mostly Montedale Leicester crosses. Grazing management is intensive, using high tensile perimeter fences and subdivisions of poly wire and electric net fencing. Some areas are harvested for hay during the summer, as well as being grazed. The sheep are moved to fresh pasture every 24 hours to 3 days. Lambs are finished entirely on pasture (no grain).



**Goals:** *Make maximum use of my pastures as a source of income; to develop a ewe flock which will wean at least 1.5 lambs and require very minimal assistance with lambing, and do this on a totally forage diet.*

### Production Objective/ Management Strategies

**Production objectives at the beginning of the study:**

- ◆ Produce at least 100 market ready lambs by mid-July;
- ◆ Use available pasture to support the ewe flock and approximately a dozen horses.

**Strategies to achieve these objectives:**

- ◆ Selecting for certain desirable characteristics. According to Farmer

005, "Ewe lamb replacements have been selected from ewes who have produced an average of 1.75 lambs/year over their lifetime and whose mothering instincts don't require much assistance. Each year I get a little better at managing pastures and stockpiling winter feed. I have begun to experiment with terminal sires to try to get a marketable lamb earlier in the year so as to save pastures for the maintenance of the ewe flock."

### **Management style:**

Farm 005 starts the grazing season generally in early to mid April and finishes in December. Lambs move to a fresh pasture every 2-3 days. They do stockpile pasture. Sheep, horses, and one cow are overwintered as much of the winter as the snow cover will permit. Hay is the main forage source during the winter. Very little grain is occasionally fed to ewes in early lactation. A mineral mix called Blue Seal Sheep is used. Manure is spread on the fields. No lime or fertilizer has been used recently. Frost seeding is done occasionally.

Farm 005 vaccinates for clostridium perfringens type C and D, and clostridium tetani annually. They deworm the ewe flock before the pasture season and the lambs several times during the summer. Spring tight fence is used for predator control.

They sell a few freezer lambs and auction the rest. Farm 005 lambs in March so that lambs will reach market size in summer and early fall. Farmer 005 works approximately 40 hours per week on the farm, although this also includes time spent with the other livestock. There is off-farm income and a bit of other labor.

### **Information Gathered/ Results**

#### **Species Composition:**

To help gain a better understanding of what was growing on the farm over the course of the study, we picked two areas to

look at soil fertility, species composition and take forage nutrition samples.

**Duck Pond Pasture:** This is an area which has relatively low productivity compared to the rest of the farm. The soil is a compacted stony clay loam. As rest periods following grazings were increased from 1995 through 1997, the researchers and farmer noticed more grass and more overall production.

**The Garden Pasture:** This a very productive pasture which grows good quality forage. It is primarily grasses and white clover. However, during the study there was an increase in ground ivy which was spreading in from a nearby hedge.

In addition to grazing management and animal impact, pastures were also affected by when the samples were taken (plant age), climatic variations and other factors. See Appendix A for percent species composition data which was collected by the clipped quadrat method.

#### **Soil & Forage tests:**

See Appendices B and C for forage and soil test results, respectively. The combination of clay soils and lower elevations provide an ideal environment for legume pastures, which in turn, are well suited to finish lambs on pasture. Liquid manure was spread on both fields in 1997. No fertilizer or lime was spread during the study.

#### **Average Daily Gains:**

No grain was fed to lambs during the study.

## Lamb Average Daily Gains

| Days of Age | 70-75         | 110-115       | 120-125       | 150-155       |
|-------------|---------------|---------------|---------------|---------------|
| 1995        | 0.60 lbs./day | 0.43 lbs./day | -             |               |
| 1996        | 0.56 lbs./day | -             | -             | 0.34 lbs./day |
| 1997        | 0.48 lbs./day | -             | 0.43 lbs./day | -             |
| 1998        | 0.65 lbs./day | -             | -             | 0.40 lbs./day |

### SPA (Standardized Performance Analysis) Data

|                                  | 1995       | 1996 | 1997 | 1998 |
|----------------------------------|------------|------|------|------|
| Gross revenue per ewe            | \$ 151     | 122  | 82   | 72   |
| Feed cost per ewe                | \$ 28      | 65   | 145  | 88   |
| Total operating expenses per ewe | \$ 195     | 102  | 193  | 155  |
| Income after expenses per ewe    | \$ -44     | 20   | -111 | -83  |
| Lambs weaned per ewe exposed     | 1.33       | 1.26 | 1.17 | 1    |
| Pounds of lamb per ewe exposed   | lbs. 138   | 91   | 83   | 73   |
| Acres per exposed ewe            | acres 0.67 | 0.57 | 0.54 | 0.46 |
| Pounds of feed per breeding ewe  | lbs. 1440  | 1000 | 1000 | 800  |

The primary source of income was lamb sales (auction and some direct). There was some wool income in some years. Feed costs included repairs, depreciation

of equipment, purchased hay and property taxes. Purchased hay cost was higher in 1997, resulting in a higher feed cost per ewe.

### Farmer Observations

#### Constraints & key elements to profitable lamb production as project begins:

*“Accessibility to markets is still probably the major issue. Producing a consistent predictable quality carcass in sufficient numbers to compete with Australian and New Zealand lamb seems to me to be an unattainable dream unless there is someone out there willing to devote a lot of free effort for many, many years.”*

*Our ‘taste test chef’ suggests that we should try marketing Vermont pasture fed lamb in top metropolitan area restaurants as a unique specialty product available only in autumn for a brief period of time. Possibly we should give him a SARE grant to undertake this as he is well able to communicate with chefs on their own level. As with other marketing ideas - very dependent, at least initially, on the energy and charisma of the salesperson.”*

## CASE STUDY 006

### Description of the Farm

Farm 006 has 35 acres total: 22 open, 7 permanently fenced, and the remainder in seasonal fence. The farm elevation is 1500' with clay-type soil, rolling to flat, south facing. The water supply is abundant. They have been grazing sheep and poultry but land is understocked, and it will be several years before maximum stocking rate is achieved. The number of ewes on the farm increased from 23 to 28 during the course of the study. Currently, Farm 006 is producing a small supply of fresh eggs sold locally and lamb which will be sold at feeder weights off grass. They no longer have time for direct marketing and are switching towards more lamb sales at auction.



**Goals:** *The farm's goal is to preserve open, productive land and produce a variety of products to be sold locally.*

### Production Objectives/ Management Strategies

**Production objectives at the beginning of the study:**

- ◆ Increase stocking density;
- ◆ Encourage growth of legumes;
- ◆ Winter-feed out on pastures to concentrate manure on poor pastures.

### Management Strategies:

Farm 006 moves ewes and lambs to a fresh pasture during the season according to pasture growth; sometimes as often as

twice/day to every 48 hours, depending on grass and producer's schedule. Their grazing season is generally April 30th to November 15th. They do stockpile pasture. They leave the flock outside until March 1<sup>st</sup>, and then move the sheep inside to shear. Farm 006 plans to leave the sheep out all winter with run-in shelter in winter 1998, and then lamb in May. The main forage source for winter feed is hay. They don't feed any grain to sheep, but do to horses and chickens. They feed a mineral mix of granular sheep mineral/salt mix from Agway.

They did not vaccinate until 1997. At that time, they started to vaccinate yearly for tetanus, because they now have horses. They de-worm prior to lambing, and again six weeks later. Pasture rotation is also a strategy for parasite control. Major health problems include unknown worm load and external lice on some of their wool animals.

Farm 006 has generally lambed early to sell to the Easter market and to be busy at a normally slack time of year. They changed to May lambing in 1998. They figure they work 25 hours per week on the farm. There is off-farm income and family members help as unpaid labor.

Electric fence is used for predator control. In summer of 1998, they also had horses on the farm. They spread composted manure and bedding on the fields and have not limed for 10 years. In 1997 they frost seeded one pasture, spread some manure on one field and plowed the hay field. They were not able to finish reseeded the hayfield until 1998. Poultry were grazed on some fields, and those areas showed a significant increase in production.

They market retail cuts at the farmers market. In summer 1998, they sold to the wholesale markets (lamb sales) and the restaurant trade.

### **Changes in management practices to achieve better pasture utilization for increased profits (goal of the project).**

At the beginning of the study, marketing was done primarily as retail through farmers markets direct sales. In 1998, all direct and retail sales stopped due to time constraints, and they marketed all lambs through auction. In 1996, a small amount

of grain was fed to the sheep. In the following years, no grain was fed to the sheep. In 1996, wool was sold through the wool pool, in subsequent years, the wool was not sold because of the low price of wool. In 1996, a small amount of hay was produced (400 bales). In subsequent years all hay was purchased.

Lambing was changed from February in 1996 and 1997 to April/May lambing in 1998 to take better advantage of pasture. All lambing in 1999 was done in late May.

### **Information Gathered/ Results**

#### **Species Composition:**

To help gain a better understanding of what was growing on the farm over the course of the study, we picked two areas to look at soil fertility, species composition and take forage nutrition samples.

Winter Pasture: This was a pasture where hay was fed to the sheep during the winter in order to improve production and soil fertility. Winter-feeding appears to have resulted in an increase in grass and reduction in clover during the study.

Visual observation by the farmer and the researchers indicate that there was a significant increase in productivity on the pasture. However, there was also an increase in the amount of rejected forage.

Three Wire Pasture: This pasture was used as a ram and horse pasture the second year. The consequence of this was that it was continuously grazed too short to sample. The overall productivity of the pasture was relatively low. The farmer hopes to winter feed sheep on this field in the future in order to improve production.

In addition to grazing management and animal impact, pastures were also affected by when the samples were taken (plant age), climatic variations and other factors. See Appendix A for percent species composition data which was collected by the clipped quadrat method.

#### Average Daily Gains:

In 1997 early fast growing lambs were sold to the Easter market (43 days of age). In both years, the lambs were sold as soon as they reached market weight. No grain was in fed to lambs in 1997 or 1998.

#### Lamb Average Daily Gains

| Days of Age | 45-50       | 55-60        | 155-160      | 205-210      |
|-------------|-------------|--------------|--------------|--------------|
| 1997        | .6 lbs./day | -            | .44 lbs./day | .36 lbs./day |
| 1998        | -           | .57 lbs./day | .35 lbs./day | -            |

#### SPA (Standardized Performance Analysis) Data

|                                  | 1996  | 1997 | 1998 |
|----------------------------------|-------|------|------|
| Gross revenue per ewe            | \$ 97 | 123  | 90   |
| Feed cost per ewe                | \$ 25 | 53   | 18   |
| Total operating expenses per ewe | \$ 75 | 124  | 48   |
| Income after expenses per ewe    | \$ 22 | -1   | 42   |
| Lambs weaned per ewe exposed     | 1.35  | 1.39 | 1.39 |
| Pounds of feed per breeding ewe  | 1216  | 896  | 840  |

The primary source of income on the farm is the sale of lambs. In 1996 and 1997 the farm did a considerable amount of direct/retail marketing at farmers markets and to the Easter market. This is reflected in higher gross revenue per ewe and in higher processing cost in those years. There was also income from culls, yarn and wool. In 1997 and 1996, some lambs were also sold at the Easter market.

They purchased nine ewe lambs in 1997 to increase the flock size. However, those

ewes did poorly and had to be culled by the end of the year.

Feed cost were higher in 1997 because hay costs were higher, and they paid to have manure spread that year. Overall pounds of stored feed fed per ewe decreased over the course of the study because of improved management. They made some hay in 1996, but purchased all hay in future years. Some of the hay purchased in 1997 was not fed until 1998.

## Farmer Observations

### Constraints & key elements to profitable lamb production as project begins:

*“Constraints include cost of ewe maintenance, winter feed expenses, and quality, availability and cost of forage. Marketing is also a constraint; there is a lot of work involved. It is rewarding but can be exhausting. Key elements to profit are ewes that will graze and produce without grain and ewes that produce more than one lamb per year.”*

*Constraints are constant. Time and energy are always a factor. Identifying a ewe with proper genetics for grazing and milk production (to raise lambs) is vital as well as being healthy and adapting to the environment here. The possibility of grain feeding has presented itself to me again. What is the most economical way to do this and to whom - lambs/ewes?*

*Some management tools are essential, such as lamb and ewe weights. This has helped me identify good milkers. Handling and weighing systems will have to be incorporated into my farm.”*

### Comments as the project wraps up:

*“I have had an improvement of focus. I am going to focus on producing meat from grass. People may need to give up their favorite breeds to do this. I am interested in selecting for or finding ewes that graze and do well on grass. It would be interesting to compare crossbreeds using a good record keeping system.”*

*Questions I have include: What is the most opportune time and group of animals (ewes or lambs) to feed grain to? Will it pay? How to feed grain on pasture? Is it worth the effort?*

*What have I learned? I need to improve my management, whether on grass or in a feed lot. I need better records and better handling. Records don't lie. I would love to weigh lambs regularly in future years.*

*What is better on the farm? Improved data and records and lamb weights. I don't know if anything has improved in the pastures. I plan to do more winter feeding with more care to improve some poor pastures. This had a significant effect on the pasture it was done on, but it was fed too heavily and the sheep were in one place for too long so the clover was smothered and there was a lot of grass. I feel more solid about ideas on how to improve soil fertility without expensive purchases now.*

*You can make money on poultry and also make manure and improve soil fertility with nutrients imported in grain. Horse manure is also very useful.*

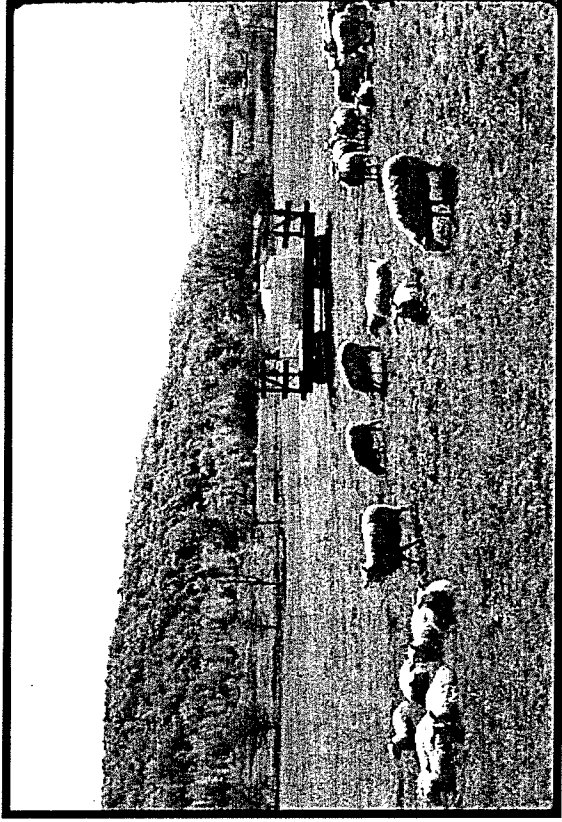
*Although some lambs reach market weight (100+ lbs.) on grass alone, some lambs never grow out well. Is this genetics or pasture? I am sure it is possible to rotate more frequently (every 12 hours) and select ewes to increase weight gains.”*



## CASE STUDY 007

### Description of Farm

This 135 acre south facing hill farm is located on a tributary to the third branch of the White River. Much of the pasture and cultivated land is river bottom. Currently, 29 acres are pasture, 7.7 are combination pasture and hay fields, 12.4 are hay fields and 12 are in corn raised by a local dairy farmer for his use. In return, that farmer does their haying.



The primary barn is 20' x 40' with hay storage above. A second barn is 10' x 35', also with storage above. Two paddocks totaling 2.4 acres are enclosed by five wire high tensile fencing, while all other pastures are enclosed by temporary three strand poly wire. They utilize intensive grazing management on most fields. The exception is a 14 acre field they are reclaiming, where the ewes spend most of the summer.

The flock is Montadale/Suffolk crosses. They have two rams: an older Montadale and a 3-year-old Suffolk. They are maintaining straight Montadale and Suffolk bloodlines for replacement ewes, while most of the market animals are crosses. They experimented with Texel ewes in 1997, but perhaps because of the quality of the animals, they were disappointed with the results. The flock is now closed.

**Goals:** *“Have a mutual (with my wife) farm based life style which successfully meets the challenges of running an agricultural business and contributes to the payment of real estate taxes; enhances our property values; keeps land open; and is fun.”*

### Production Objectives/ Management Strategies

Production objectives at the beginning of the study:

- ◆ In the area of lamb production:
  - Increase market carcass weight from 45.9 to 47 pounds, including organs;
  - Reduce lamb losses;
  - Market 70 lambs.

- ◆ In the area of pasture management:
  - Develop better utilization of early growth;
  - Increase quality of hay.

- Fence lower pasture (five wire) if economics allow;
- Stockpile grass for fall/early winter consumption.

### Management strategies:

### Information Gathered/ Results

#### ◆ Lamb production:

#### Species Composition:

- Feed limited amounts of corn starting 7/1;
- Worm on a regular time table (monthly during the summer);
- Bring in two new rams for the fall 2000 breeding period;

To help gain a better understanding of what was growing on the farm over the course of the study, we picked two areas to look at soil fertility, species composition and take forage nutrition samples.

- Continue to aggressively cull;
- Breed 37 ewes including 6 yearlings that will average 2.1 surviving lambs. That will be 78 lambs if our losses are held to 4;
- Keep at least 4 replacement ewes.

**New Seeding:** This area was previously rented out to a farmer who grew corn on it. It was seeded down to a pasture/hay mix in the spring of 1998.

#### ◆ Pasture Management:

- In fall, evaluate soil conditions in all pastures; correct major deficiencies;
- Cut first growth as early as possible and evaluate selling some;
- Cut lower pasture after flock has been through once;
- Continue to develop upper meadow, including soil tests, and consider cutting early;

**Hill Pasture:** This area is a steep pasture which tends to get very dry in late spring to mid summer.

In addition to grazing management and animal impact, pastures were also affected by when the samples were taken (plant age), climatic variations and other factors. See Appendix A for percent species composition data which was collected by the clipped quadrat method.

#### Average Daily Gains:

Lambs are rotated through pastures and supplemented with grain.

### Lamb Average Daily Gains Data

| Days of Age | 60-75        | 140-150      |
|-------------|--------------|--------------|
| 1997        | .76 lbs./day | .61 lbs./day |
| 1998        | .64 lbs./day | .48 lbs./day |

## SPA (Standardized Performance Analysis) Data

|                                  | 1996       | 1997 | 1998 |
|----------------------------------|------------|------|------|
| Gross revenue per ewe            | \$ 205     | 267  | 264  |
| Feed cost per ewe                | \$ 73      | 113  | 50   |
| Total operating expenses per ewe | \$ 237     | 336  | 266  |
| Income after expenses per ewe    | \$ -32     | -68  | -2   |
| Lambs weaned per ewe exposed     | lambs 1.86 | 1.79 | 1.83 |
| Pounds of lamb per ewe exposed   | lbs. 207   | 214  | 173  |
| Pounds of feed per breeding ewe  | lbs. 1725  | 1966 | 1094 |
| Return on assets: cost basis     | % -2.3     | -4.6 | -0.2 |

### Farmer Observations

#### Constraints & key elements to profitable lamb production as project begins:

*“A 40 ewe sheep farm managed by a couple with outside jobs/income, marketing meat and excess hay, can be profitable to the point of covering property taxes and property upkeep. Limited investment should be needed if property has a basic farm infrastructure. Our property can handle 100 ewes with little additional investment, but our time availability would not be sufficient and some hired help would be necessary. Beyond 100 ewes, some major investment would be required with additional paid labor, or a reallocation of our time required.”*

#### Comments as the project wraps up:

*“We have learned a great deal during the past three years, particularly about our farm as a business. And we are beginning to reach our near-term financial objectives within the scale of operation we have chosen. We have reduced our real and indirect costs, improved our pastures, and have a higher return per ewe. One of our key objectives was to increase the return from each lamb sold by increasing the market weight. Our goal was to exceed 47 pounds carcass weight on average. During the first third of our 1999 shipping year, our lambs are weighing in at 51.9 pounds on average!*

*This project has contributed to our understanding of our cost structure. And it has had a major impact on our ability to raise quality grass in quantity, thanks to Sarah Flack’s tutelage. Our constraints to a larger operation remain the same, and relate primarily to the amount of time we have to commit to the farm.*

*Overall, the project has been a benefit to us. It would have been more helpful if we could have discussed the relative farm performance results as we went along, so each of us could have made adjustments based on others ideas and performance. Hopefully the final report will provide this type of information. Does it make sense to have the participants sit down together to discuss the final report?”*

## CASE STUDY 008

### Description of Farm

This hillside farm consists of about 60 acres of pasture and meadow. There are 78 Montadale ewes. They usually use a Montadale ram, although one year they also used a Hampshire ram as a terminal sire. Fencing is all electric and includes high tensile and polywire. Grazing management is relatively intensive, and they are reclaiming some brushy areas using mob-stocking. Lambs are born in late winter and early spring. Most are marketed as Easter lamb and the rest are marketed in late summer and fall. This farm also raises some poultry, pigs and cows.



**Goals:** *“To make as efficient a farming operation as possible on a small scale. We raise mainly sheep. However, we raise a few heifers, milk a cow, have pigs, chickens, eggs and maple syrup. Our goals include being as profitable as possible, improving the land, eating well, keeping mentally and physically sound and having fun (not necessarily in that order). Having said all of that, this operation is a labor of love - having a farm that we can be pleased with and enjoy living on.”*

### Production Objectives/ Management Strategies

**Production objectives at the beginning of the study:**

- ◆ Reduce exposed ewes slightly;
- ◆ Have 100 lambs in February;
- ◆ Have all but replacement ewes and a few feeder lambs sold by Memorial Day;
- ◆ Move toward more intense rotational grazing ;
- ◆ Have more pasture available for winter and early spring grazing.

**Management Strategies:**

Farm 008 moves their sheep every two to three days during the grazing season. They keep track of the rotational pattern, i.e., when and where the sheep have been. Their grazing season is lengthening. Up until 1996, it was May 15<sup>th</sup> to November 1<sup>st</sup>. Now, they hope to start April 15<sup>th</sup> and finish only when there is too much snow for the ewes to get to forage. They stockpile pasture, and in winter, animals are outside with access to shelter. In lambing season,

they shut the sheep inside at night. They feed hay grown on the farm in the winter. They feed the milk cow and chickens grain and creep feed grain to the lambs. They have started feeding kelp along with salt. They do spread manure on their fields but feel they don't have enough. They lime when needed but have not used fertilizer in the last 7 years. The only animals that they have purchased during the past 10 years are rams.

They vaccinate for rabies when necessary. They control parasites by deworming the ewes twice a year with commercial dewormers. Lambs, once weaned, are dewormed every 25 or so days. They lamb in February in hopes of selling lambs for the Easter market. For predator control, Farm 008 uses a burro and has good electric fences. This has been a successful strategy as they have had the burro for 10 years and only lost 4 sheep.

Farm 008 has off-farm income. They work, on average, a total of 56 hours a week on the farm and they have some occasional unpaid (family) labor and a very small amount of paid labor at some times of the year. They feel that marketing is not their strong suit. About 50% of their lambs are hot house lambs, about 25% go to auction, and about 25% are sold to the restaurant, freezer trade.

### **Changes in management practices to achieve better pasture utilization for increased profits (goal of the project)**

The flock size was increased in 1996 to 84, after which they culled heavily and went back to 76 ewes. They may increase the flock size again over time using their own replacements.

During the study, they made significant improvements in pasture management and used mob stocking to reclaim some brushy pastures. They fed hay to livestock out on pasture in fall and winter to decrease the amount of manure they needed to spread and to improve the pastures in poorer areas. The improvement in pasture productivity and quality has extended their grazing season and helped decrease the amount of stored feed they need.

## **Information Gathered/ Results**

### **Species Composition:**

To help gain a better understanding of what was growing on the farm over the course of the study, we picked two areas to look at soil fertility, species composition and take forage nutrition samples.

**Brushy Hill Pasture:** This pasture was one that was in the process of being brought back from brush by mob stocking. At the time of the study, the pasture is a very diverse mix of trees, forbs and grasses. The forbs included golden rod, raspberries, buttercup, milkweed and many woody species. The area where the clipped quadrants were taken were primarily grass with about 15% percent clover. Researchers observed during the course of this study that the overall amount of woody forbs and trees decreased and the density of the desirable pasture grasses increased. The farmer said that the field looked "100 percent better" in 1998, and that there was definite decrease in non-edible weed species.

**Lower Pasture:** This pasture has been in the farm pasture rotation for many years and was producing high quality forage. This area has received no manure, and it is usually cut once for hay and then grazed. It

was generally representative of the majority of pastures on the farm, and there were no changes in how the area was managed.

In addition to grazing management and animal impact, pastures were also affected by when the samples were taken (plant age), climatic variations and other factors. See Appendix A for percent species composition data which was collected by the clipped quadrat method.

#### **Soil & Forage Tests:**

The soil test reflected what would be expected of a pasture in each respective situation. The Brushy Hill pasture showed a considerable increase in available phosphorus from 1997 to 1998. This is what one would expect in a mob-stocking situation. The soil test results are listed in Appendix C.

This farm does not produce enough manure to spread on all fields on a regular basis. But, even so, they have not applied any

commercial fertilizer to the farm in over seven years. Manure is spread primarily on fields that are harvested for hay.

The forage analysis results are listed in Appendix B

#### **Average Daily Gains:**

This farm lambs early (February) and targets the Easter market for the largest and fastest growing lambs. The lambs that go to this market are not reflected in the following average daily gains. Therefore, the following average daily gains only reflect the slower growing and later born lambs. The younger lambs show a higher rate of gain. This is normally expected, but the fact that they are supplemented with creep feed when they are young would also add to their rate of gain. Once lambs go out to pasture they are not supplemented with grain.

In 1998, there were more parasite problems than was usually seen on the farm, and there were also several cases of fly strike.

#### **Lamb Average Daily Gains**

| <b>Days of Age</b> | <b>75-85</b> | <b>160-170</b> |
|--------------------|--------------|----------------|
| 1997               | .62 lbs./day | .38 lbs./day   |
| 1998               | .41 lbs./day | .39 lbs./day   |

## SPA (Standardized Performance Analysis) Data

|                                  | 1996    | 1997 | 1998 |
|----------------------------------|---------|------|------|
| Gross revenue per ewe            | \$ 68   | 67   | 96   |
| Feed cost per ewe                | \$ 23   | 23   | 48   |
| Total operating expenses per ewe | \$ 42   | 44   | 66   |
| Income after expenses per ewe    | \$ 26   | 23   | 30   |
| Lambs weaned per ewe exposed     | 1.28    | 1.33 | 1.33 |
| Pounds of lamb per ewe exposed   | lbs. 67 | 68   | 70   |
| Pounds of feed per breeding ewe  | 1075    | 1204 | 884  |

The primary source of income on this farm is from sales of lamb, most of which go to the Easter market. The remaining lambs are sold at auction, freezer trade, and as replacement animals. Income from wool is higher than on many farms because it is sold to a local processor. Other income includes the sale of cull animals. A considerable amount of effort is put into direct marketing of products in order to receive the highest price possible. In 1998, there was a larger than usual amount of income from culls, and the lamb prices were higher than usual for both freezer and Easter lambs.

Feed cost per ewe tends to be relatively low because most hay is made on the farm with fully depreciated equipment. The total pounds of stored feed fed decreased during the study due to improved pastures and increased grazing season. In 1997 no hay was purchased. In 1996, about 1-ton of hay was purchased, and in 1998 2-tons of hay was purchased due to lower hay yields and higher stocking rate on the farm. This farm keeps detailed financial records and makes an effort to keep expenses as low as possible. Feed costs include repairs, hay, grain, property taxes and fuel.

## Farmer Observations

### Constraints & key elements to profitable lamb production as production begins:

*"Profitability is a relative thing. I think that the major problem is cost of production. Taxes, vet bills, feed costs, repairs, etc. To get to a critical mass, I think you need too much land which is very expensive. I do believe that there is a better market (therefore, price) in the Boston/NY area. However, there are too few sheep to provide a consistent supply. How do we get more sheep in Vermont?"*

*Allegedly the state wants to keep the land open, keep family farms intact, etc. Why not offer a \$25 per ewe annual subsidy to sheep farmers? I think this would create lots of interest in sheep - and kill about 5 birds with one stone!*

*The biggest constraints to profit... are that we have to cut our costs. Marketing might also be a constraint, but direct marketing to restaurants may help us with this."*

**Comments as the project wraps up:**

*"It would be interesting to look at this data over 10 years or longer instead of just 2 or 3. I think this project has been interesting and it has given us more focus to our operation and looking at different aspects of it.*

*The most valuable thing was visiting other farms in the project and going on pasture walks. Interaction with other farmers was very helpful, I wish there was more of that. Our pastures are better because we participated in this project.*

*I think our grazing is the most important thing that we have learned, especially since it has allowed us to have a longer grazing season. The project has also helped us look at costs too - we are more conscious of feeding grain and other costs. The only way we could make more money is to cut costs more...cutting costs right across the board!*

*We'll make more money in 1999 with many fewer lambs (we are keeping more replacements) due to our changes in marketing this year. We are selling light lambs directly to restaurants."*





## Appendix A: Pasture Species & Composition

001

| Year     | Ridge Pasture |      |      | SE Corner |      |      |      |      |
|----------|---------------|------|------|-----------|------|------|------|------|
|          | 1995          | 1996 | 1997 | 1998      | 1995 | 1996 | 1997 | 1998 |
| % Grass  | 82.9          | 91.3 | 87.1 | 70.3      | 89.2 | 91.1 | 91.3 | 91.6 |
| % Clover | 16.0          | 7.1  | 12.9 | 28.8      | 8.5  | 6.0  | 6.0  | 2.1  |
| % Forb   | 1.0           | 1.6  | 0.0  | 0.8       | 2.3  | 2.9  | 2.7  | 6.2  |

002

| Year     | Landing |      |      | Hovencamp |      |      |      |      |
|----------|---------|------|------|-----------|------|------|------|------|
|          | 1995    | 1996 | 1997 | 1998      | 1995 | 1996 | 1997 | 1998 |
| % Grass  | 89.6    | 86.3 | 87.0 | 81.7      | 45.8 | 92.1 | 81.1 | 68.0 |
| % Clover | 0.3     | 0.5  | 6.2  | 16.4      | 9.4  | 0.0  | 11.0 | 24.4 |
| % Forb   | 10.1    | 13.2 | 6.8  | 2.0       | 44.8 | 7.9  | 7.9  | 7.6  |

003

| Year     | Field #1 |      |      | Field #2 |      |      |      |      |
|----------|----------|------|------|----------|------|------|------|------|
|          | 1995     | 1996 | 1997 | 1998     | 1995 | 1996 | 1997 | 1998 |
| % Grass  | 97.7     | 99.1 | 93.8 | 95.2     | 84.4 | 95.3 | 98.1 | 98.3 |
| % Clover | 1.1      | 0.5  | 6.3  | 3.6      | 14.5 | 3.2  | 1.5  | 1.2  |
| % Forb   | 1.3      | 0.4  | 0.0  | 1.2      | 1.0  | 1.5  | 0.5  | 0.5  |

004

| Year     | Barn Pasture |      |      | Hillside Pasture |      |      |      |      |
|----------|--------------|------|------|------------------|------|------|------|------|
|          | 1995         | 1996 | 1997 | 1998             | 1995 | 1996 | 1997 | 1998 |
| % Grass  | -            | 76.1 | 82.8 | 82.3             | -    | 79.7 | 51.3 | 52.3 |
| % Clover | -            | 8.7  | 9.0  | 7.2              | -    | 1.2  | 3.6  | 8.2  |
| % Forb   | -            | 15.2 | 8.2  | 10.4             | -    | 19.1 | 45.2 | 39.5 |

005

| Year     | Duck Pond |      |      | Garden Plot |      |      |      |      |
|----------|-----------|------|------|-------------|------|------|------|------|
|          | 1995      | 1996 | 1997 | 1998        | 1995 | 1996 | 1997 | 1998 |
| % Grass  | 47.1      | 78.7 | 85.0 | -           | 68.8 | 82.3 | 61.5 | -    |
| % Clover | 42.1      | 14.7 | 8.8  | -           | 27.5 | 11.0 | 16.5 | -    |
| % Forb   | 10.2      | 6.6  | 6.1  | -           | 3.8  | 6.7  | 22.0 | -    |

006

| Year     | Wire |      |      | Winter Pasture |      |      |      |      |
|----------|------|------|------|----------------|------|------|------|------|
|          | 1995 | 1996 | 1997 | 1998           | 1995 | 1996 | 1997 | 1998 |
| % Grass  | -    | -    | 35.9 | -              | -    | -    | 73.2 | 89.3 |
| % Clover | -    | -    | 15.0 | -              | -    | -    | 23.7 | 0.7  |
| % Forb   | -    | -    | 49.0 | -              | -    | -    | 3.1  | 10.0 |

007

| Year     | Hill Pasture |      |      | New Seeding |      |      |      |      |
|----------|--------------|------|------|-------------|------|------|------|------|
|          | 1995         | 1996 | 1997 | 1998        | 1995 | 1996 | 1997 | 1998 |
| % Grass  | -            | -    | 35.9 | 73.8        | -    | -    | 53.2 | 35.3 |
| % Clover | -            | -    | 15.0 | 5.9         | -    | -    | 16.4 | 54.6 |
| % Forb   | -            | -    | 49.0 | 20.3        | -    | -    | 30.4 | 10.1 |

008

| Year     | Brushy Hill |      |      | Lower Pasture |      |      |      |      |
|----------|-------------|------|------|---------------|------|------|------|------|
|          | 1995        | 1996 | 1997 | 1998          | 1995 | 1996 | 1997 | 1998 |
| % Grass  | -           | -    | 79.3 | 79.0          | -    | -    | 76.4 | 82.0 |
| % Clover | -           | -    | 16.7 | 15.4          | -    | -    | 11.9 | 7.1  |
| % Forb   | -           | -    | 4.1  | 5.6           | -    | -    | 11.7 | 10.9 |

## Appendix B: Forage Nutritional Analysis

Note: All analysis results, except dry matter %, calculated on a dry matter basis.

|                              | Ridge Pasture |      |      |      | South End East Corner |      |      |      |
|------------------------------|---------------|------|------|------|-----------------------|------|------|------|
|                              | 1995          | 1996 | 1997 | 1998 | 1995                  | 1996 | 1997 | 1998 |
| <b>001</b>                   |               |      |      |      |                       |      |      |      |
| % Dry Matter                 | 20.8          | 16.9 | 22.1 | 18.7 | 23.7                  | 23.2 | 15.1 | 14.1 |
| % Crude Protein              | 22.3          | 31.1 | 17.2 | 17.8 | 20.7                  | 18.0 | 18.4 | 19.4 |
| % Soluble Protein            | -             | 48.3 | 48.1 | 49.1 | -                     | 55.2 | 47.7 | 47.9 |
| % Acid-Detergent Fiber       | 29.7          | 32.2 | 34.9 | 28.0 | 32.3                  | 34.9 | 26.1 | 24.0 |
| % Neutral-Detergent Fiber    | 53.6          | 59.2 | 62.1 | 45.2 | 58.3                  | 62.5 | 42.3 | 40.4 |
| % Total Digestible Nutrients | 68.9          | 66.9 | 64.5 | 70.3 | 66.8                  | 64.7 | 72.4 | 73.4 |
| % Calcium                    | 0.87          | 0.52 | 0.56 | 1.14 | 0.65                  | 0.56 | 0.81 | 0.93 |
| % Phosphorus                 | 0.37          | 0.33 | 0.33 | 0.35 | .31                   | 0.24 | 0.28 | 0.32 |
| % Potassium                  | 2.16          | 2.40 | 1.97 | 1.76 | 1.61                  | 1.89 | 1.98 | 2.30 |
| % Magnesium                  | 0.30          | 0.18 | 0.20 | 0.22 | 0.28                  | 0.19 | 0.21 | 0.23 |
| <b>002</b>                   |               |      |      |      |                       |      |      |      |
|                              |               |      |      |      | Landing               |      |      |      |
|                              |               |      |      |      | Hovencamp             |      |      |      |
|                              |               |      |      |      | 1995                  | 1996 | 1997 | 1998 |
| % Dry Matter                 | -             | 22.3 | 18.3 | 11.2 | -                     | 22.4 | 18.0 | 11.1 |
| % Crude Protein              | -             | 20.3 | 20.8 | 25.1 | -                     | 21.6 | 24.4 | 26.2 |
| % Soluble Protein            | -             | 31.4 | -    | 40.7 | -                     | 55.9 | -    | 44.4 |
| % Acid-Detergent Fiber       | -             | 30.3 | 26.5 | 24.2 | -                     | 28.2 | 23.0 | 23.1 |
| % Neutral-Detergent Fiber    | -             | 56.0 | 44.1 | 40.9 | -                     | 55.1 | 41.7 | 36.8 |
| % Total Digestible Nutrients | -             | 68.4 | 71.4 | 73.2 | -                     | 70.0 | 74.2 | 74.1 |
| % Calcium                    | -             | 0.52 | 1.06 | 1.13 | -                     | 0.60 | 1.20 | 0.96 |
| % Phosphorus                 | -             | 0.41 | 0.30 | 0.41 | -                     | 0.33 | 0.40 | 0.48 |
| % Potassium                  | -             | 2.72 | 2.15 | 3.17 | -                     | 1.50 | 1.82 | 3.49 |
| % Magnesium                  | -             | 0.21 | 0.32 | 0.27 | -                     | 0.14 | 0.27 | 0.27 |
| <b>003</b>                   |               |      |      |      |                       |      |      |      |
|                              |               |      |      |      | Field #1              |      |      |      |
|                              |               |      |      |      | 1995                  | 1996 | 1997 | 1998 |
| % Dry Matter                 | 23.4          | 17.5 | 19.5 | 19.7 | 20.1                  | 20.1 | 19.2 | 17.4 |
| % Crude Protein              | 19.9          | 26.6 | 24.6 | 20.3 | 20.1                  | 23.0 | 20.1 | 16.9 |
| % Soluble Protein            | -             | 48.5 | 47.8 | 46.9 | -                     | 52.7 | 47.9 | 46.5 |
| % Acid-Detergent Fiber       | 23.6          | 27.6 | 32.6 | 33.8 | 25.8                  | 27.9 | 33.4 | 38.4 |
| % Neutral-Detergent Fiber    | 52.3          | 52.9 | 55.9 | 59.8 | 44.9                  | 53.4 | 55.8 | 61.1 |
| % Total Digestible Nutrients | 69.8          | 70.5 | 68.7 | 65.6 | 72.0                  | 70.3 | 68.2 | 62.0 |
| % Calcium                    | 0.50          | 0.72 | 0.72 | 0.53 | 0.78                  | 0.32 | 0.37 | 0.47 |
| % Phosphorus                 | 0.32          | 0.43 | 0.42 | 0.43 | 0.30                  | 0.36 | 0.41 | 0.45 |
| % Potassium                  | 2.04          | 2.15 | 2.61 | 2.81 | 2.14                  | 2.19 | 2.93 | 3.10 |
| % Magnesium                  | 0.19          | 0.19 | 0.20 | 0.25 | 0.24                  | 0.13 | 0.18 | 0.23 |
| <b>004</b>                   |               |      |      |      |                       |      |      |      |
|                              |               |      |      |      | Barn Pasture          |      |      |      |
|                              |               |      |      |      | 1995                  | 1996 | 1997 | 1998 |
| % Dry Matter                 | -             | 15.7 | 28.6 | 17.1 | -                     | 16.2 | 24.8 | 20.0 |
| % Crude Protein              | -             | 20.2 | 20.1 | 22.3 | -                     | 19.3 | 16.3 | 16.4 |
| % Soluble Protein            | -             | 27.6 | 20.1 | 48.7 | -                     | 26.4 | 16.3 | 45.0 |
| % Acid-Detergent Fiber       | -             | 27.5 | 26.1 | 24.4 | -                     | 31.0 | 30.5 | 31.4 |
| % Neutral-Detergent Fiber    | -             | 48.3 | 53.3 | 24.0 | -                     | 51.7 | 54.1 | 47.6 |
| % Total Digestible Nutrients | -             | 70.6 | 71.7 | 73.1 | -                     | 67.8 | 68.2 | 67.5 |
| % Calcium                    | -             | 0.86 | 1.00 | 1.13 | -                     | 1.10 | 0.98 | 1.12 |
| % Phosphorus                 | -             | 0.42 | 0.51 | 0.38 | -                     | 0.38 | 0.21 | 0.33 |
| % Potassium                  | -             | 2.65 | 1.95 | 3.11 | -                     | 2.93 | 2.33 | 2.46 |
| % Magnesium                  | -             | 0.29 | 0.45 | 0.28 | -                     | 0.31 | 0.26 | 0.26 |
|                              |               |      |      |      | Hillside Pasture      |      |      |      |
|                              |               |      |      |      | 1995                  | 1996 | 1997 | 1998 |
| % Dry Matter                 | -             | 15.7 | 28.6 | 17.1 | -                     | 16.2 | 24.8 | 20.0 |
| % Crude Protein              | -             | 20.2 | 20.1 | 22.3 | -                     | 19.3 | 16.3 | 16.4 |
| % Soluble Protein            | -             | 27.6 | 20.1 | 48.7 | -                     | 26.4 | 16.3 | 45.0 |
| % Acid-Detergent Fiber       | -             | 27.5 | 26.1 | 24.4 | -                     | 31.0 | 30.5 | 31.4 |
| % Neutral-Detergent Fiber    | -             | 48.3 | 53.3 | 24.0 | -                     | 51.7 | 54.1 | 47.6 |
| % Total Digestible Nutrients | -             | 70.6 | 71.7 | 73.1 | -                     | 67.8 | 68.2 | 67.5 |
| % Calcium                    | -             | 0.86 | 1.00 | 1.13 | -                     | 1.10 | 0.98 | 1.12 |
| % Phosphorus                 | -             | 0.42 | 0.51 | 0.38 | -                     | 0.38 | 0.21 | 0.33 |
| % Potassium                  | -             | 2.65 | 1.95 | 3.11 | -                     | 2.93 | 2.33 | 2.46 |
| % Magnesium                  | -             | 0.29 | 0.45 | 0.28 | -                     | 0.31 | 0.26 | 0.26 |

|                              | Duck Pond |      |      |   |      |      |      |   |      |      |      |   |
|------------------------------|-----------|------|------|---|------|------|------|---|------|------|------|---|
|                              | 1995      |      | 1996 |   | 1997 |      | 1998 |   | 1999 |      | 2000 |   |
|                              |           |      |      |   |      |      |      |   |      |      |      |   |
| 005                          |           |      |      |   |      |      |      |   |      |      |      |   |
| % Dry Matter                 | 25.4      | 20.2 | 23.7 | - | 21.3 | 09.8 | 17.4 | - | 21.3 | 09.8 | 17.4 | - |
| % Crude Protein              | 25.2      | 30.0 | 22.6 | - | 23.6 | 26.8 | 22.4 | - | 23.6 | 26.8 | 22.4 | - |
| % Soluble Protein            | -         | 47.4 | 37.3 | - | -    | 45.9 | 37.4 | - | -    | 45.9 | 37.4 | - |
| % Acid-Detergent Fiber       | 22.5      | 23.2 | 23.5 | - | 24.9 | 24.8 | 22.9 | - | 24.9 | 24.8 | 22.9 | - |
| % Neutral-Detergent Fiber    | 39.8      | 44.5 | 41.1 | - | 42.7 | 45.9 | 32.3 | - | 42.7 | 45.9 | 32.3 | - |
| % Total Digestible Nutrients | 74.6      | 74.0 | 73.8 | - | 72.7 | 72.7 | 74.3 | - | 72.7 | 72.7 | 74.3 | - |
| % Calcium                    | 0.62      | 0.86 | 0.94 | - | 0.60 | 0.79 | 1.38 | - | 0.60 | 0.79 | 1.38 | - |
| % Phosphorous                | 0.40      | 0.49 | 0.38 | - | 0.37 | 0.44 | 0.43 | - | 0.37 | 0.44 | 0.43 | - |
| % Potassium                  | 2.60      | 2.55 | 3.03 | - | 2.76 | 2.59 | 3.65 | - | 2.76 | 2.59 | 3.65 | - |
| % Magnesium                  | 0.27      | 0.20 | 0.25 | - | 0.30 | 0.22 | 0.30 | - | 0.30 | 0.22 | 0.30 | - |

|                              | Three Wire Pasture |   |      |   |      |   | Winter Pasture |   |      |   |      |      |      |   |      |   |
|------------------------------|--------------------|---|------|---|------|---|----------------|---|------|---|------|------|------|---|------|---|
|                              | 1995               |   | 1996 |   | 1997 |   | 1998           |   | 1999 |   | 2000 |      | 2001 |   | 2002 |   |
|                              |                    |   |      |   |      |   |                |   |      |   |      |      |      |   |      |   |
| 006                          |                    |   |      |   |      |   |                |   |      |   |      |      |      |   |      |   |
| % Dry Matter                 | -                  | - | 20.6 | - | -    | - | -              | - | -    | - | -    | 16.8 | 17.8 | - | -    | - |
| % Crude Protein              | -                  | - | 16.6 | - | -    | - | -              | - | -    | - | -    | 19.1 | 28.2 | - | -    | - |
| % Soluble Protein            | -                  | - | 35.4 | - | -    | - | -              | - | -    | - | -    | 37.8 | 428  | - | -    | - |
| % Acid-Detergent Fiber       | -                  | - | 30.8 | - | -    | - | -              | - | -    | - | -    | 27.5 | 26.3 | - | -    | - |
| % Neutral-Detergent Fiber    | -                  | - | 47.2 | - | -    | - | -              | - | -    | - | -    | 44.2 | 45.0 | - | -    | - |
| % Total Digestible Nutrients | -                  | - | 68.0 | - | -    | - | -              | - | -    | - | -    | 70.6 | 71.6 | - | -    | - |
| % Calcium                    | -                  | - | 1.09 | - | -    | - | -              | - | -    | - | -    | 0.92 | 0.31 | - | -    | - |
| % Phosphorous                | -                  | - | 0.34 | - | -    | - | -              | - | -    | - | -    | 0.40 | 0.48 | - | -    | - |
| % Potassium                  | -                  | - | 3.20 | - | -    | - | -              | - | -    | - | -    | 3.31 | 4.15 | - | -    | - |
| % Magnesium                  | -                  | - | 0.28 | - | -    | - | -              | - | -    | - | -    | 0.24 | 0.20 | - | -    | - |

|                              | New Seeding |   |      |      |      |   | Hill Pasture |   |      |   |      |      |      |   |      |   |
|------------------------------|-------------|---|------|------|------|---|--------------|---|------|---|------|------|------|---|------|---|
|                              | 1995        |   | 1996 |      | 1997 |   | 1998         |   | 1999 |   | 2000 |      | 2001 |   | 2002 |   |
|                              |             |   |      |      |      |   |              |   |      |   |      |      |      |   |      |   |
| 007                          |             |   |      |      |      |   |              |   |      |   |      |      |      |   |      |   |
| % Dry Matter                 | -           | - | 18.2 | 14.2 | -    | - | -            | - | -    | - | -    | 18.6 | 18.7 | - | -    | - |
| % Crude Protein              | -           | - | 25.1 | 28.6 | -    | - | -            | - | -    | - | -    | 23.9 | 24.9 | - | -    | - |
| % Soluble Protein            | -           | - | 48.1 | 38.9 | -    | - | -            | - | -    | - | -    | -    | 39.5 | - | -    | - |
| % Acid-Detergent Fiber       | -           | - | 26.6 | 19.6 | -    | - | -            | - | -    | - | -    | 28.0 | 28.1 | - | -    | - |
| % Neutral-Detergent Fiber    | -           | - | 40.6 | 32.9 | -    | - | -            | - | -    | - | -    | 44.9 | 45.0 | - | -    | - |
| % Total Digestible Nutrients | -           | - | 71.3 | 76.9 | -    | - | -            | - | -    | - | -    | 70.0 | 70.1 | - | -    | - |
| % Calcium                    | -           | - | 1.07 | 1.02 | -    | - | -            | - | -    | - | -    | 0.90 | 0.89 | - | -    | - |
| % Phosphorous                | -           | - | 0.46 | 0.47 | -    | - | -            | - | -    | - | -    | 0.43 | 0.49 | - | -    | - |
| % Potassium                  | -           | - | 2.82 | 3.21 | -    | - | -            | - | -    | - | -    | 2.82 | 2.98 | - | -    | - |
| % Magnesium                  | -           | - | 0.30 | 0.28 | -    | - | -            | - | -    | - | -    | 0.29 | 0.27 | - | -    | - |

|                              | Brushy Hill |   |      |      |      |   | East Hill/ Low Pasture |   |      |   |      |      |      |   |      |   |
|------------------------------|-------------|---|------|------|------|---|------------------------|---|------|---|------|------|------|---|------|---|
|                              | 1995        |   | 1996 |      | 1997 |   | 1998                   |   | 1999 |   | 2000 |      | 2001 |   | 2002 |   |
|                              |             |   |      |      |      |   |                        |   |      |   |      |      |      |   |      |   |
| 008                          |             |   |      |      |      |   |                        |   |      |   |      |      |      |   |      |   |
| % Dry Matter                 | -           | - | 25.8 | 18.6 | -    | - | -                      | - | -    | - | -    | 23.2 | 19.9 | - | -    | - |
| % Crude Protein              | -           | - | 13.8 | 21.5 | -    | - | -                      | - | -    | - | -    | 15.3 | 22.1 | - | -    | - |
| % Soluble Protein            | -           | - | 31.6 | 35.6 | -    | - | -                      | - | -    | - | -    | 44.0 | 37.9 | - | -    | - |
| % Acid-Detergent Fiber       | -           | - | 26.1 | 25.1 | -    | - | -                      | - | -    | - | -    | 28.0 | 24.6 | - | -    | - |
| % Neutral-Detergent Fiber    | -           | - | 46.9 | 42.7 | -    | - | -                      | - | -    | - | -    | 44.5 | 40.8 | - | -    | - |
| % Total Digestible Nutrients | -           | - | 71.7 | 72.6 | -    | - | -                      | - | -    | - | -    | 70.2 | 72.9 | - | -    | - |
| % Calcium                    | -           | - | 0.92 | 0.87 | -    | - | -                      | - | -    | - | -    | 0.97 | 0.69 | - | -    | - |
| % Phosphorous                | -           | - | 0.29 | 0.36 | -    | - | -                      | - | -    | - | -    | 0.37 | 0.38 | - | -    | - |
| % Potassium                  | -           | - | 2.22 | 2.54 | -    | - | -                      | - | -    | - | -    | 2.82 | 2.64 | - | -    | - |
| % Magnesium                  | -           | - | 0.18 | 0.26 | -    | - | -                      | - | -    | - | -    | 0.20 | 0.23 | - | -    | - |

## Appendix C: Soil Tests

| 001                      | Ridge Pasture |      |      |      | SE Corner Pasture |      |      |      |
|--------------------------|---------------|------|------|------|-------------------|------|------|------|
|                          | 1995          | 1996 | 1997 | 1998 | 1995              | 1996 | 1997 | 1998 |
| pH                       | -             | 6.3  | 6.7  | 7.0  | -                 | 5.8  | 6.0  | 6.0  |
| Available P (ppm)        | -             | 1.3  | 1.4  | 2.0  | -                 | 0.7  | 1.3  | 2.9  |
| Reserve P (ppm)          | -             | 23   | 24   | 29   | -                 | 13   | 20   | 35   |
| Potassium (ppm)          | -             | 48   | 49   | 57   | -                 | 16   | 21   | 29   |
| Magnesium (ppm)          | -             | 84   | 78   | 71   | -                 | 36   | 33   | 35   |
| Calcium (ppm)            | -             | 1775 | 1799 | 2228 | -                 | 760  | 884  | 1102 |
| Effective CEC (meq/100g) | -             | -    | -    | 11.9 | -                 | 4.1  | -    | 5.9  |
| % Soil Organic Matter    | -             | -    | -    | 11.9 | -                 | -    | -    | 12.1 |

| 002                      | Hovencamp |      |      |      | Landing |      |      |      |
|--------------------------|-----------|------|------|------|---------|------|------|------|
|                          | 1995      | 1996 | 1997 | 1998 | 1995    | 1996 | 1997 | 1998 |
| pH                       | 6.0       | 5.7  | 5.8  | 6.3  | 6.1     | 6.2  | 6.1  | 6.6  |
| Available P (ppm)        | 7.0       | 6.3  | 6.4  | 6.6  | 7.4     | 5.9  | 7.2  | 7.8  |
| Reserve P (ppm)          | 107       | 182  | 170  | 124  | 118     | 115  | 125  | 132  |
| Potassium (ppm)          | 77        | 89   | 88   | 56   | 63      | 36   | 65   | 58   |
| Magnesium (ppm)          | 79        | 100  | 65   | 63   | 68      | 50   | 56   | 58   |
| Calcium (ppm)            | 1625      | 710  | 830  | 1003 | 1115    | 880  | 1008 | 1219 |
| Effective CEC (meq/100g) | -         | 4.6  | -    | 5.7  | -       | 4.9  | -    | 6.7  |
| % Soil Organic Matter    | -         | n/a  | -    | 7.3  | -       | n/a  | -    | 5.4  |

| 003                      | Field #1 |      |      |      | Field #2 |      |      |      |
|--------------------------|----------|------|------|------|----------|------|------|------|
|                          | 1995     | 1996 | 1997 | 1998 | 1995     | 1996 | 1997 | 1998 |
| pH                       | -        | 6.5  | 6.3  | 6.2  | -        | 6.1  | 6.3  | 6.3  |
| Available P (ppm)        | -        | 15.8 | 7.2  | 6.6  | -        | 6.3  | 6.0  | 6.0  |
| Reserve P (ppm)          | -        | 114  | 104  | 93   | -        | 98   | 104  | 106  |
| Potassium (ppm)          | -        | 130  | 130  | 135  | -        | 31   | 41   | 38   |
| Magnesium (ppm)          | -        | 53   | 72   | 88   | -        | 41   | 31   | 30   |
| Calcium (ppm)            | -        | 2470 | 1928 | 1608 | -        | 802  | 810  | 812  |
| Effective CEC (meq/100g) | -        | 13.1 | -    | 9.1  | -        | -    | -    | 4.4  |
| % Soil Organic Matter    | -        | n/a  | -    | 10.0 | -        | -    | 7.0  | 7.4  |

| 004                      | Barn Pasture |      |      |      | Hillside Pasture |      |      |      |
|--------------------------|--------------|------|------|------|------------------|------|------|------|
|                          | 1995         | 1996 | 1997 | 1998 | 1995             | 1996 | 1997 | 1998 |
| pH                       | -            | 6.1  | 6.3  | 6.0  | -                | 5.8  | 5.8  | 5.7  |
| Available P (ppm)        | -            | 5.1  | 5.2  | 6.0  | -                | 0.5  | 0.9  | 0.8  |
| Reserve P (ppm)          | -            | 89   | 110  | 108  | -                | 9    | 11   | 10   |
| Potassium (ppm)          | -            | 50   | 46   | 68   | -                | 57   | 61   | 63   |
| Magnesium (ppm)          | -            | 126  | 122  | 109  | -                | 64   | 52   | 51   |
| Calcium (ppm)            | -            | 1470 | 1471 | 1191 | -                | 1215 | 991  | 967  |
| Effective CEC (meq/100g) | -            | 8.5  | 8.5  | n/a  | -                | 6.8  | 5.5  | n/a  |
| % Soil Organic Matter    | -            | n/a  | 9.3  | 10.1 | -                | n/a  | 8.3  | 10.1 |

| 005                      | Duck Pond |      |      | Garden Pasture |      |      |      |      |
|--------------------------|-----------|------|------|----------------|------|------|------|------|
|                          | 1995      | 1996 | 1997 | 1998           | 1995 | 1996 | 1997 | 1998 |
|                          | pH        | 6.1  | 6.2  | 6.8            | 6.4  | 6.1  | 6.2  | 6.2  |
| Available P (ppm)        | 3.9       | 3.5  | 19.8 | 9.2            | 9.9  | 10.3 | 12.0 | 13.5 |
| Reserve P (ppm)          | 16        | 24   | 64   | 47             | 75   | 63   | 84   | 84   |
| Potassium (ppm)          | 161       | 291  | 406  | 220            | 206  | 179  | 17   | 281  |
| Magnesium (ppm)          | 188       | 199  | 202  | 178            | 142  | 105  | 17   | 141  |
| Calcium (ppm)            | 1915      | 1635 | 2289 | 1756           | 1525 | 1070 | 905  | 1309 |
| Effective CEC (meq/100g) | -         | 10.6 | 14.2 | 10.8           | -    | 6.7  | 4.7  | 8.4  |
| % Soil Organic Matter    | -         | n/a  | n/a  | 10.8           | -    | n/a  | n/a  | 6.5  |

| 006                      | Three Wire Pasture |      |      | Winter Pasture |      |      |      |      |
|--------------------------|--------------------|------|------|----------------|------|------|------|------|
|                          | 1995               | 1996 | 1997 | 1998           | 1995 | 1996 | 1997 | 1998 |
|                          | pH                 | -    | -    | 7.2            | 7.4  | -    | -    | 7.3  |
| Available P (ppm)        | -                  | -    | 1.0  | 1.2            | -    | -    | 5.2  | 7.7  |
| Reserve P (ppm)          | -                  | -    | 12   | 13             | -    | -    | 55   | 75   |
| Potassium (ppm)          | -                  | -    | 149  | 162            | -    | -    | 232  | 255  |
| Magnesium (ppm)          | -                  | -    | 45   | 55             | -    | -    | 52   | 92   |
| Calcium (ppm)            | -                  | -    | 2142 | 2331           | -    | -    | 1888 | 1940 |
| Effective CEC (meq/100g) | -                  | -    | -    | 12.5           | -    | -    | -    | 11.1 |
| % Soil Organic Matter    | -                  | -    | -    | 7.5            | -    | -    | -    | 5.5  |

| 007                      | New Seeding |      |      | Hill Pasture |      |      |      |      |
|--------------------------|-------------|------|------|--------------|------|------|------|------|
|                          | 1995        | 1996 | 1997 | 1998         | 1995 | 1996 | 1997 | 1998 |
|                          | pH          | -    | -    | 7.2          | 7.4  | -    | -    | 6.9  |
| Available P (ppm)        | -           | -    | 12.2 | 16.4         | -    | -    | 10.1 | 9.1  |
| Reserve P (ppm)          | -           | -    | 154  | 176          | -    | -    | 72   | 68   |
| Potassium (ppm)          | -           | -    | 63   | 86           | -    | -    | 43   | 46   |
| Magnesium (ppm)          | -           | -    | 90   | 91           | -    | -    | 38   | 44   |
| Calcium (ppm)            | -           | -    | 5273 | 6587         | -    | -    | 1014 | 967  |
| Effective CEC (meq/100g) | -           | -    | -    | 33.9         | -    | -    | -    | 5.3  |
| % Soil Organic Matter    | -           | -    | -    | 5.4          | -    | -    | -    | 3.5  |

| 008                      | Brushy Hill |      |      | East Hill/ Low Pasture |      |      |      |      |
|--------------------------|-------------|------|------|------------------------|------|------|------|------|
|                          | 1995        | 1996 | 1997 | 1998                   | 1995 | 1996 | 1997 | 1998 |
|                          | pH          | -    | -    | 5.7                    | 5.6  | -    | -    | 6.8  |
| Available P (ppm)        | -           | -    | 1.3  | 2.4                    | -    | -    | 2.1  | 2.4  |
| Reserve P (ppm)          | -           | -    | 17   | 33                     | -    | -    | 32   | 34   |
| Potassium (ppm)          | -           | -    | 55   | 96                     | -    | -    | 38   | 72   |
| Magnesium (ppm)          | -           | -    | 31   | 58                     | -    | -    | 130  | 212  |
| Calcium (ppm)            | -           | -    | 732  | 827                    | -    | -    | 1615 | 1788 |
| Effective CEC (meq/100g) | -           | -    | 4.1  | 4.9                    | -    | -    | 9.3  | 10.9 |
| % Soil Organic Matter    | -           | -    | 5.7  | 9.7                    | -    | -    | 7.0  | 10.1 |





