VIRGINIA GRAIN HANDLING PRACTICES AND CORN FOR POULTRY LITTER EXCHANGE PROGRAM

by

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Thesis submitted to the Faculty of
Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements
for the degree of:
Master of Science in Agricultural and Applied Economics

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July 14, 1999
Blacksburg, VA

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

ABSTRACT

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Keyword: corn, grain, exchange, fertilizer, phosphorous, and poultry litter

In the past twenty years the grain industry has experienced production declines in Virginia due to inability to compete with Midwestern grain producers. During this same time, consumption of grain by the poultry industry in Virginia has expanded rapidly. The levels of production and consumption of grain in Virginia are calculated and described on a state, regional, and county basis. Handling, storage, and marketing practices of grain in Virginia are assessed and described. Several different alternatives are presented and evaluated to determine their ability to improve the competitive position of Virginia corn with Midwestern states through the use of poultry litter to decrease production costs and present opportunities for producers to achieve better prices.

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INTRODUCTION

PREFACE

Over the past 20 to 30 years, the agricultural sector in Virginia has experienced many changes. Perhaps the most striking adjustment has been in the composition of the agricultural industry in the state. Large expansion in some agricultural sectors such as turkeys and broilers has occurred, while other sectors, like grain, have failed to flourish. Even with the expansion of some grain-consuming sectors, a decreasing percentage of Virginia land has been used for agricultural purposes, mainly because of a substantial decrease in corn and soybean acreage. While grain production has been declining, grain consumption within the state has reached all-time highs.

Although technological advances have served to lessen some of the impact, the decreases in corn and soybean (particularly corn) acreage over the past 20 to 30 years have been large. Many Virginia producers cannot compete with Midwestern producers and have taken acres out of production, switched to different crops, or used the land for non-agricultural purposes. What has happened to grain production, what will happen in the future, and what the possible implications of this change portend are of widespread concern.

Virginia is a large net importer of grain. Imports have increased over time, resulting in dollars that once contributed to the Virginia economy being sent to other states. The intent of this study is to assess the grain consumption and production within the state of Virginia, typical handling and marketing practices, and alternative marketing practices. The results provide important insight to the grain, livestock, and poultry sectors for future research to help the existing grain sector remain competitive and to investigate possible cooperation between the grain and poultry sectors to simultaneously improve the economic and environmental well-being of both sectors.

PROBLEM STATEMENT

During the past two decades farms in Virginia have become fewer in number and larger in size. In the past 20 years total corn and soybean acreage and production for the state has decreased. During this same time period usage of grain has greatly increased within the state. Poultry feeding during this time period has expanded dramatically and contract hog production has expanded in the southern part of the state.

The state is currently exporting much of its corn production at port locations such as Tappahanock and West Point, while at the same time the Virginia poultry industry is importing millions of bushels of grain by rail cars from the Midwest. **Virginia's grain production regions have not been able to successfully compete with Midwestern states, resulting in declining production. At the**

same time, consumption of corn and soybeans by Virginia poultry is at record high levels providing opportunities for the Virginia grain industry to capture more of the demand for grain in Virginia.

OBJECTIVES

The overall objective for this project is to conceptualize alternatives to help Virginia grain producers to better be able to compete with Midwestern grain producers. This overall objective will be completed in the context of several more specific objectives. These objectives are as follows:

1) Use typical feed rations and animal and poultry numbers to estimate Virginia consumption of corn and soybeans on a state, district and county level for 1989-1997.

2) Compile state, district, and county estimates of Virginia corn and soybean production from 1989-1997 using secondary data sources.

3) Survey 1,500 producers to determine current harvesting, handling, and marketing practices of Virginia corn, soybean, and wheat producers.

4) Compile an assessment of the current situation of poultry litter removal by the Virginia poultry industry.

5) Conceptualize a system for poultry litter usage and a grain transfer / poultry litter exchange in Virginia.

6) Provide information to grain producers and end users about the potential benefits and related issues of programs involving poultry litter as a substitute for commercial fertilizer and a grain/transfer poultry litter exchange system.

HYPOTHESES

This research project has two central hypotheses which tie all of the different components together. These hypotheses are the statements that: one can propose changes in production that will lower production costs and one can propose changes in marketing practices that will increase grain producer prices. This research project attempts to prove or disprove these hypotheses through descriptive techniques, cost estimates, and economic considerations.

KEY ASSUMPTIONS

Throughout this project several assumptions are made. These assumptions permit simplification of the problem and help to make it more manageable. The primary key assumption is that the term grain refers to only corn and soybeans. Later on in the study, some information will be provided about wheat, however it is not included in final assessments.

As the research moves along other key assumptions are made. The first assumption is that all livestock are fed according to typical feed rations. These feed rations are used to obtain reasonable estimates of grain consumption throughout the state. However, it is clear that there are often departures from this ration, particularly from independent to contract producers. The feed rations used are the same throughout the state.

An additional assumption made affects mileage distances between locations. To further permit simplification of the problem all mileage is gauged from major cities or the county seat. It is simply not feasible to look at transportation from each town or producer. Using major cities and the county seat gives producers reasonable estimates of transportation costs.

PROJECT COMPONENTS

This project consists of three major components. Each of the components are separate yet related. The first component of the project looks at the consumption and production of corn and soybeans in Virginia for the past thirty years. The data in this component provides a foundation for the rest of the project. The second component of the project takes the analysis of the Virginia grain industry one step further by looking at the handling, storage, and marketing practices of Virginia corn, soybean, and wheat producers. The final phase of the project uses the data in the first two components to conceptualize new production practices and a new marketing system to allow the Virginia grain industry to take advantage of the demand for grain in Virginia to improve their own economic well-being. These three components provide an overall assessment of the current and the alternative Virginia grain industry practices.

METHODOLOGY

The first two components of this study rely heavily on descriptive statistics to determine the current state of the grain industry in Virginia and to identify important trends. These two components rely on secondary data and expert opinion. The assessment of handling, storage, and marketing practices is based on

a producer survey. The survey was sent to 1,500 grain producers and was completed in cooperation with the Virginia Agricultural Statistics Service. The final component of this project is the conceptualization of alternatives to reduce grain production costs and/or help grain producers receive better prices. Data from components one and two, cost estimates, and economic considerations are used to conceptualize programs to use poultry litter in production practices. These programs also include a grain for litter marketing program that has the potential to benefit both the grain and poultry industries. A primary consideration in conceptualizing these alternatives is that they would be profitable as business ventures.

ORGANIZATION

This research was funded in part by the Virginia Corn Board over two years. Funding considerations make it necessary to report research progress each year. Therefore, this research project contains one research report that has already been published (Chapter 2) and another research report near publication (Chapter 3). The fourth chapter includes the conceptualization of a grain for litter exchange program marketing system and other alternatives using information contained in Chapters 2 and 3. Given that Chapters 2 and 3 were written to stand alone as research reports, the integration of the various components of this project does not occur until Chapter 4. Therefore, Chapters 2, 3, and 4 are more independent of each other than in a typical thesis, but they all address the same problem—how to make the Virginia grain industry more profitable.

This project is important to the grain industry because it will help to determine possible changes needed within the grain industry. Chapters 2 and 3 provide information which makes it possible to evaluate potential changes in the Virginia grain industry. This project includes description and partial analysis of these potential changes. The next chapters give the background for the changes and detail the economic feasibility of potential alternative programs for production and marketing grain in Virginia. Research in this area is important because it could help Virginia overcome competitive weaknesses with Midwestern states. This study will provide valuable answers to many questions about changes in the Virginia grain industry. Combined, the next three sections help to examine the past, present and the future for the grain industry in the state of Virginia.

CORN AND SOYBEAN CONSUMPTION AND PRODUCTION IN VIRGINIA

INTRODUCTION

It is important to determine consumption and production of corn and soybeans in Virginia to establish a foundation for the rest of the project. This was done by determining typical feed rations for livestock, poultry, and dairy animals in Virginia. These rations were then applied to animal population estimates to determine feed demand for corn and soybeans by each sector. Then corn and soybean production data by county was collected using secondary data sources. Based on the data, state and regional consumption, production, and deficits were calculated. The results of this work are described in the rest of this chapter.

FEED CONSUMPTION

Feed Consumption Calculations and Estimates

The amount of grain consumption in Virginia is not readily available through any data source, thus a method of determining grain consumption had to be formulated. Grain consumption was determined on a monthly basis for the eight primary grain consuming animal sectors in the state. The animal sectors include beef cattle, broilers, cattle on feed, dairy, hogs, horses, layers, and turkeys. Grain consumption was estimated using livestock, poultry, and dairy numbers and feed consumption rations for each. Feed assumptions, reflecting practices in Virginia, were determined by consulting various publications and university and extension personnel. The use estimates are based on the assumptions that corn weighs 56 pounds per bushel and that each 60-pound bushel of soybeans yields 47.3 pounds of soybean meal (sbm). Exports are not included in the use estimates.

For each livestock group, feed consumption was estimated monthly by year from 1965 to 1997. The feed assumptions include use by breeding stock and market animals. They also reflect changing feed efficiency over time and seasonal feeding in some sectors. Basic assumptions about feed use are summarized in Table 1. Detailed feed use assumptions and monthly consumption by county are available in the technical report *Corn and Soybean Production and Consumption in Virginia: Detailed Analysis.*[1]

[1] This report is available for $25.00 from David Kenyon, Dept. of Ag. and Applied Econ. (0401), Virginia Tech, Blacksburg, VA 24061.

Table 1. Feeding Assumptions

Beef Cattle	- 37% of total number of beef cattle wintered for slaughter are fed grain from November 1 to April 7 - 4.5 lbs. of corn and 1 lb. of soybean meal fed daily
Broilers	- commercial broilers fed 42 days - typical feed is 68% corn, 26% sbm, and 6% other - lbs. of feed/lb. of broiler has ranged from 2.02 and 2.00 between 1989 and 1997
Cattle on Feed	- cattle enter feedlot on first week of the month and slaughter occurs on 15th of each month - steers enter at 800 lbs. and leave at 1200 lbs.; heifers enter at 750 lbs. and leave at 1125 lbs. - 160 days on feed - steers consume 12 lbs. corn/day, 1.6 lbs. sbm/day; heifers consume 10 lbs. corn/day, 1.3 lbs. sbm/day - annual number of cattle fed is 1.56 times January 1 cattle inventory - 69% are steers, 31% are heifers
Dairy	- 87% of herd is in milk at one time - 63% of calves are born from July-December and 37% from January-June - 74% of concentrate portion of ration is corn and 21.5% is sbm for both lactating cows and replacement heifers - replacement heifers fed 4 lbs. of grain/day from 2-5 months of age; 3 lbs./day from 6-10 months; and 4 lbs. per day from 11-24 months - lactating cows fed 17 lbs. of grain concentrates daily
Hogs	- gestation period is 114 days - gilts bred at 8 months - sow replacement rate is 25% - one boar per 15.75 sows - market hogs are fed for 166 days - feeder pigs imported at 21 days - commercial hogs slaughtered at 256 lbs.
Horses	- 1,100 lb. average body weight - 2/3 of inventory idle - 1/3 of inventory working - all working horses fed year round - 10% of idle horses fed no grain - 30% of idle horses fed grain only November-February - 60% of idle horses fed grain year round - idle horses receive 3 lbs. corn/day and ½ lb. of sbm/day - working horses receive 6 lbs. corn/day and 1 lb. sbm/day
Layers	- .253 lbs. of feed consumed per day - feed is 65% corn, 21% soybean meal, and 14% other
Turkeys	- feed is composed of 63% corn, 27% sbm, and 10% other - market turkeys fed 111 days - market turkey feed rations combine hens and toms proportionately - market turkeys fed 2.7 lbs. of feed per lb. of bird produced - breeding stock assumed to be in the same proportion as reported in 1992 Census of Agriculture - every tom serves 9 breeding hens - breeding stocks and replacements are equal - breeders fed 365 days, males consume .9 lbs./day; females consume .5 lbs./day - replacements fed 98-112 days and males consume .48-.7 lbs./day; females consumes .36-.45 lbs./day

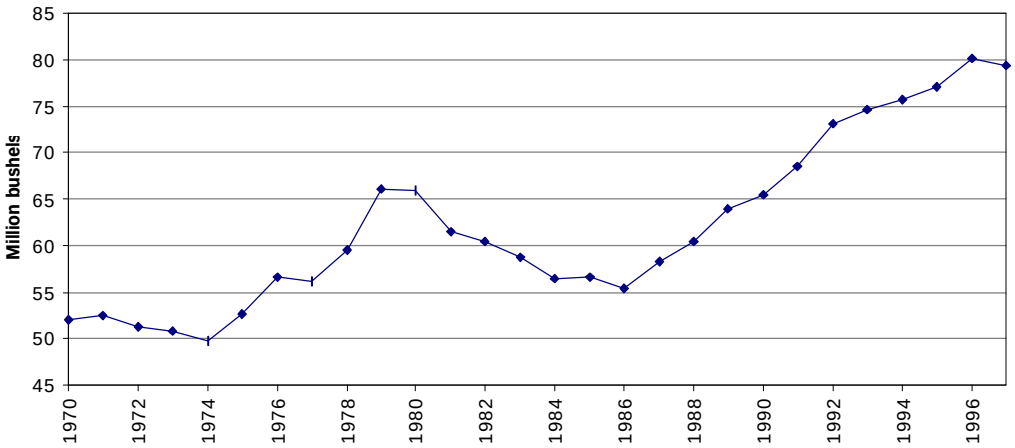
Feed use depends on feed consumption per animal unit and the number of animal units. The number of animals in each sector are shown in Table 2. These numbers provide an idea of the trend in animal numbers for each sector. Feed use in any sector also depends on breeding stock, imports into Virginia, and seasonal feeding. All these animals are included in the feed-use estimates. The detailed formulas for determining animal numbers by type for each sector are available in the technical report *Corn and Soybean Production and Consumption in Virginia: Detailed Analysis.*

Table 2. Livestock, Poultry and Dairy Numbers: 1989-1997

Year	Beef Cattle	Broilers	Cattle on Feed	Dairy Cows	Pig Crop	Horses	Layers	Turkeys
	---thousands---							
1989	202	182,371	40	142	748,000	81	3,760	16,600
1990	199	195,900	30	141	759,000	93	3,759	17,000
1991	196	218,700	35	141	748,000	104	3,843	17,300
1992	198	238,200	35	137	792,000	116	4,092	19,300
1993	199	244,400	40	132	735,000	127	3,966	21,000
1994	197	252,700	40	130	713,000	139	3,833	22,000
1995	205	260,100	40	129	640,000	150	3,821	23,500
1996	218	259,100	35	126	675,000	162	3,895	25,000
1997	228	259,400	30	122	667,000	173	3,693	25,000

Source: VASS

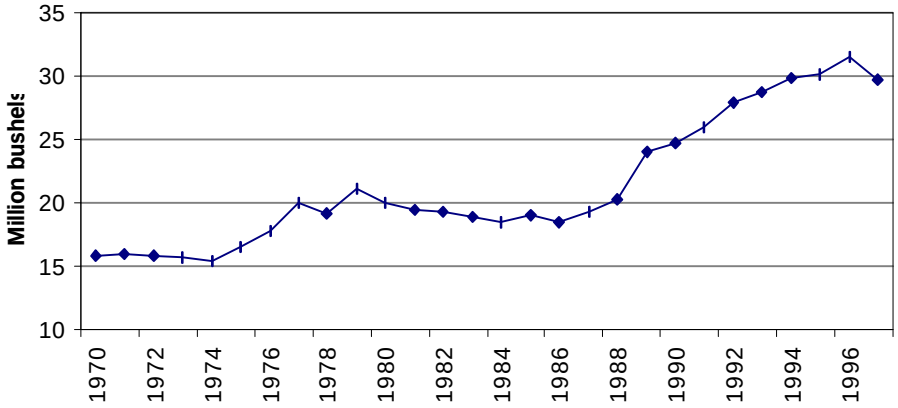
Figure 1. Virginia Corn Consumption: 1970-1997



Statewide Feed Consumption

In the past three decades, feed consumption of grain has greatly increased in the state of Virginia. Usage of corn (Figure 1) and soybeans (Figure 2) as livestock feed has gradually increased and was at an all-time high in 1996, with corn consumption exceeding 80 million bushels and soybean consumption exceeding 30 million bushels. Corn consumption has increased over 30 percent in the past 15 years, while soybean consumption has increased over 60 percent.

Figure 2. Virginia Soybean Consumption: 1970-1997



Feed Consumption by Livestock, Poultry, and Dairy Sectors

In the past three decades, large increases in broiler and turkey production have increased the demand for feedgrain within the state, particularly in the last 10 years. These increases have offset the decreases in consumption by hogs. At the same time, use by the dairy and layer sectors has remained relatively constant or declined slightly.

In 1997, broilers, turkeys, and dairy were the largest consumers of corn and soybeans in the state (Figure 3). Broilers were the largest corn and soybean consumers: 37 percent of all corn for grain and 43 percent of all soybeans. Turkeys were the second largest consumers of corn and soybeans, consuming 20 percent and 26 percent, respectively. Dairy is the third largest consumer of corn and soybeans, consuming 15 percent and 13 percent, respectively. These three sectors account for 72 percent of all corn consumed and 82 percent of all soybeans consumed. The category labeled as “Other” in each case represents the combination of horses, cattle on feed, and beef cattle wintered. Table 3 shows how these percentages by sector have changed every ten years starting in 1967.

Figure 3. Percentage of Corn and Soybean Use by Livestock Category: 1997

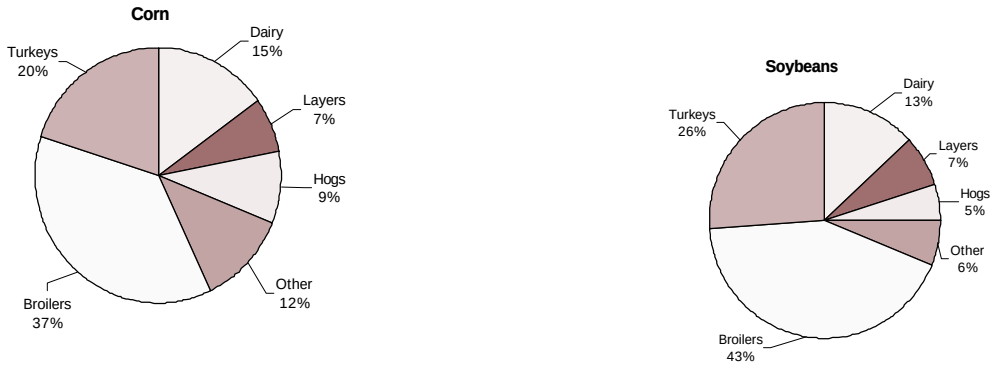


Table 3. Percentage of Corn and Soybean Use by Livestock Category Over Time

Category	1967	1977	1987	1997
	----------Corn----------			
Broilers	12	20	25	37
Turkeys	8	11	16	20
Layers	11	7	7	7
Dairy	30	22	23	15
Hogs	32	32	18	9
Other	7	8	11	12
	----------Soybeans----------			
Broilers	18	25	34	43
Turkeys	8	21	17	26
Layers	15	9	8	7
Dairy	33	21	24	13
Hogs	22	19	10	5
Other	4	5	7	6

Source: 1967-1987 "Corn and Soybean Use and Production in Virginia: Trends and Issues," 1989.

The consumption figures in Tables 4 and 5 give a picture of the trends in consumption for each individual sector over the last 25 years. In 1967, hogs and dairy accounted for most of the grain consumption. However, over the past 10 years, poultry has dominated consumption within the state. Consumption of corn and soybeans peaked in 1996 and is expected to remain high with the possibility of expansion in the turkey, broiler, and horse sectors.

Table 4. Annual Corn Consumption by Sector: 1970-1997

Year	Beef	Broiler	COF[a]	Dairy	Hogs	Horses	Layers	Turkey	Total
1970	1,036	8,042	1,383	12,591	20,671	1,325	4,222	2,547	52,032
1971	1,046	8,621	1,818	10,795	21,288	1,376	4,138	3,262	52,549
1972	1,062	9,186	1,466	11,669	19,259	1,416	3,925	3,092	51,268
1973	1,117	8,978	1,542	11,730	18,970	1,453	3,729	3,168	50,876
1974	1,277	8,790	1,224	11,456	18,441	1,489	3,510	3,357	49,732
1975	1,423	9,417	1,224	11,997	18,053	1,498	3,504	5,300	52,597
1976	1,426	10,546	1,581	11,887	19,829	1,507	3,641	6,008	56,597
1977	1,402	11,055	1,777	12,238	17,874	1,517	3,745	6,431	56,213
1978	1,234	10,762	1,975	14,486	18,138	1,525	4,033	7,245	59,577
1979	1,194	13,109	2,282	14,598	20,284	2,090	4,344	7,680	66,086
1980	1,971	13,055	2,328	15,218	20,951	1,801	4,200	5,934	65,957
1981	2,098	14,059	1,870	14,706	16,517	1,512	4,271	6,028	61,512
1982	1,982	14,523	2,379	14,630	14,282	1,521	4,192	6,397	60,363
1983	2,308	14,088	1,697	14,363	14,184	1,529	3,698	6,422	58,731
1984	2,754	14,545	1,636	13,715	11,605	1,538	3,683	6,564	56,443
1985	2,569	15,258	1,377	13,984	10,176	1,538	3,699	7,547	56,548
1986	2,620	14,032	1,780	13,476	9,302	1,546	4,090	8,088	55,335
1987	2,356	14,572	2,428	13,609	10,238	1,555	4,055	9,060	58,290
1988	2,013	16,224	2,042	14,031	10,591	1,582	4,015	9,513	60,391
1989	2,875	19,683	2,068	13,759	8,684	1,841	4,584	10,510	64,004
1990	2,549	21,516	1,831	13,475	8,759	2,100	4,800	10,453	65,483
1991	2,505	24,020	1,895	14,161	8,584	2,359	4,236	10,690	68,450
1992	2,528	25,453	1,965	13,399	8,921	2,619	6,240	11,985	73,110
1993	2,544	27,302	2,177	13,092	8,466	2,878	5,172	12,977	74,608
1994	2,516	28,844	2,248	12,598	8,329	3,137	6,000	13,528	75,658
1995	2,625	29,058	2,248	12,656	7,169	3,396	5,472	14,593	77,025
1996	2,789	30,204	2,037	12,410	6,977	3,655	6,336	15,676	80,084
1997	2,909	29,609	1,758	11,843	7,332	3,955	5,916	15,980	79,342

Source: 1967-1987 "Corn and Soybean Use and Production in Virginia: Trends and Issues," 1989 and 1988-1997 computed from livestock and poultry numbers using feeding assumptions.

[a] COF is Cattle on Feed.

Table 5. Annual Soybean Consumption by Sector: 1970-1997

Year	Beef	Broiler	COF[a]	Dairy	Hogs	Horses	Layers	Turkey	Total
1970	272	3,662	278	4,225	4,341	262	1,923	893	15,873
1971	275	3,926	369	3,623	4,426	271	1,884	1,149	15,939
1972	279	4,183	296	3,843	3,996	280	1,787	1,088	15,764
1973	296	4,087	314	3,948	3,932	287	1,699	1,114	15,689
1974	338	4,002	249	3,838	3,842	294	1,600	1,183	15,358
1975	376	4,290	249	4,032	3,812	295	1,595	1,866	16,257
1976	375	4,803	321	3,994	4,201	296	1,658	2,115	17,775
1977	368	5,035	360	4,232	3,831	299	1,704	4,098	19,939
1978	325	4,900	398	4,872	3,890	301	1,836	2,585	19,119
1979	314	5,968	358	4,919	4,406	401	1,978	2,704	21,136
1980	519	5,945	365	5,113	3,862	349	1,606	2,143	19,979
1981	552	6,402	293	4,941	3,061	292	1,634	2,178	19,421
1982	521	6,613	373	4,915	2,633	297	1,604	2,311	19,333
1983	607	6,415	266	4,826	2,677	297	1,414	2,321	18,890
1984	724	6,623	256	4,608	2,099	298	1,409	2,372	18,454
1985	676	6,948	216	4,699	1,919	298	1,415	2,728	18,963
1986	689	6,389	279	4,528	1,743	298	1,564	2,924	18,481
1987	620	6,636	381	4,573	1,954	301	1,551	3,275	19,356
1988	530	7,388	320	4,714	1,980	304	1,536	3,439	20,275
1989	678	8,910	351	4,623	1,975	356	1,752	5,333	23,978
1990	669	9,740	287	4,528	1,976	403	1,836	5,304	24,743
1991	659	10,874	298	4,759	1,921	452	1,620	5,424	26,007
1992	667	11,522	309	4,501	1,987	508	2,388	6,081	27,963
1993	667	12,359	339	4,400	1,875	559	1,980	6,584	28,763
1994	662	13,057	351	4,232	1,834	610	2,292	6,864	29,902
1995	690	13,154	351	4,230	1,567	658	2,088	7,404	30,145
1996	732	13,673	319	4,169	1,517	710	2,424	7,954	31,498
1997	764	13,403	243	3,981	1,597	764	2,256	8,108	31,116

Source: 1967-1987 "Corn and Soybean Use and Production in Virginia: Trends and Issues," 1989 and 1988-1997 computed from livestock and poultry numbers using feeding assumptions.

[a] COF is Cattle on Feed.

Overview of Feed Consumption by Sector

Broilers: Not only are broilers the largest consumers of corn and soybeans, but they are also the fastest growing sector. Since 1970, corn and soybean consumption by this sector has increased by more than 250 percent. In the past 10 years alone, consumption has increased by over 100 percent. Consumption by broilers peaked in 1996; however, the upward trend in consumption is expected to continue in the future.

Turkeys:. Since 1970, corn and soybean consumption by turkeys, the second largest consumer of feedgrain in the state, has increased by over 500 percent. In the past 10 years, it has increased by over 75 percent. The sector has become more feed efficient while simultaneously increasing bird weight. In the past 5 years, the number of turkeys raised has increased by nearly 20 percent, and the pounds produced have increased by over 30 percent. These increases indicate growth of this sector is likely to continue.

Dairy: Cow numbers have declined over the past ten years in Virginia. During this same time, feeding practices have changed very little. In the past 10

years, both the number of animals and feedgrain consumption have decreased about 15 percent. A pattern of slight decline in consumption is expected to continue in the future.

Hogs: From 1965 to 1980, hogs were the largest grain consumers in the state (Thornsbury and Kenyon, 1989). Consumption was anticipated to increase in the late 1980's with the introduction of contract hog feeding in Virginia; however, these increases failed to materialize as smaller producers left the sector (Thornsbury and Kenyon, 1989). In the past 10 years, corn consumption by hogs has dropped 30 percent and soybean consumption has dropped 20 percent. Although some of the decline is due to improved feed efficiency, the majority of the decline has been the result of a decrease in the number of animals being fed (Table 2). Environmental and nuisance concerns have contributed to the decline of the hog sector in Virginia over the past ten years (Purcell, p. 13). Environmental and zoning regulations will likely affect the future growth of this sector in Virginia.

Layers: Feed consumption by layers has increased slightly over the past three decades. In the past five years, rapid growth and increased variability in usage has occurred from year to year. Whether this recent increase in consumption will continue in the future is not clear.

Other: This category is generally comprised of beef cattle wintered, cattle on feed, and horses. Beef cattle wintered and cattle on feed have remained relatively stable over the past ten years. This trend is expected to continue. Horses have experienced growth in the past ten years, and future expansion of the horse sector is expected. Previous studies have included sheep, but with the decline in numbers in recent years, grain consumption by sheep is negligible and, therefore, was not included in this study.

Future Feed Consumption

Growth of corn and soybean consumption is expected to continue as we enter the new millennium. This growth will most likely not be as large as the growth experienced in the 1990's. The poultry and horse sectors have both indicated intentions to expand in upcoming years, while the hog and dairy sectors are expected to decline. The declines in these sectors are expected to be gradual and will probably be offset by the increases in the poultry sector. Environmental and zoning regulations will continue to play a part in the growth of hog, poultry, and dairy sectors. Overall, the demand for corn and soybeans by the livestock and poultry sectors is expected to grow in the next decade.

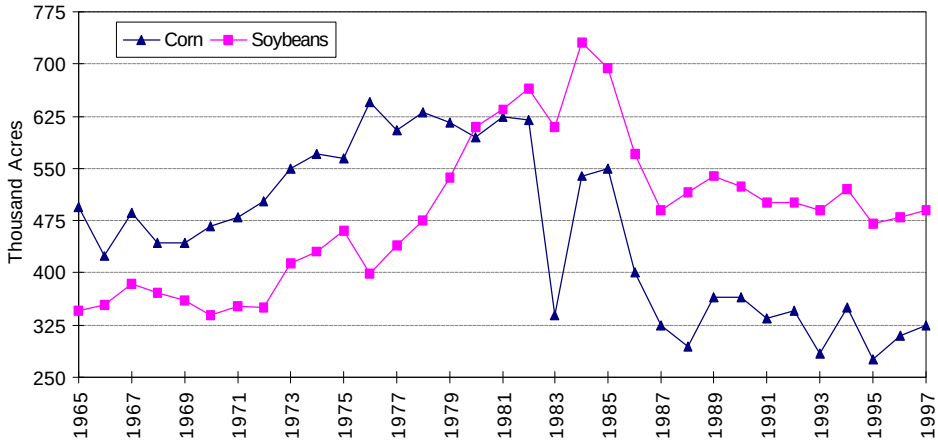
PRODUCTION

Production of corn and soybeans in Virginia has changed substantially over the past 30 years. Corn acres harvested for grain has declined, while soybean acreage peaked in the mid-eighties and after a sharp drop has remained relatively constant since 1987 (Figure 4).

Almost 300,000 acres of land previously in corn production in the 1970's is no longer in production. The inability of Virginia producers to compete with Midwestern corn producers is the main reason for this decrease. According to *The Economic Position of Virginia Agriculture: Mid-1990s,* the major causes for this lack of competitiveness are 1) weather and soil problems, 2) a national farm policy that puts Virginia producers at a disadvantage, and 3) lack of effort in the state during lean budget years to support research that generates technology appropriate for Virginia conditions (Purcell, p. 23).

The REAP study *Where Have All the Corn Acres Gone?* looks at what has happened to acreage taken out of production rather than why this trend has occurred. Evidence indicates these changes are not due primarily to increased urbanization, rather the majority (47 percent) of the acreage taken out of corn production have historically been placed in government feedgrain programs. The second largest (28 percent) cause of acreage decline was increased urbanization. The remaining 25 percent decrease in corn acreage is the result of acreage transferred to alternative crops because of poor returns associated with corn production (Thornsbury and Kenyon, p.15).

Figure 4. Corn and Soybeans for Grain: Harvested Acres, 1965-1997



The Thornsbury and Kenyon study also indicates the majority of these reductions have occurred over a 30-county area spread throughout the northern, eastern, and central parts of the state. They account for two-thirds of the total reduction in corn acreage. The study concludes that with higher prices over half the corn acreage taken out of production could be put back into production quickly. The significance of this conclusion is that the reduced corn acreage in Virginia does not have to be a permanent situation. If the economic incentives to produce corn for grain existed, much of the acreage would be put back into production. The growth of the poultry and other sectors in Virginia that use corn for feed could help to produce the economic incentives necessary to increase or stabilize corn for grain production within the state.

Corn (Figure 5) and soybean (Figure 6) production is highly variable in Virginia as the result of yield variations from year to year. Soybean production has been much more stable than corn production.

Figure 5. Corn for Grain Production: 1970-1997

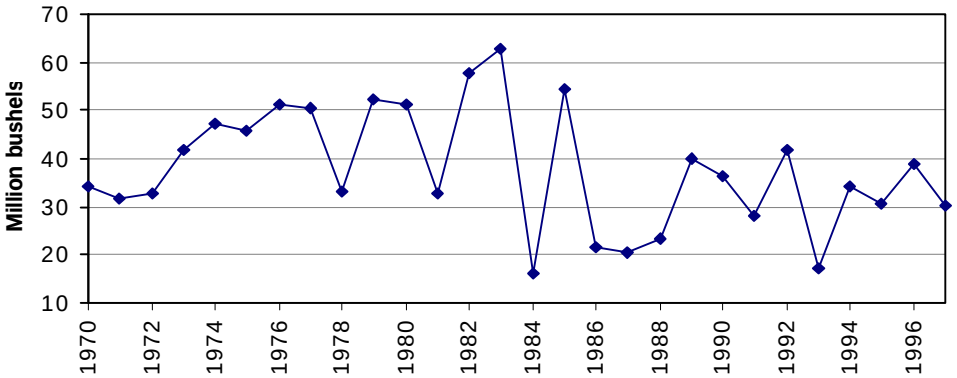
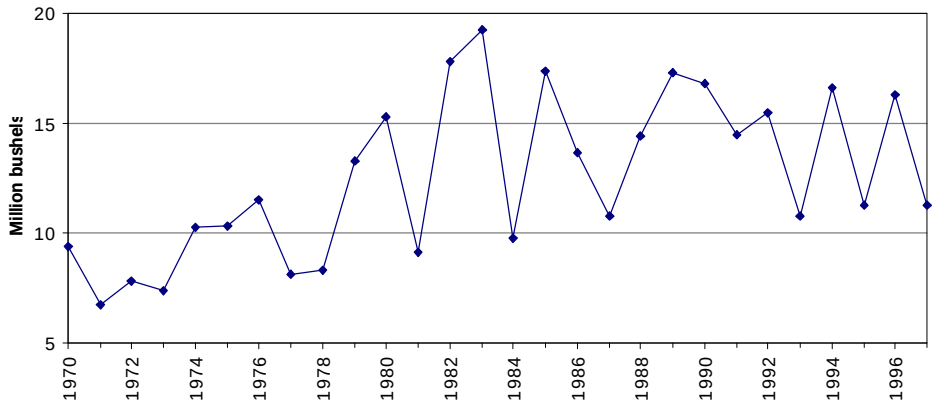


Figure 6. Soybean Production: 1970-1997



Like corn, soybeans have experienced a reduction in acreage over the past decade. Soybean production experienced a peak around 1985, dropped off rather sharply, and has stabilized in recent years. Soybeans tend to be more drought-resistant than corn and double-cropping soybeans with wheat has increased per acre returns. With the expansion of the poultry sector within the state, the soybean sector should remain stable in the state. Like corn, if economic incentives existed to increase production or technological advances improved profitability, more soybeans could be produced in Virginia.

FEED DEFICIT

The difference between production and consumption of corn and soybeans in Virginia determines the overall grain deficit. The size of the deficit is important because it determines how much grain is imported from other states, particularly the Midwest. Over the past 25 years, increased corn consumption has caused a general rise in the deficit. During this time period, the average deficit has been 23 million bushels. In the past 10 years, the average deficit has been nearly 40 million bushels, an increase of over 65 percent (Figure 7 and Table 6). Over the past 5 years, the deficit has been between 41 and 58 million bushels. The peak deficit year, 1993, was the result of low yields. Yield and acreage instability accounts for most of the variability in the deficit. The large deficit and the continued deficit growth are important concerns for Virginia agriculture. The fact that animal numbers are increasing while grain production has remained relatively constant in recent years clearly indicates that corn is coming from other states.

Figure 7. Virginia Corn Deficit: 1970-1997

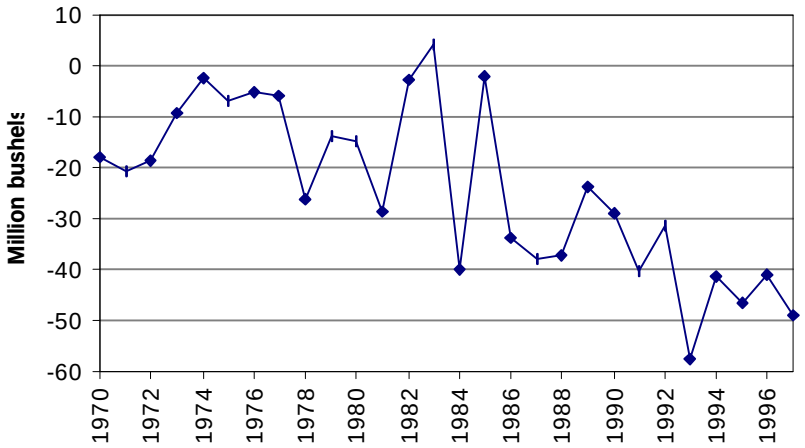


Table 6. Yearly Corn Deficit: 1970-1997

Year	Production	Consumption	Deficit
	----------Thousand bushels----------		
1970	34,188	52,032	-17,844
1971	31,756	52,549	-20,793
1972	32,640	51,268	-18,628
1973	41,666	50,876	-9,210
1974	47,299	49,732	-2,433
1975	45,603	52,597	-6,994
1976	51,307	56,597	-5,290
1977	50,311	56,213	-5,902
1978	33,275	59,577	-26,302
1979	52,289	66,086	-13,797
1980	51,071	65,957	-14,886
1981	32,741	61,512	-28,771
1982	57,708	60,363	-2,655
1983	62,896	58,731	+4,165
1984	16,316	56,443	-40,127
1985	54,450	56,548	-2,098
1986	21,600	55,335	-33,735
1987	20,475	58,290	-37,815
1988	23,305	60,391	-37,086
1989	40,150	64,004	-23,854
1990	36,500	65,483	-28,983
1991	28,140	68,450	-40,310
1992	41,794	73,110	-31,316
1993	17,100	74,608	-57,508
1994	34,300	75,658	-41,358
1995	30,525	77,025	-46,500
1996	39,060	80,084	-41,024
1997	30,225	79,342	-49,087

Source: Deficit calculated using VASS production and calculated consumption.

As with corn, the deficit in soybeans has risen since the mid- to late-1980s. A decrease in soybean acreage coupled with an increase in the poultry sector has caused this deficit. The deficit for the soybean industry is not as large as the corn deficit in bushels; however, the deficit for both equals about half the consumption. The lack of Virginia supply means that other states, like Ohio, Indiana, and Illinois, are capturing the economic gains from the demand for feedgrains in Virginia. The increasing deficit is likely to continue in the future unless economic incentives are put in place for Virginia grain producers to increase production.

Figure 8. Virginia Soybean Deficit: 1970-1997

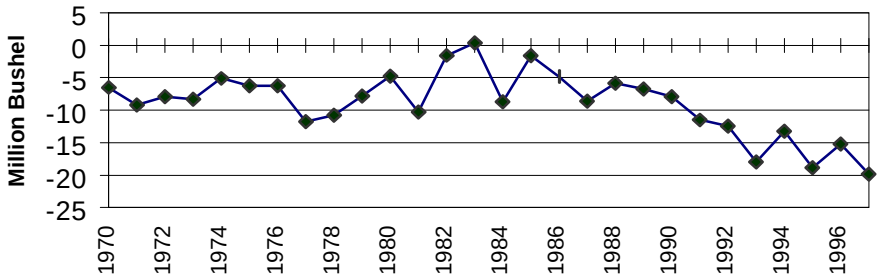


Table 7. Yearly Soybean Deficit: 1970-1997

Soybean Year	Production (000 bu)	Consumption (000 bu)	Deficit (000 bu)
1970	9380	15873	-6493
1971	6770	15939	-9169
1972	7834	15764	-7930
1973	7383	15689	-8306
1974	10272	15358	-5086
1975	10305	16527	-6222
1976	11500	17775	-6275
1977	8164	19939	-11775
1978	8352	19119	-10767
1979	13300	21136	-7836
1980	15277	19979	-4702
1981	9156	19421	-10265
1982	17786	19333	-1547
1983	19256	18890	366
1984	9765	18454	-8689
1985	17375	18963	-1588
1986	13680	18481	-4801
1987	10780	19356	-8576
1988	14420	20275	-5855
1989	17280	23978	-6698
1990	16800	24743	-7943
1991	14500	26007	-11507
1992	15500	27963	-12463
1993	10780	28763	-17983
1994	16640	29902	-13262
1995	11280	30145	-18865
1996	16320	31498	-15178
1997	11270	31116	-19846

Source: Deficit calculated using Virginia Agricultural Statistics Service production and calculated consumption.

REGIONAL ANALYSIS

Grain production and consumption is not evenly spread out across the state. To determine what areas were deficit versus surplus, Virginia was divided into seven regions using the Virginia Agricultural Statistics Service (VASS) crop reporting districts (Figure 9 and Table 8). Consumption was calculated based on the percentage of animals in each region according to the 1992 Census of Agriculture for Virginia data and annual county production data from the VASS.

Figure 9. Virginia Agricultural Statistics Service Crop Reporting District Map

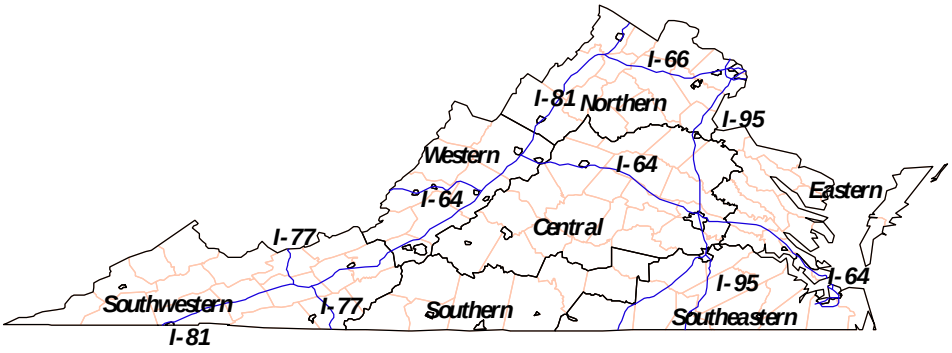


Table 8. Virginia Agricultural Statistics Service Regions

Northern	Eastern	Central	Southeastern	Southern	Southwestern	Western
Clarke	Accomack	Albemarle	Brunswick	Charlotte	Bland	Alleghany
Culpeper	Charles City	Amelia	Dinwiddie	Franklin	Buchanan	Augusta
Fairfax	Essex	Amherst	Greensville	Halifax	Carroll	Bath
Fauquier	Gloucester	Appomattox	Isle of Wight	Henry	Dickenson	Botetourt
Frederick	James City	Bedford	Mecklenburg	Lunenburg	Floyd	Craig
Loudon	King and Queen	Buckingham	Prince George	Nottoway	Giles	Highland
Madison	King George	Campbell	Southampton	Patrick	Grayson	Roanoke
Page	King William	Caroline	Surry	Pittsylvania	Lee	Rockbridge
Prince William	Lancaster	Chesterfield	Sussex		Montgomery	
Rappahannock	Mathews	Cumberland	Chesapeake		Pulaski	
Rockingham	Middlesex	Fluvanna	Suffolk		Russell	
Shenandoah	New Kent	Goochland	Virginia Beach		Scott	
Warren	Northampton	Greene			Smyth	
	Northumberland	Hanover			Tazewell	
	Richmond	Henrico			Washington	
	Westmoreland	Louisa			Wise	
	York	Nelson			Wythe	
		Orange				
		Powhatan				
		Prince Edward				
		Spotsylvania				

The production, consumption, and deficit data by region in Tables 9 and 10 indicate the regions of the state that are grain deficit. The assumption was made that each region is self-contained and does not export or import any grain from other regions or states. Grain consumption was calculated by region for each livestock, dairy, and poultry sector.

Table 9. Regional Corn Deficits: 1993-97 and 1997

	1993-97			1997		
Region	Production	Consumption	Deficit	Production	Consumption	Deficit
	----------Thousand bushels----------					
Northern	6,658	38,428	-31,770	6,524	39,716	-33,192
Western	1,432	8,193	-6,761	1,495	8,514	-7,019
Central	3,638	8,000	-4,362	3,668	7,969	-4,301
Eastern	9,391	4,041	+5,350	9,869	4,047	+5,822
Southwestern	1,185	3,903	-2,718	1,108	3,938	-2,830
Southern	1,108	2,801	-1,693	951	2,811	-1,860
Southeastern	6,830	6,955	-125	6,611	6,728	-117
TOTAL	**30,248**	**72,322**[1]	**42,074**	**30,255**	**79,342**[1]	**49,087**

[1] Regional consumption is approximately 93% of total state consumption because of disclosure problems in some counties.

Source: Deficit calculated using VASS production and calculated consumption.

Table 10. Regional Soybean Deficits: 1993-97 and 1997

Region	1993-97			1997		
	Production	Consumption	Deficit	Production	Consumption	Deficit
	----------Thousand bushels----------					
Northern	741	16,050	-15,309	857	17,224	-16,367
Western	53	3,308	-3,255	51	3,575	-3,524
Central	1,612	2,697	-1,085	1,445	2,695	-1,250
Eastern	6,255	1,579	+4,676	4,806	1,610	+3,196
Southwestern	4	1,163	-1,159	0	1,194	-1,194
Southern	296	950	-654	282	966	-684
Southeastern	4,396	1,840	+2,556	3,825	1,730	+2,095
TOTAL	**13,358**	**27,588**[1]	**14,230**	**11,270**	**28,994**[1]	**17,724**

[1] Regional consumption is approximately 93% of total state consumption because of disclosure problems in some counties.

Source: Deficit calculated using VASS production and calculated consumption.

The Northern region of the state stands out because of its large deficit. Over the past 5 years, the Northern region has, on average, accounted for 53 percent of total corn consumption and 58 percent of total soybean consumption. This region includes the Shenandoah Valley, where much of Virginia's poultry sector is located. The Western and Central regions have each averaged 11 percent of total Virginia corn consumption. The Western region accounted for 12 percent of soybean consumption in the past 5 years and the Central region 10 percent. Regional consumption of corn and soybeans by sector for years 1989 to 1997 is reported in the Appendix.

Production of corn and soybeans are dominated by the Eastern region. Over the past 5 years, the Eastern region has produced 31 percent of the corn and 47 percent of the soybeans in the state, making it the largest production region for both. The Southeastern region was the second largest producer of corn from 1993 to 1997 with 23 percent, and the Northern region was third with 22 percent. For soybeans, the Southeast region was second in regional production with 33 percent, and the Central region was third with 12 percent.

In the past five years, the Eastern region is the only region which has consistently met its own corn and soybean needs. Consistently, the Southeastern region has met its own needs for soybeans but has had a corn deficit over 100,000 bushels.

SUMMARY AND IMPLICATIONS

The livestock, poultry, and dairy sectors in Virginia consume nearly twice as much corn and soybeans as is produced in the state. In the past decade, the deficit has not only increased, but it has done so at an increasing rate. The deficit will continue to grow as the poultry sector continues to grow and grain production remains constant. In the last ten years, poultry has increased in the state while the number of dairy cows and hogs have decreased. Although the horse sector is one of the smallest, it has increased steadily in the past decade and is expected to continue to increase.

Much of the consumption and production of corn and soybeans in Virginia occurs in two regions separated by the Blue Ridge Mountains. Consumption occurs mostly in the Shenandoah Valley and production occurs primarily east of Interstate 95 from Fredericksburg to Emporia (Figure 9). These two regions are very different. The consuming region is growing and is characterized by a few, large, integrated poultry firms. The production region is stagnant and consists of many independent producers. Although these two regions are only 100 to 150 miles apart, very little grain moves between them. The Valley region generally finds it more economical to import feed by rail from the Midwest than to buy grain shipped by truck from Eastern Virginia.

Some of the characteristics of these two regions help identify the current situation and suggest some possible opportunities for the future that might benefit both sectors. The consumption sector in the Valley is dominated by the highly integrated poultry sector, which makes its own feed from corn. The demand for feed from independent feed dealers is declining because they generally serve sectors that are not growing. These trends are expected to continue in the near future.

The large integrated firms have less than one-week storage capacity for grain. Therefore, the integrators must have a regular, consistent supply of grain, which they import by rail from the Midwest. These large quantities of grain arriving in the Shenandoah Valley mean that a large volume of nutrients, specifically nitrogen and phosphorous, are being imported into the region as well. Sufficient cropland acreage does not exist in close proximity to poultry production to permit the land application of all these nutrients in an environmentally sound way. Hence, these nutrients must be shipped out of the poultry production region to be used as feed, fertilizer, or both. If the poultry sector is to continue to grow in the Valley, an increasingly larger portion of the poultry litter will need to be shipped out of the counties where the poultry is produced.

Grain production in Eastern Virginia in acreage and total bushels produced has declined over the last 20 years. The decline in production provides little

incentive to expand or upgrade existing grain handling facilities. In addition, the decline in hog production in the Eastern region has resulted in excess feed manufacturing capacity. Unless these two trends change direction, grain handlers in the Eastern region have little incentive to improve the grain assembly, storage, and distribution system.

The large feed demand and surplus nutrients in the Shenandoah Valley and the surplus of grain in Eastern Virginia would seem to indicate that these two sectors should be able to work together to improve the economic well being of both sectors. The magnitudes and location of the feed deficits and surpluses have been identified in this study. Additional research needs to be done to determine if a mutually beneficial arrangement of shipping grain from Eastern Virginia to the Valley and litter from the Valley to Eastern Virginia can be designed. Such an arrangement would have to address several key issues. The poultry sector needs to have a regular supply of high quality grain. To be interested in truck shipments from Eastern Virginia, the poultry sector would need a commitment of a consistent weekly supply over a number of years. The poultry sector would need to design a system for accumulating litter to be shipped to Eastern Virginia. Producers would need to know the nutrient content of the litter so that appropriate application rates could be guaranteed. Some storage for litter would be needed since crop producers apply fertilizer at specific times while litter is produced almost continuously. Sanitation considerations could arise from hauling grain and litter in the same trucks. These and other issues are currently being studied to determine if such a system is possible.

The existence of surplus grain manufacturing capacity in the Eastern part of the state would seem to indicate that expansion of the poultry or swine sector in Central or Eastern Virginia could increase the demand for grain, utilize existing excess feed manufacturing capacity, and create additional income opportunities for farmers. With the reduction in tobacco allotments, many producers may be looking for additional income sources. Contract feeding of poultry, swine, or both may be a possibility.

The deficit in corn and soybean production relative to consumption is likely to grow in Virginia in the future. The rate at which the deficit grows will depend on the factors previously mentioned and cooperative efforts to provide solutions to these problems. Identifying these solutions will require cooperation among researchers and the associations representing the poultry and grain sectors, private businesses, and entrepreneurs. It has been said “great opportunities are often brilliantly disguised as unsolvable problems” (anonymous). A cooperative effort between the grain and poultry sectors in Virginia could very well be that “great opportunity.”

PRODUCTION, HANDLING, AND MARKETING PRACTICES

INTRODUCTION

Over the past twenty years there have been many advancements in the products, handling, and marketing practices of the agricultural industry. These advances include the introduction of biologically engineered foods, advancements in crop rotations, more productive equipment, and the introduction of vertical integration and coordination, networking, and contracting. These advancements have enabled the agriculture industry to become more efficient. However, while the agriculture industry as a whole has been taking advantage of these advancements and reaping the benefits of such, the grain industry in Virginia has done little to change their existing infrastructure. Over the past twenty years, grain farms in Virginia have become larger, but fewer in number. However, the grain handling infrastructure which exists was designed to meet the needs of the grain industry as it was fifteen or twenty years ago. This situation is not ideal as Virginia farmers struggle to compete with Midwestern producers.

A clear picture of the grain infrastructure in the state is necessary for evaluation purposes. This study uses survey data to provide an up-to-date, clear picture of the grain handling and marketing practices in Virginia. This study is the second in a series of three studies being completed to examine agricultural competitiveness within the Virginia grain industry. The results provide important insight into the Virginia grain industry and will be used in further research describing alternative handling and marketing practices.

SURVEY

In order to assess the grain industry infrastructure, it is necessary to have data about the existing infrastructure. Little data is currently available on the handling and marketing practices of Virginia grain producers. A survey was used to obtain data to assess the current handling and marketing practices of Virginia grain producers. The survey was administered in March 1998 by the Virginia Agricultural Statistics Service and asked 1500 producers about their current harvesting, handling, drying, storing and marketing practices of corn, soybeans, wheat, barley and sorghum. A copy of this survey is found in Appendix A. Before administering the survey, a small group of producers were used to pre-test the questionnaire. The Virginia Agricultural Statistics Service then drew the sample of producers to be included in the survey and mailed the survey to those producers. The mail survey was then followed up with telephone interviews for those not responding. After all data collection methods were complete, a total of 957 valid responses were included in the data assessment. The remainder of those surveyed not included in the total responses represent people who did not respond, were no longer in production or filled out the survey incorrectly.

The survey was sent only to producers who had previously indicated in Virginia Agricultural Statistics surveys that they had more than 25 acres of production of some type of grain. The sample for the survey was determined based on the commodity produced by the operation, location, and farm size. Figure 1 shows the Virginia Crop Reporting Districts and Table 1 indicates the number of respondents from each Virginia crop reporting district. Table 2 has the respondents broken down by district and by total grain acres. Table 2 includes 896 valid responses to a question which asked how many total cropland acres were on their operation. The other respondents failed to respond to this question or gave responses which disagreed with later question answers. The sample was taken in such a way as to obtain an average response from typical farmers.

Figure 1. Virginia Agricultural Statistics Service Crop Reporting District Map

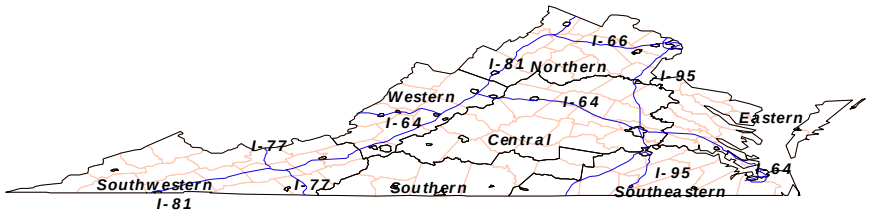


Table 1. District Survey Respondents	
District	Number of Respondents
Northern	204
Western	64
Central	170
Eastern	219
Southwestern	47
Southern	42
Southeastern	211
State	957

Table 2. Survey Respondents by Total Cropland Acres (acres)

Region	25-50	51-100	101-200	201-300	301-400	401-500	501-600	601-700	701-1000	1001-2000	2001+
Northern	20	44	65	21	10	3	9	3	9	1	1
Western	12	11	21	11	4	1	1	0	1	0	0
Central	29	34	35	26	7	12	10	0	3	4	0
Eastern	41	39	43	18	6	12	5	11	14	17	1
Southwestern	6	14	13	4	4	2	1	0	0	0	0
Southern	5	5	7	6	10	3	2	1	1	0	0
Southeastern	38	36	39	21	16	8	5	4	16	10	4
State	151	183	223	107	57	41	33	19	44	32	6

Table 2 can be used to obtain an idea of the type of producers included in this survey. By dividing the table into three different acreage groups it is possible to try and determine whether the farmers are full-time or part-time farmers. Producers having more than 600 acres account for 11% of survey respondents and are most likely full-time farmers. Producers having less than 200 acres account for 63% of survey respondents and are likely part-time farmers unless they have other intensive operations. This data suggests there are a lot of small farms. This demographic is important when interpreting later results.

Originally the survey was designed to give state and district averages. However difficulties arose with the way the sample was taken after the survey had been completed. Numerous attempts to expand the data to state levels gave results that were unreasonable or failed to account for all production within the state. When the sample for the survey was drawn, although measures were taken to make sure the sample was statistically valid, specific measures were not taken to ensure that it would be statistically valid when using expansion factors to expand to a state level.

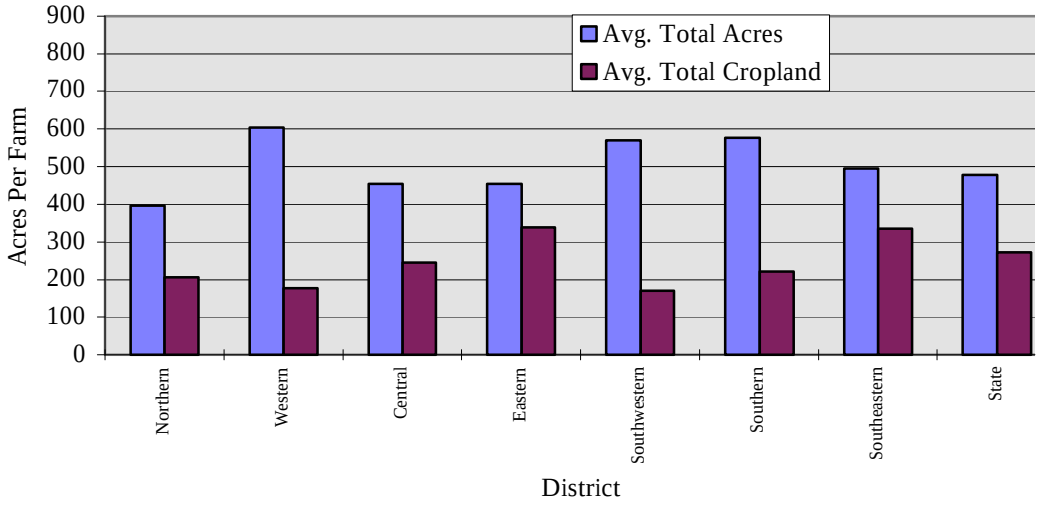
As a result, the survey data can not be accurately expanded to a state level. Although the population results are not valid, the sample results still retain validity.

The sample data was obtained by taking averages of all non-zero responses for each question by district and by state total. Not enough barley and sorghum producers were surveyed by region to accurately depict what is happening in these two sectors of the grain industry. The results for corn, soybeans, and wheat help give a picture of practices of Virginia farmers that can be used to help develop alternative grain handling systems.

ACRES

The first thing to examine when looking at the production practices of grain farmers is the size of the operations they own. The producers included in the survey had farms that were on average 478 total acres. The state average farm size according to the 1997 Census of Agriculture is 200 acres. However, the survey completed did not include farms which are below 25 acres or receive less than $1000 in income from farm proceeds. Thus, the results from the survey would be expected to be higher than census figures. Figure 2 indicates average total acres and average total cropland acres per farm.

Figure 2. 1997 Survey Response Total Farm and Total Cropland Acres



Of the survey respondents, on average nearly 60% of the total farm acres were in cropland. The Eastern and Southeastern districts tended to have more acreage in crops, with up to 75% of the total operation being cropland. The Southwestern and Western districts had as little as 30% of the operation devoted to cropland.

Once the total cropland acres were determined, the next step was to determine how much of that cropland was in grains. Table 3 indicates the total acres harvested for each of the five different commodities included in this study by district and state. Soybean acres account for 43%, corn 31%, and wheat 21% of acreage included in this survey. Since these three commodities account for 95% of the acreage included in the survey, from this point forward the results for barley and sorghum will not be reported.

The total acreage reported in Table 3 accounts for 16% of the combined state total for corn, soybeans, and wheat. When broken down by commodity the acreage captured by the survey is very evenly distributed. The survey captured 17% of the total state corn acreage, 16% of the state soybean acreage, and 15% of the state wheat acreage. The responses indicate farms in the Eastern district accounted for the most acreage of each commodity. Soybean operations were highly concentrated in the Eastern and Southeastern districts with these districts accounting for 80% of the reported acres. The Central district also had a lot of acres, which were mostly found in the counties bordering the edge of the Eastern district. On average corn and wheat were more evenly spread out across districts. The Eastern district accounted for most of the 37% of the corn and the Northern district accounted for 23%. This left the other 40% spread out over the other districts. For wheat the Eastern district accounted for 58% of total acreage and the Southeastern district accounted for 25%. Like corn, the other 17% was spread out amongst the remaining districts.

Table 3. 1997 Survey Response Average per Operation (acres/farm) and District Total (acres)

	Soybeans		Corn		Wheat		Barley		Sorghum	
Region	**Avg.**	**Total**	**Avg.**	**Total**	**Avg.**	**Total**	**Avg.**	**Total**	**Avg.**	**Total**
Northern	66	3,098	88	12,797	35	1,513	34	1,145	69	207
Western	39	347	73	3,287	41	371	46	323	0	0
Central	178	11,187	88	7,254	55	3,306	47	1,518	40	120
Eastern	215	38,884	153	20,760	156	21,073	96	4,148	30	298
Southwestern	10	10	52	1,710	32	127	40	40	0	0
Southern	51	662	58	1,046	37	889	77	306	55	55
Southeastern	151	22,052	91	8,781	94	9,104	30	240	22	178
State	170	76,240	103	55,635	99	36,383	60	7,720	34	858

Table 4 indicates the distribution of survey acreage for corn, soybeans, and wheat compared to the state distribution of acreage reported in the 1997 Virginia Agricultural Statistics Annual Bulletin. Although the numbers are not exactly the same, the distribution of acreage by district is very similar. This is important because later in this study it will be crucial to breakdown the data by district.

Table 4. 1997 Survey Distributions vs. VASS Annual Bulletin Distributions

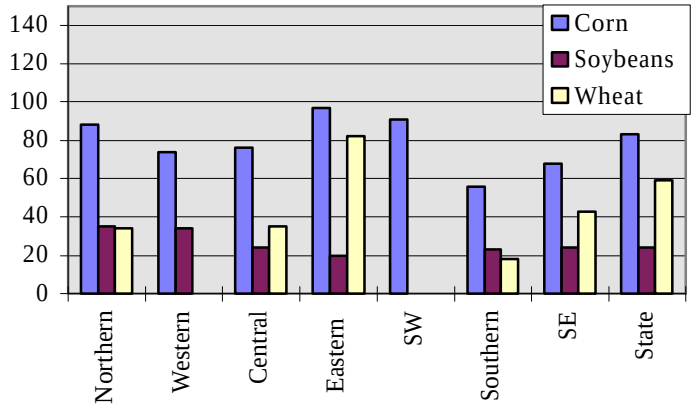
----- percent of total acreage -----

	Corn			Soybeans			Wheat		
Region	Survey	VASS	Diff.	Survey	VASS	Diff.	Survey	VASS	Diff.
Northern	22	23	-1	4	4	0	7	4	+3
Western	4	6	-2	0	0	0	1	1	0
Central	12	13	-1	12	15	-3	11	9	+2
Eastern	30	37	-7	50	50	0	45	58	-13
Southwestern	4	3	+1	0	0	0	0	0	0
Southern	4	2	+2	2	1	+1	8	2	+6
Southeastern	24	16	+8	32	30	+2	28	25	+3

YIELDS

Another important aspect of producer practices is the yields achieved. The producers surveyed were asked to report the yields received in 1997. The weather conditions are important to the yields achieved in 1997. Planting conditions were good for grain producers, however early cool summer temperatures coupled with drought conditions hurt yields for crops within Virginia. The producers surveyed reported yields that were lower than state averages. Figure 3 indicates average yields by commodity and district from the survey.

Figure 3. 1997 Survey Average Yields by Commodity and District (bushels/acre)



Of the producers surveyed, the Eastern District clearly had the best yields for corn and wheat. The Northern district reported the best yields for soybeans. The districts reporting the best yields are consistent with published Virginia Agricultural Statistics Service data for 1997. However, the actual yields tended to be reported lower than published figures across districts. This was due in part to

the farm size of those included in the survey. A large number of the respondents were small operations, and they typically have lower yields. In addition, for each commodity a few of the largest producers, which typically have better yields, left the yield section of the survey blank.

PRODUCTION

Naturally, after acreage and yields, total production would be the next consideration. Table 5 shows the total bushels per district and the average bushels per farm. The Eastern district had the highest production and had the best overall yield for corn. The Central region had the next best production per farm, but their yields were below the survey average as was previously shown in Figure 3. The Southwestern region had high yields, but low total production due to lower total acres. For soybeans, although their district yields were lower than the average state yield found by this survey (Figure 3), the Eastern and Southeastern district had over 75% of the total production captured by this survey. The Northern district had the best soybean yields and the highest average production per operation.

Table 5. 1997 Total Production and Production per Operation (bushels)

	Corn		Soybeans		Wheat	
Region	**Avg.**	**Total**	**Avg.**	**Total**	**Avg.**	**Total**
Northern	6,852	739,979	2,155	94,816	1,850	70,312
Western	5,897	200,493	1,426	11,405	2,368	21,309
Central	7,674	498,802	4,040	234,302	3,343	183,870
Eastern	15,349	1,980,084	4,396	734,088	11,302	1,435,314
Southwestern	4,630	69,455	0	0	2,413	9,650
Southern	2,777	33,320	1,115	12,269	1,784	37,471
Southeastern	6,151	553,631	3,619	499,404	5,720	526,260
State	9,293	4,075,764	3,868	1,586,284	6,679	2,284,186

Combining

The term handling practices is meant to encompass combining, hauling grain from the field, grain drying, and storage. Understanding current handling practices is crucial to Virginia grain producers if they are to adjust or change any handling practices to improve their economic well-being.

The first handling practice examined is combining grain in the field. The survey asked two questions about combining practices. The first of these questions was concerned with how many acres could be combined in one day. Answers to this question are summarized in Table 6 and appear to be relatively close from district to district. Overall the state corn average was 25 acres per day, the soybean average was 32 acres per day, and the wheat average was 31 acres per day. Although the averages are close from district to district, the Southern district notably deviates in acres per day for each district. A possible explanation of this deviation is the fact that there is very little grain production in this district and the equipment being used in this district may be older and generally have less capacity. The conditions of the cropland, such as slope and small fields in this district could also slow down the combining practices.

Table 6. 1997 Average Acres Combined per Day per Operation (daily acres per farm)

Region	Corn	Soybeans	Wheat
Northern	24	30	25
Western	25	34	24
Central	23	28	26
Eastern	27	36	38
Southwestern	18	NA	30
Southern	13	15	17
Southeastern	24	30	31
State	25	32	31

The survey also asked how many combines could be found at each operation. This information, in addition to the information from the previous question, indicates how quickly combining activities can take place. In general many of the smaller operations did not have combines and many of the larger operations had more than one. All districts, with the exception of the Southern district, had an average of 1 combine per grain operation. This means, using the average acres per operation in Table 2, it takes an average soybean operation 5.3 days to combine, a corn operation 4.1 days to combine, and a wheat operation 3.2 days to combine.

Hauling Grain From the Field

The survey allowed the respondents to indicate one of five different equipment types used to haul grain from the field. The four major equipment types were two-ton trucks (6-wheeler), ten-ton trucks (eight-wheeler), eighteen wheelers, and hopper wagon. The survey also indicated a place where respondents could simply mark "Other" if none of the choices properly described their activities. Tables 7 to 9 summarize the information collected from the respondents.

Table 7. Equipment Used to Haul Corn from Field (Total Trucks)

Region	Two-ton	Ten-ton	Eighteen	Hopper Wagon	Other
Northern	65	14	14	86	23
Western	23	2	1	17	7
Central	73	17	13	28	6
Eastern	94	64	67	4	5
Southwestern	15	1	1	21	3
Southern	8	1	1	7	2
Southeastern	94	20	8	11	24
STATE	372	119	105	174	70

Table 8. Equipment Used to Haul Soybeans from Field (Total Trucks)

Region	Two-ton	Ten-ton	Eighteen Wheeler	Hopper Wagon	Other
Northern	34	10	5	15	3
Western	4	2	2	3	3
Central	57	15	17	6	2
Eastern	135	74	71	9	8
Southwestern	2	1	0	0	0
Southern	10	2	0	4	2
Southeastern	134	27	19	24	38
STATE	376	131	114	61	56

Table 9. Equipment Used to Haul Wheat from Field (Total Trucks)					
Region	Two-ton	Ten-ton	Eighteen Wheeler	Hopper Wagon	Other
Northern	23	7	9	16	3
Western	9	0	0	5	3
Central	53	12	14	7	5
Eastern	113	66	81	6	33
Southwestern	4	0	0	3	0
Southern	19	1	1	8	2
Southeastern	104	25	13	16	17
STATE	325	111	118	61	63

The tables indicate that the primary choice of transportation for all three commodities is the two-ton truck. The Eastern district had far more hauling equipment than the other regions and the eighteen-wheeler and ten-ton trucks were mainly used by the Eastern district. For the Eastern district, the larger farms (as determined by strata size) had an average of 2 eighteen-wheelers per operation.

The survey also asked producers to report the capacity of each vehicle used. Tables 10 through 12 indicate the average capacities of the equipment used to haul grain from the field. The legal limit an eighteen wheeler can haul is 52 to 55 thousand pounds depending on the design of the vehicle. Using an average weight of 56 pounds per bushel for corn and 60 pounds per bushel for soybeans, an eighteen-wheeler could haul around 900-975 bushels of corn and around 865-920 bushels of soybeans and likely be within the legal limits. Several of the survey respondents report capacities larger than the legal limits. This is something that occurred in hauling grain from the field and later on hauling grain to the market. Of those reporting using eighteen-wheelers, approximately 30 producers reported capacities above the legal limits for each grain type. The majority of the remaining producers reported capacities very close to the legal limits. These producers caused the district averages to be above the legal limits in some cases.

Table 10. Capacity of Equipment Used to Haul Corn from Field (bushels/truck)					
Region	Two-ton	Ten-ton	Eighteen	Hopper Wagon	Other
Northern	347	295	790	183	146
Western	353	438	600	181	212
Central	352	485	1307	196	250
Eastern	352	596	941	310	627
Southwestern	211	---	950	103	48
Southern	269	---	---	166	188
Southeastern	366	534	1148	217	477
STATE	349	545	976	187	284

* --- indicates none reported

Table 11. Capacity of Equipment Used to Haul Soybeans from Field (bushels/truck)					
Region	Two-ton	Ten-ton	Eighteen Wheeler	Hopper Wagon	Other
Northern	366	239	700	169	60
Western	445	---	700	228	250
Central	358	478	1145	393	217
Eastern	367	566	871	333	430
Southwestern	---	---	---	---	---
Southern	284	500	---	240	202
Southeastern	328	558	899	392	151
STATE	350	542	905	311	192

* --- indicates none reported

Table 12. Capacity of Equipment Used to Haul Wheat from Field (bushels/truck)					
Region	Two-ton	Ten-ton	Eighteen Wheeler	Hopper Wagon	Othe
Northern	293	---	833	183	110
Western	397	---	---	253	250
Central	340	508	1,229	320	260
Eastern	378	596	871	280	705
Southwestern	300	---	---	245	---
Southern	272	500	---	171	202
Southeastern	349	513	1007	223	613
STATE	349	557	923	233	439

* --- indicates none reported

Drying

The next step in the handling process is drying. Of the 957 survey respondents, 20% had grain drying facilities on their operation. Nearly 50% of

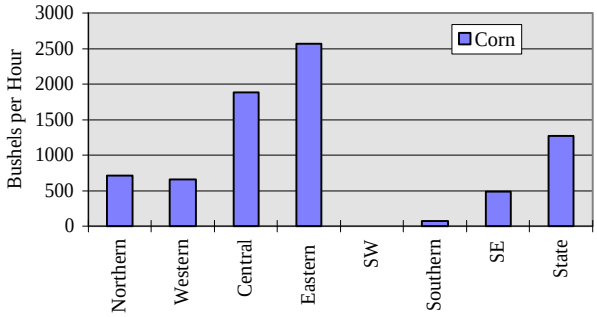
corn producers had grain drying facilities. Those who had grain drying facilities produce over 35,000 acres of corn or around 62% of the corn included in this survey. Those with grain drying facilities were also asked how many bushels of corn they dried in 1997 and how many bushels of corn they could dry from 22 percent to 15 percent moisture per hour. The average bushels dried per farm are summarized in Table 13. These averages correspond relatively closely to the production for each district (Table 5).

Table 13. Corn Dried and Percent of Production Dried

	Corn			
	Avg. Dried Per Farm	Total Dried	Total Prod. Production	Prod. Dried
Region	(bu/farm)	(bu)	(bu)	%
Northern	5,529	182,643	739,979	25
Western	5,125	10,250	200,493	5
Central	12,774	217,164	498,802	44
Eastern	18,233	437,594	1,980,084	22
Southwestern	4,125	4,125	69,455	6
Southern	1,200	1,200	33,320	4
Southeastern	7,969	358,606	553,631	65
State	10,619	1,211,402	4,075,764	30

Answers to the question regarding how much grain can be dried per hour were less consistent. Figure 4 shows the amount of grain which could be dried per hour varied widely from district to district. As expected, the Central and Eastern districts had the largest drying capacities and the Southern districts had the least.

Figure 4. 1997 Average Corn Bushels Dried per Hour



Storage

Another aspect of handling practices is grain storage. Table 14 details grain storage capacity reported from the survey. The questionnaire was mailed out in March of 1998 and at this time producers were still storing some of their 1997 crops. Thus, given the nature of the storage questions, producers were asked to base their answers considering storage of the 1996 crop. This information is useful in determining if there is excess or shortages of storage capacity in different regions. Storage information indicates where there is excess capacity and/or where more storage capacity may be needed.

Table 14. Reported Grain Storage Capacity

	Total Corn, Soybeans, Wheat, Barley, and Sorghum Storage			
	Avg. per Farm	Total Storage Capacity	1996 Grain Prod.	% of Prod. Which Could be Stored
Region	(bu/farm)	(bu)	(bu)	%
Northern	8,848	743,260	995,954	75
Western	6,179	123,570	239,407	52
Central	10,430	698,820	995,580	71
Eastern	15,083	1,055,800	4,524,358	24
Southwestern	5,350	85,600	83,105	103
Southern	4,540	95,350	97,159	99
Southeastern	13,757	1,389,475	1,551,877	90
State	11,826	4,191,875	8,487,440	50

Once the grain handling capacity of the respondents was determined, the next step was determining the capacity actually used. Table 15 indicates the total capacity used by each region and the excess capacity based on the figures found in Table 14. The figures found in Table 15 show there is excess storage capacity in each region. This excess ranges from 37 to 70% of the total storage capacity. Overall there is a 55% excess of storage capacity in the state. The 1996 crop year was a good production year and storage figures indicate what might happen on a typical year under typical conditions.

Table 15. 1996 Bushels Corn, Wheat, and Soybeans Stored

	Total Stored	Total Capacity	Excess	Total Capacity Used
Region	(bu)	(bu)	(bu)	%
Northern	263,586	743,260	499,674	35
Western	77,935	123,570	45,635	63
Central	392,946	698,820	305,874	56
Eastern	561,986	1,055,800	493,814	53
Southwestern	37,360	85,600	48,240	44
Southern	28,420	95,350	66,930	30
Southeastern	540,544	1,389,475	848,931	39
State	1,902,777	4,191,875	2,289,098	45

The grain storage situation can even be broken down further by the commodity stored. Table 16 shows the amount stored by district and commodity. The numbers reveal corn was the grain with the greatest volume stored in 1996 and wheat as the least.

Table 16. 1996 Bushels Stored and Percent of Production Stored

	Corn		**Soybeans**		**Wheat**	
Region	**Bu Stored**	**% Stored**	**Bu Stored**	**% Stored**	**Bu Stored**	**% Stored**
Northern	244,238	33	14,748	16	4,600	7
Western	71,855	36	200	2	5,880	28
Central	213,965	43	84,074	36	94,907	52
Eastern	274,900	14	180,115	25	106,971	7
Southwestern	37,160	54	0	0	200	2
Southern	17,930	54	7,840	64	2,650	7
Southeastern	278,775	50	200,719	40	61,050	12
State	1,138,823	28	487,696	31	276,258	12

The survey respondents were also asked to give the number of months each crop was stored. These averages are found in Tables 17 to 19. On average producers were storing grain 5-8 months. Sixty percent of the producers who stored wheat also stored corn. Out of 257 respondents who stored either corn, soybeans, or wheat, over 15% were storing both corn and wheat.

Table 17. Average Months 1996 Crop Stored			
Region	**Corn**	**Soybeans**	**Wheat**
Northern	8	4	6
Western	9	12	6
Central	8	5	5
Eastern	6	5	4
Southwestern	10	0	6
Southern	6	7	7
Southeastern	8	5	4
State	8	5	5

Tables 18 and 19 also indicate how long corn and soybean producers stored their crops by district and months. Overall most producers were storing 6 months. However, almost 50% of corn producers were storing 7 to 11 months, while only 20 percent of soybean producers were storing more than 6 months. The longer storage period for corn is probably related to corn use as livestock feed.

Table 18. Corn Storage Distribution (# of producers)						
Months	**1-2**	**3-4**	**5-6**	**7-8**	**9-10**	**11+**
Northern	6	8	26	9	9	18
Western	0	4	4	4	1	8
Central	2	2	14	9	3	9
Eastern	1	11	12	5	2	3
Southwestern	1	0	2	0	0	5
Southern	1	2	4	1	0	1
Southeastern	0	3	15	12	6	8
State	11	30	77	40	21	52

Table 19. Soybean Storage Distribution (# of producers)						
Months	**1-2**	**3-4**	**5-6**	**7-8**	**9-10**	**11+**
Northern	2	2	5	0	0	0
Western	0	0	0	0	0	1
Central	3	6	10	4	1	0
Eastern	2	16	11	5	1	1
Southwestern	0	0	0	0	0	0
Southern	0	1	1	0	0	1
Southeastern	4	19	15	5	2	4
State	11	44	42	14	4	7

Hauling to Market

Grain in Virginia is typically brought to the market using four major equipment types. The survey asked producers how grain was hauled to the market. Producers could choose from one of the four categories or write in something not listed in the "Other" category. The results showed two-ton trucks were the most popular method of transporting grain to the market. Tables 20 to 22 summarize the results by commodity and district.

Table 20. Equipment Used to Haul Corn to Market (Total Trucks)					
Region	Two-ton	Ten-ton	Eighteen Wheeler	Hopper Wagon	Other
Northern	53	12	16	7	6
Western	23	4	1	0	1
Central	42	10	19	0	1
Eastern	78	51	63	2	2
Southwestern	4	0	0	1	0
Southern	4	1	2	2	1
Southeastern	69	11	19	1	2
STATE	273	89	120	13	13

Table 21. Equipment Used to Haul Soybeans to Market (Total Trucks)					
Region	Two-ton	Ten-ton	Eighteen Wheeler	Hopper Wagon	Other
Northern	22	13	7	0	2
Western	6	3	2	0	1
Central	46	13	30	0	3
Eastern	112	62	66	5	2
Southwestern	0	0	0	0	0
Southern	9	1	1	0	2
Southeastern	100	16	34	5	8
STATE	295	108	140	10	18

Table 22. Equipment Used to Haul Wheat to Market (Total Trucks)					
Region	Two-ton	Ten-ton	Eighteen Wheeler	Hopper Wagon	Other
Northern	18	11	11	5	1
Western	6	0	1	0	1
Central	44	11	26	0	3
Eastern	86	56	68	2	2
Southwestern	0	0	1	0	0
Southern	21	0	2	1	1
Southeastern	71	12	27	1	6
STATE	246	90	136	9	14

Tables 20 to 22 are similar in distribution to Tables 7, 8, and 9. The primary difference is that all equipment types other than the eighteen-wheeler decrease. The decrease is particularly noticeable in the two-ton truck category, which is the largest of the all the categories. The eighteen-wheeler is the only equipment whose usage increased. The usage increased 15% for corn, 41% for soybeans, and 15% for wheat. Considering the capacity of the different equipment types, the eighteen-wheeler carried the most grain to the market.

Amount Hauled to Market

Producers were asked to indicate where their grain was sold. Those responding to this question represent 50% of the grain in this study. The remaining 50% was either not taken to market, remained in storage, or the producer failed to respond to this survey question. In order for a survey response to be counted as valid for this question, it had to include location the grain was sold and the amount sold. A large number of respondents declined to answer this

question completely, thus the results only reflect those who responded completely. Eastern producers took more production to market than any other district. Table 23 shows how much of each commodity was taken to market for this survey and Table 24 shows the percent of total production taken to the market.

Table 23. Total Bushels Taken to the Market According to Survey Respondents

Region	Corn	Soybeans	Wheat
Northern	174,844	57,258	52,717
Western	49,760	4,199	7,000
Central	159,911	145,468	119,324
Eastern	1,097,218	441,563	596,027
Southwestern	0	0	0
Southern	6,941	4,519	13,091
Southeastern	479,010	235,053	176,424
State	1,967,684	888,060	964,583

Table 24. Percent of Total Production Taken to Market

Region	Corn	Soybeans	Wheat
Northern	24	60	75
Western	25	37	33
Central	32	62	65
Eastern	55	60	42
Southwestern	0	0	0
Southern	21	37	35
Southeastern	87	47	34
State	48	56	42

The percent taken to market varies substantially across the districts. In the Southeastern district almost all corn production is taken to market. For wheat the Northern district takes almost all of its production to market. With these exceptions, the remaining districts take about two-thirds of their production or less to market. Typically the Northern, Eastern, Central, and Southeastern districts take the most to the market based on percentage and overall production.

Individual Markets

A total of 75 possible markets were mentioned by survey respondents. Of these markets, the top six were determined. For all three grain types there were approximately six major markets. These markets received 61, 59, and 60 percent

of corn, soybeans, and wheat respectively, reported in the survey. These markets are listed in Table 25. The market listed as Southern States includes all grain elevators operated by Southern States in Virginia.

Table 25. Major Grain Markets by Grain Type

Grain	Market
Corn	Perdue, Tappahannock
	Old Dominion Grain Corp., West Point
	Walters Grain, Windsor
	Wakefield Farm Service, Wakefield
	R.O. Mayes, Petersburg
	Southern States, Various Locations
Soybeans	Perdue, Tappahannock
	Southern States, Various Locations
	R.O. Mayes, Petersburg
	Old Dominion Grain Corp., West Point
	Perdue, Salisbury, MD
	Cargill, Norfolk
Wheat	Perdue, Tappahannock
	T-F Grain, Eastville
	Southern States, Various Locations
	Old Dominion Grain Corp., West Point
	Cargill, Norfolk
	R.O. Mayes, Petersburg

From this point, it was determined which counties were most likely to sell to each of these six markets for each commodity. Tables 26 to 28 summarize the major markets and the primary counties which sold to each market. This information is important because it helps indicate which counties and districts are selling to each of the markets. In most cases the major markets are served by the Eastern and the Southeastern districts. Some of the counties which serve the soybean markets are located in the Northern district. There are some counties which are served by two competing grain elevators in the area. Number of farms and their respective volumes could not be reported due to disclosure reporting regulations.

Table 26. Primary Counties Selling to Major Corn Markets	
Perdue	King and Queen
Tappahannock	Richmond
	Northumberland
	Essex
Old Dominion Grain Corporation	King and Queen
West Point	New Kent
	Gloucester
Walters Grain	Isle of Wight
Windsor	Suffolk City
Wakefield Farm Service	Sussex
Wakefield	Surry
	Southampton
R.O. Mayes	Dinwiddie
Petersburg	Prince George
Southern States	Various Virginia Counties
Various Virginia Locations	--- primarily Northumberland, Richmond, and Westmoreland

Table 27. Primary Counties Selling to Major Soybean Markets	
Perdue Tappahannock	Essex Richmond King and Queen Northumberland Hanover
Southern States Various Virginia Locations	Various Virginia Counties --- primarily Hanover, Henrico, and Louisa
R.O. Mayes Petersburg	Dinwiddie Prince George Brunswick
Old Dominion Grain Corporation West Point	King and Queen New Kent Gloucester
Perdue Maryland	Accomack
Cargill Norfolk	Charles City Greensville Mecklenburg Sussex

Table 28. Primary Counties Selling to Major Wheat Markets	
Perdue Tappahannock	Richmond Essex King and Queen Northumberland
T-F Grain Eastville	Northampton Accomack
Southern States Various Virginia Locations	Various Virginia Counties ---primarily Northumberland and
Old Dominion Grain Corporation West Point	King and Queen New Kent
Cargill Norfolk	Suffolk City Charles City
R.O. Mayes Petersburg	Dinwiddie Prince George Brunswick

SUMMARY OF TYPICAL PRACTICES

At this point it is possible to describe what might happen on an average Virginia farm during a typical growing season. An Eastern district farm is used as an example because it would typically produce the most grain. A typical Eastern district corn operation would be an operation consisting of 454 acres of which 339 would be cropland. An average operation would have 153 of those cropland acres in corn. The corn acres planted would be expected to yield 97 bushels per acre in a typical year, resulting in nearly 15,000 bushels of corn.

At a typical combining rate of 27 acres per day using an average of 1 combine per operation, harvesting would take around 5 days. The corn would most likely be brought in from the field using an eighteen wheeler or a two-ton truck. In the Eastern district about 13% of the respondents had grain drying facilities on their operation. Thus, it is most likely that this operation would take the corn somewhere to a market facility to be dried. If it were dried on-site, the drying rate would be around 2572 bushels per hour from 22 to 15 percent moisture. Thus, all the corn produced by this operation could feasibly be dried in one day. If on-site storage was available on this facility, it would likely store 14% of total production, which would be over 2000 bushels of corn. These bushels would be stored an average of 6 months. Grain would most likely be hauled to market using an eighteen-wheeler or a two-ton truck. Most of the corn would be sold to Perdue in Tappahannock, Virginia or Old Dominion Grain Corporation in West Point, Virginia.

The survey data helps to provide a clear picture of the grain handling practices in Virginia. Overall, the Eastern and Southeastern districts dominate grain production in Virginia. Due to this dominance in production, they also have the equipment with the greatest capacities. These districts do not have the best yields in the state, primarily due to the sandy soil type and lack of adequate moisture. However, they do have the largest combining capacity based on acres per day and some of the highest levels of drying capacity. The Eastern and Southeastern districts take, on average, over half of their total grain production to market and they typically store grain in the same patterns as the rest of the Virginia crop reporting districts. The Eastern and Southeastern districts also have a lot of excess storage capacity, especially the Southeastern district. This is significant because it opens up the opportunity for alternative handling and marketing practices which rely on excess storage capacity.

Grain handling and marketing practices are extremely important to the economic well-being of the grain industry in Virginia. In order to remain competitive, it is essential that efficient handling and marketing practices be in

place for each district in Virginia. As shown in the survey results, the various crop reporting districts in Virginia are quite different. Grain production is clearly dominated by the Eastern and Southeastern parts of the state. However, grain consumption is located primarily in the Shenandoah Valley. The grain industry in Virginia would benefit greatly if they were able to find a way to sell corn to poultry integrators in this state. The demand for corn is there, but the Virginia corn would have to meet the same standards as corn from the Midwest in regard to moisture and disease. Also, corn right now is brought in from the Midwest by rail car. It would take some adjustments for the integrators to take grain from trucks. Naturally, since the poultry industry is the largest sector of Virginia agriculture based on cash receipts (VASS), the grain industry should make every effort to sell to these integrators. They are a large part of Virginia agriculture and intend to grow in the future. Capturing part of the grain market of the Virginia poultry industry would serve to greatly benefit the grain industry in Virginia. It would serve as a steady source of consumption and could also potentially provide poultry litter for fields that could result in potential savings over commercial fertilizer.

Capturing the grain market for the Virginia poultry industry would not be easy and is only one viable alternative. Other alternatives are not readily obvious. This study provides information which will make the development of more alternatives easier in the future. This leaves the grain industry with hurdles to overcome and at the same time provides opportunities for improvement as well. The picture of the grain industry and the infrastructure of this industry will aid in the development and improvement of grain handling and marketing practices in Virginia.

POULTRY LITTER FOR FERTILIZER PROGRAMS

INTRODUCTION

The information provided in the previous components of this project provides the necessary background information for the development of alternatives to help Virginia grain producers be more competitive with Midwestern grain producers. In previous years there has been much research effort put into the potential for competitive corn production in Virginia. This research has concluded that in order for Virginia to remain competitive in a national market, they must be able to grow corn at a cost less than the cost of Midwestern grain plus transportation costs of Midwestern grain to Virginia (Thornsbury, p.11). However, many of the grain acres in Virginia can not produce yields which are competitive with Midwestern producers. This leaves Virginia grain producers with two options to increase their competitive position. The first option is to reduce production costs and the second option is to realize better prices. The information from Chapters 2 and 3 provides background information to help determine if there are viable alternatives to achieve either of these options.

Using the background information, two alternatives were developed to help Virginia grain producers improve their competitive position. The first of these alternatives develops from the information compiled in Chapter 2. This chapter clearly shows the poultry industry is the largest consumer of grain for feed in Virginia. In the 1940's the average American ate less than 20 pounds of poultry per year. By 1995 this number increased to 63 pounds (*Broiler Farms' Organization, Management, and Performance*, p.3). The Virginia poultry industry has rapidly increased production in Virginia to help meet this increase in per capita consumption. According to the Virginia Poultry Federation the industry has built over 700 new houses in Virginia since 1990. A direct result of the increased production is the availability of large quantities of poultry litter, which can be used as a substitute for or supplement to commercial fertilizer.

In the spring of 1999 the Virginia General Assembly passed House Bill 1207 which is a regulatory program for the management of poultry litter (Appendix C). H.B. 1207 requires the Department of Conservation and Recreation to report back to the General Assembly ways the "Commonwealth should assist poultry growers and processors to improve the economic feasibility of transporting and selling poultry waste, and pursue alternative uses of poultry waste, including the establishment of the equal matching grant program." In the past poultry litter has been regarded as waste, however for the Virginia grain industry it could be a valuable resource. One of the possible alternatives for removing excess poultry litter is the application of excess litter on corn fields as an alternative to or supplement to commercial fertilizer. Thus, the first option to be examined to improve the competitive position of Virginia grain is the reduction of corn production costs through the application of poultry litter as fertilizer. The first option only examines corn for grain because it has the largest harvested acreage of grain in Virginia. Soybeans do not require nitrogen, which is a major component of poultry litter, thus it was not included in this option.

The next alternative for improving the competitive position of Virginia grain builds on information on production, consumption, handling, storage and marketing practices developed in Chapters 2 and 3. This alternative takes the first option examined one step further. The first option looks at poultry litter as a substitute for commercial fertilizer. The second option looks at shipping poultry litter to Virginia corn producers as a substitute for commercial fertilizer and then backhauling corn for poultry feed to the Shenandoah Valley in the same truck. The poultry industry in Virginia imports over 47 million bushels of grain each year from the Midwest. The poultry industry currently imports grain by rail car because it is cheaper to get the grain from further away by rail, than it is to get it closer by truck. According to the Virginia Poultry Federation, Virginia imports over 10,000 rail cars of corn (35 million bushels) and over 3,000 rail cars of soybean meal (12 million bushels of soybeans). At the same time this grain is being imported, Virginia is exporting much of its production at port locations such as Tappahannock and West Point. The option to backhaul grain to the Shenandoah Valley once poultry litter has been delivered might provide the opportunity for Virginia grain producers to reduce transportation costs, eliminate going to the grain elevator, and receive better prices. These opportunities will be examined to determine if Virginia grain producers can improve their competitive position with Midwestern states through a poultry litter for corn exchange system.

These two options have the potential to increase the competitive position of the Virginia grain industry by treating poultry litter as a valuable resource rather than waste. The next section provides conceptualizations of the two alternatives building on information about production, consumption, handling, storage, and marketing practices found in Chapters 2 and 3. The background information from previous chapters allows for the development of alternatives which attempt to be acceptable and mutually beneficial to grain producers, poultry contractors, integrators, and litter brokers. Chapter 4 gives basic plans and attempts to determine overall feasibility, costs, and benefits of the alternatives. Due to the scope of this project, further research efforts are necessary to fully address all of the issues involved with these programs and to provide a more specific assessment of the costs and benefits of these alternatives.

ALTERNATIVE 1: APPLICATION OF POULTRY LITTER ON CORN FOR GRAIN FIELDS

Availability of Poultry Litter for Fertilizer

The first alternative attempts to help Virginia corn producers reduce fertilizer costs by using poultry litter. The first step in determining the feasibility of using poultry litter for fertilizer is to determine the availability of poultry litter using county poultry numbers generated in Chapter 2. The poultry industry is spread throughout the state, however it is highly concentrated in the Shenandoah Valley. The Shenandoah Valley accounts for nearly 1,000 of the state's 1,300 poultry

farms (Virginia Poultry Federation). Thus, from this point on, only the Shenandoah Valley will be examined.

The Shenandoah Valley consists of three major poultry-producing counties. These counties include Rockingham, Augusta, and Page. The county of Rockingham is the number one county in Virginia for poultry production and cash receipts. The county of Augusta ranks second in overall poultry production in the state and also ranks second in cash receipts. According to the 1997 Census of Agriculture, Rockingham accounts for 45.6% of broiler production. The second-ranking county for broiler production is Page which accounts for 17.2%. Rockingham also leads turkey production accounting for 52.8% of production. The second-ranking county in turkey production is Augusta, which accounts for 24.6% of production.

The poultry industry is vertically integrated and has four major companies which operate in the Shenandoah Valley. These companies contract out growers on a flock to flock contract. The companies typically own the birds and the feed and the growers own the poultry houses, dead birds, animal bedding, poultry litter, and so forth. The growers are typically paid based on how much weight the birds gain in comparison to how much they are fed. The amount of birds per house varies widely based on the size of the house. The growers are allowed to chose how often they clean out the houses. National literature indicates houses are typically cleaned out once a year (Evers, p.1). However, this too varies widely and producers in the Shenandoah Valley clean houses anywhere from between each flock to only once every five years. Turkeys produce considerably more litter than broilers per bird so this also affects cleaning rates. When they do clean out the house, the poultry litter inside consists of poultry excreta, feathers, wasted feed, and bedding materials (Evers, p.1). Bedding material in Virginia normally consists of pine shavings or peanut hulls. The grower pays for the bedding materials and the amount put in each house varies depending on grower preference and bedding costs. The type of bedding chosen is based on price and availability. Growers cite little to no difference between the two bedding types, other than the perceived appeal of peanut hulls in poultry litter used as cattle feed.

Growers clean out the houses themselves or they allow someone else to come in and clean out the houses. If someone else cleans out the house, it is common practice to give the poultry litter in return for the cleaning service. The houses are cleaned out using equipment such as a skid loader or a tractor outfitted with a scraping device. If the poultry grower cleans out the house, the poultry litter is currently valued at $12 per ton if it is feed grade and $6-8 ton for fertilizer. Normally all turkey litter is only suitable for fertilizer and most broiler litter is suitable for livestock feed. However, the majority of broiler litter is currently used for fertilizer. Poultry litter used for livestock feed is normally very low in moisture and is more granular. Litter not used for feed is typically removed from the house in a process called caking. Litter can then be deepstacked in storage bins to kill

the bacteria in the litter with heat. Litter which has been deepstacked is normally ready after 7 days.

Over 95% of poultry litter produced in the United States is applied to agricultural land as fertilizer. Poultry litter as a fertilizer has several desirable attributes including slower nitrogen release which reduces leaching, total nutrient contents of nitrogen, phosphorous, and potassium, calcium content reduces soil acidity, and the added organic matter improves the water and nutrient holding capacity of the soil (Evers, p.1). However, the application of poultry litter as fertilizer must be done at application rates suitable for the soil type and crop usage. Failure to do this properly can result in the leaching and run-off of nitrogen and phosphates. These nutrients, although valuable to plants at appropriate levels, provide environmental hazards when present in the water supply.

The need to remove excess poultry litter from the Shenandoah Valley has lead to the establishment of litter brokerage firms in the valley. Various sources report between 50,000 and 100,000 tons of poultry litter are being removed from the valley using litter brokering services and other methods. However, there is much more than 100,000 tons of litter being produced each year. Table 1 details broiler litter production in 1997 for the Shenandoah Valley. For our purposes the Shenandoah Valley only includes the counties of Rockingham, Augusta, and Page, which are the valley's main broiler producers. Phosphate levels are also shown based on poultry litter with and without phytase supplements in Table 1.

Table 1. 1997 Shenandoah Valley Broiler Nutrient Production

TYPE	QUANTITY
Rockingham broilers sold (millions)	118.286
Page broilers sold (millions)	44.617
Augusta broilers sold (millions)	7.782
Total Broilers (millions)	170.690
Manure (tons)	170,690
Nitrogen (million lbs)	10.753
Phosphate (million lbs)	10.583
Phosphate with phytase (million lbs)	7.94

Assumptions: 1 ton manure/1000 birds and 63 lbs N, 62 lbs P_2O_5, and 29 lbs K_2O per ton
Sources: VASS Annual Bulletin 1997, VA Ag. Census 1997, and Parsons, 1998.

Table 2 details turkey litter production in 1997 for the Shenandoah Valley. For our purposes the Shenandoah Valley only includes the counties of Rockingham, Augusta, and Page, which are the valley's main turkey producers..

Table 2. 1997 Shenandoah Valley Turkey Nutrient Production

TYPE	QUANTITY
Rockingham turkeys sold (millions)	13.200
Augusta turkeys sold (millions)	6.150
Page turkeys sold (millions)	2.150
Total Turkeys (millions)	21.500
Manure (tons)	193,500
Nitrogen (million lbs)	11.997
Phosphate (million lbs)	12.384
Phosphate with phytase (million lbs)	9.29

Assumptions: 9 tons manure/1000 birds and 62 lbs N, 64 lbs P_2O_5, and 24 lbs K_2O per ton
Sources: VASS Annual Bulletin 1997, VA Ag. Census 1997, and Parsons, 1998.

The figures in Tables 1 and 2 can be added to determine the amount of poultry litter for both the broiler and turkey industries in the Shenandoah Valley. Total production of poultry litter is 364,190 tons. In this analysis each ton of poultry litter is assumed to be 46.9 % broiler and 53.1% turkey litter. Each ton of Virginia poultry litter is assumed to contain 62.1 lbs of N per ton, 63.0 lbs of P_2O_5 per ton, and 26.3 lbs of K_2O per ton. The total litter in the Shenandoah Valley contains 22.616 million lbs of nitrogen (N), 22.944 million lbs of phosphate (P_2O_5), and 9.578 million lbs of potash (K_2O).

Various estimates indicate 50,000 to 100,000 tons of litter are being removed from the valley through litter brokering. The remaining litter is being applied to land in the valley and surrounding counties, sold as livestock feed, bagged and sold for various purposes. Subtracting the litter currently being brokered means there is still approximately 265,000 to 315,000 tons which needs to be managed. Using phosphorous application as the limiting nutrient, the amount of nitrogen utilization necessary ranges from 16.457 to 19.561 million lbs and the amount of phosphate utilization necessary ranges from 16.695 million to 19.845 million pounds based on the top three production counties in the Shenandoah Valley.

Now that an estimate of the amount of poultry litter available has been obtained, it is important to determine how many acres of corn for grain the available poultry litter could fertilize. There are various methods for determining how much poultry litter can be applied to each field. Corn for grain requires three major nutrients: nitrogen, phosphate and potash. Application rates depend on which nutrient is used as the limiting factor. The first method is to apply poultry litter based on the recommended amount of N, and P_2O_5 is not considered. Currently litter is being applied on a N basis, however H.B. 1207 mandates that it be applied on a phosphorous basis by certain dates in the future. When poultry litter application rates are based on recommended amount of P_2O_5 per acre, supplemental amounts of N and K_20 must be applied as commercial fertilizer. An acre using N as the limiting factor will not need any additional nutrient supplements and will take roughly twice as much poultry litter as one where poultry litter is applied using P_2O_5 as the limiting factor. A third method is to apply poultry litter where phytase, which is a P_2O_5-reducing agent, has been fed to the poultry. Phytase can reduce the amount of P_2O_5 in the litter by anywhere from 15 to 35 percent according to various reports by organizations involved in Virginia agriculture. From this point on, using a conservative estimate of the capabilities of phytase, it will be assumed phytase will result in a 25% decrease in the amount of P_2O_5 .

Using these three different methods of application it is possible to determine how many corn acres would be necessary in Virginia to apply all of the excess poultry litter from the Shenandoah Valley. Application rates of poultry litter to corn for grain acres are based on the recommendations found in Virginia Nutrient Management Standards and Criteria, November 1995 and application rates found in VALUES, December 1992. The application rates are established for what is

determined to be an average of Virginia soil types. (Napit, p.343). Nitrogen is applied based on soil productivity type 3 and P_2O_5 and K_20 are applied based on state averages. The soil assumptions resulted in recommended application rate of 125 lbs N per acre, 30 lbs P_2O_5 per acre, and 60 lbs K_20 per acre on typical Virginia soil.

Table 3. Corn Acres Necessary for Poultry Litter Removal Based on Limiting Nutrient

	N	P_2O_5 without phytase	P_2O_5 with phytase
maximum acres	136,957	630,000	450,000
minimum acres	115,217	530,000	378,571

Table 3 indicates the number of corn for grain acres necessary for each method of poultry litter application. Table 3 assumes P_2O_5 is not already in excess in the Shenandoah Valley and fields need these nutrients each year. A 1998 study entitled *Economic and Environmental Impact of Nutrient Loss Reductions of Dairy and Dairy/Poultry Farms* published by REAP indicates P_2O_5 is in excess in parts of the Shenandoah Valley. However, for this study for simplification purposes it is assumed no areas of the state are currently in excess. In further research this is an assumption that will need to be examined more closely.

The maximum and minimums are based on the calculated minimum and maximum number of tons of poultry litter available. Information found in Chapter 2 indicates Virginia harvested 325,000 acres of corn for grain in 1997. Clearly there is enough poultry litter in the Shenandoah Valley alone to supply all Virginia grain producers. When poultry litter application is nitrogen-based the corn for grain acres could take all of the poultry litter in the Shenandoah Valley. However, when litter is applied on a phosphorous basis, the results are quite different. If litter was applied based on phosphate without phytase, it would be necessary to apply it on four to five times more corn acres than when it was applied on a nitrogen basis. When the litter was applied with phytase, it would take four times the amount of corn acres as when it was applied on a nitrogen basis. Based on the amount of harvested acres for corn for grain in 1997, it is clear if litter is applied on a phosphorous basis there are not enough Virginia corn acres to take all of the litter. The poultry litter would need to be applied to corn for silage, wheat and pasture acres as well.

Costs of Commercial Fertilizer and Poultry Litter for Fertilizer

Now that availability of litter has been established, the next step is to look at the viability of substituting poultry litter for commercial fertilizer on Virginia corn for grain operations. The 1991 study *The Economic Potential for More Effective Poultry Litter Use in Virginia* indicates poultry litter could be a viable alternative to commercial fertilizer when applied on a nitrogen basis. Could it be possible for Virginia grain producers to reduce fertilizer costs by using poultry litter on a phosphorous basis? In order to answer this question it is necessary to look at the three different application methods and to look at their costs, as well as the cost of commercial fertilizer. Several key assumptions are made in this section. The first assumption is that 80% of commercial nitrogen is taken up by the plant (Napit, p.12). The second key assumption is 75% of the N in poultry litter is organic and 25% is inorganic. Of the organic nitrogen 50% is taken up by the plant in the year of application and 12, 5, 2, and 2 percent are released and taken up by the plant in years 2, 3, 4, and 5 respectively (Napit, p.12). Using estimates of nutrients found in poultry litter from the Virginia Tech Manure Testing Lab (Parsons, p.4) it is possible to determine how much nitrogen available in poultry litter is taken up by the plant. The following equation shows how much total nitrogen is available over a five year period:

$$.75 \times 15.5 + (0.5 + .12 + .05 + .02 + .02) \times 46.60 = 44.7 \text{ lbs of N taken up by the plant in one ton of poultry litter}$$

The total lbs of Nitrogen taken up by the plant over a five year period is used to determine the value of poultry litter as fertilizer. Because the values are for a five year time period, the calculated cost of poultry litter for fertilizer is based on a program that would be continual from year to year. Using these assumptions and several data sources it was possible to estimate the cost of four different fertilizer alternatives. Tables 4 through 8 summarize the costs for commercial fertilizer and the three application methods. The costs include the cost of commercial supplements when P_2O_5 is used as a limiting factor. The costs do not include transportation costs from the Shenandoah Valley, however they will be discussed in the next section.

Table 4. Cost of Commercial Fertilizer per Acre for Corn for Grain July 1998

Nitrogen→125 lbs/acre at $.26/lb 80% taken up by plant	$32.50
Phosphate→30 lbs/acre at $.29/lb	8.70
Potash→60 lbs/acre at $.14/lb	8.40
Commercial Fertilizer Application Cost	4.00
TOTAL COST	$53.60

Source: Nutrient Prices, Agricultural Price Summary, July 1998 and Commercial Fertilizer Application Costs, Doane's Ag. Report, Vol. 2, No. 21-5, 5/21/99.

Next it is important to look at the cost of poultry litter application based on the three different methods. However, it is first necessary to determine the costs of storing, assembly and applying poultry litter in Virginia. The removal, assembly, storage, testing, loading, application, and brokerage costs are based on a method developed by Bosch and Napit in the publication Economic Potential for Effective Poultry Litter Use in Virginia, June 1991. The figures reported in this publication were updated with more recent equipment and labor costs based on July 1998 *Agricultural Prices* and information from various litter brokers in the Shenandoah Valley. It also assumes the litter is hauled in a walking trailer which is an eighteen wheeler which unloads poultry litter from the back by using a device which continually pushes the litter out the back.

The following assumptions are made to determine poultry litter application costs:

8,000 tons per year

1 full-time employee

25 ton walking trailer hauls litter

4,000 ton storage capacity

$0.70 per ton loading cost

14 ton spreader on truck

These assumptions are used to calculate costs per ton of poultry litter. These costs resulted in the following costs per ton of poultry litter used as fertilizer summarized in Table 5:

Table 5. Assembly, Storage, and Application Costs of Poultry Litter *

Removal	$3.56 per ton
Assembly	$1.10 per ton
Storage	$1.82 per ton
Testing	$0.75 per ton
Loading	$0.70 per ton
Application	$3.70 per ton
Brokerage	$1.00 per ton
TOTAL	$12.63 per ton

Source: Prices, Agricultural Price Summary, July 1998, various litter brokers in the Shenandoah Valley, and Bosch, June 1991.

* costs based on July 1998 and May 1999 prices

Using these costs, it is now possible to determine the costs of poultry litter application based on the three different nutrient-limiting methods. The first involves applying 2.3 tons of litter based on N needs per acre. The secod method is based on phosphorous needs without the use of phytase. The third method is based on phosphorous treated with phytase. The second and third methods involve applying both litter and commercial fertilizer.

The methods described in Tables 7 and 8 both involve 2 applications. There is one for poultry litter and one for commercial fertilizer. This is important because some producers might be hesitant to select these options due to the time involved in two applications. It is important that producers are educated in the best management practices for two applications if either of these options is implemented.

Table 6. Cost of Poultry Litter per Acre for Corn for Grain based on N

2.3 tons of poultry litter per acre based on N	
Nitrogen→ no additional necessary 102.8 lbs taken up by plant	$0
Phosphate→ no additional necessary	0
Potash→ no additional necessary	0
Removal→$3.56 per ton	8.19
Assembly→$1.10 per ton	2.53
Storage→$1.82 per ton	4.19
Testing→$0.75 per ton	1.73
Loading→$0.70 per ton	1.61
Application→$3.70 per ton	8.51
Brokerage→$1.00 per ton	2.30
TOTAL COST	$29.06
TOTAL SAVINGS COMPARED TO COMMERCIAL FERT.	$24.54

Source: Nutrient Prices, Agricultural Price Summary, July 1998 and Commercial Fertilizer Application Costs, Doane's Ag. Report, Vol. 2, No. 21-5, 5/21/99.

Table 7. Cost of Poultry Litter per Acre for Corn for Grain based on P_2O_5 without Phytase

.5 tons of poultry litter per acre based on P_2O_5	
Nitrogen→ 31.05 lbs N in litter 22.4 lbs taken up by plant 97 lbs additional commercial Nat $0.26/lb 77.6 lbs taken up by plant 100 total lbs taken up by plant	$25.22
Phosphate→ no additional necessary	0
Potash→ 46.8 lbs additional at $0.14/lb	6.56
Removal→$3.56 per ton	1.78
Assembly→$1.10 per ton	.55
Storage→$1.82 per ton	.91
Testing→$0.75 per ton	.38
Loading→$0.70 per ton	.35
Application→$3.70 per ton	1.85
Brokerage→$1.00 per ton	.50
Commercial Fertilizer Application Cost	4.00
TOTAL COST	$42.10
TOTAL SAVINGS COMPARED TO COMMERCIAL FERT.	$11.50

Source: Nutrient Prices, Agricultural Price Summary, July 1998 and Commercial Fertilizer Application Costs, Doane's Ag. Report, Vol. 2, No. 21-5, 5/21/99.

Table 8. Cost of Poultry Litter per Acre for Corn for Grain based on P_2O_5 with Phytase (25% reduction in P_2O_5)

.7 tons of poultry litter per acre based on P_2O_5 with Phytase	
Nitrogen→43.4 lbs N in litter 31.3 lbs taken up by plant 85.9 lbs additional commercial Nat $0.26/lb 68.7 lbs taken up by plant 100 total lbs taken up by plant	$22.34
Phosphate→ no additional necessary	0
Potash→ 41.6 lbs additional at $0.14/lb	5.83
Removal→$3.56 per ton	2.50
Assembly→$1.10 per ton	.77
Storage→$1.82 per ton	1.28
Testing→$0.75 per ton	.53
Loading→$0.70 per ton	.49
Application→$3.70 per ton	2.59
Brokerage→$1.00 per ton	.70
Commercial Fertilizer Application Cost	4.00
TOTAL COST	$41.03
TOTAL SAVINGS COMPARED TO COMMERCIAL FERT.	$12.57

Source: Nutrient Prices, Agricultural Price Summary, July 1998 and Commercial Fertilizer Application Costs, Doane's Ag. Report, Vol. 2, No. 21-5, 5/21/99.

Transportation Costs

Tables 4 through 8 clearly indicate poultry litter can be a viable economic alternative to commercial fertilizer, without considering transportation costs. However, transportation costs can be significant as the distance the poultry litter is shipped increases. In order to determine if this program is economically viable, it will be necessary to determine the cost of transporting the litter and the distance it will need to be transported. According to sources within the poultry industry, most poultry growers in the Shenandoah Valley are currently using phytase in their feeding programs. The legislation passed in spring of 1999 mandates poultry litter be managed on a phosphorous basis in the near future. Thus, it would be best to

determine how far the litter could be transported and still remain a cost equal to or less than commercial fertilizer based on phosphorous with phytase as the limiting agent.

Several sources within the poultry and trucking industries have indicated poultry litter could be transported on an 18-wheeler walking trailer with 25 ton capacity at a cost of $.11 per mile without a backhaul and at $.07 per mile with a backhaul. Using the savings of $12.57 per acre over commercial fertilizer in Table 8 it is possible to determine how far poultry litter could be transported at a cost equal to or less than commercial fertilizer. Poultry litter from birds fed phytase could potentially fertilize acres within 163 miles at a cost equal to or less than commercial fertilizer. The breakeven cost number of miles transported is determined using the following equation:

($/acre savings) x (acre / tons of poultry litter) x (tons of poultry litter/$ shipping cost / mile) = BREAKEVEN MILEAGE

($12.57/acre savings) x (1 acre / .7 tons) x (1 ton/ $ .11/mile) = 163 miles

Keeping the breakeven transportation mileage of 163 in mind, it is possible to determine locations where poultry litter could be transported. Table 9 details Virginia counties which are within 163 miles of Rockingham, Augusta, and Page counties. The respective 1997 corn for grain acres harvested found in these counties are listed as well.

Table 9 clearly indicates that in 1997 there were 143,500 acres of corn for grain within the breakeven mileage for poultry litter application based on phosphorous with phytase fed to the poultry. This acreage accounts for approximately 44% of the harvested acres of corn for grain in Virginia. These acres could take over 100,000 tons of poultry litter. Thus, if poultry litter was shipped in a program that only involved its usage as a substitute for commercial fertilizer on corn for grain acres, this alternative would have the possibility to reduce production costs for up to 44% of the corn for grain producers in Virginia. At 163 miles there would have been no reductions in costs.

The distances in Table 9 were based on the distances from the county seat of the origination point to the county seat of the delivery point. All distances were determined using the mapping program *Mapquest*, 1998. These distances are based on shortest actual driving mileage from one location to another.

Table 9 shows that if all corn for grain acres were included in this program, corn producers would save a total of $888,889 in these counties. This is an average savings of $6.19 per acre over the use of commercial fertilizer. In these counties commercial fertilizer use would be reduced by nearly nine million lbs including nearly 4 million lbs of N, 3 million lbs of P_2O_5 and nearly 2 million lbs of K_20. Instead nearly 100,450 tons of poultry litter would be utilized. Almost all of

these farms should have at a minimum the required 36 acres for one truckload (25 tons) of litter based on survey results in the previous chapter.

Table 9. Locations within Breakeven Mileage and Total Savings

Delivery Point	Mileage	1997 Harvested Corn Acres	Total Savings ($)
Amelia	163	2,100	40
Appomattox	122	900	2,858
Augusta	25	10,600	112,837
Bedford	126	900	2,581
Botetourt	105	1,200	5,382
Buckingham	113	1,100	4,256
Campbell	112	1,700	6,708
Caroline	150	6,900	7,038
Charles City	162	4,200	403
Charlotte	164	700	-41
Clarke	74	1,900	13,057
Culpeper	36	7,200	70,546
Cumberland	115	900	3,344
Fauquier	44	10,700	98,247
Floyd	155	800	508
Frederick	64	2,400	18,341
Goochland	102	2,800	13,205
Greene	31	500	5,092
Hanover	141	8,800	15,074
Henrico	128	1,500	4,071
King George	115	4,000	14,860
Loudon	98	12,900	64,810
Louisa	87	1,500	8,807
Madison	49	5,700	50,143
Montgomery	132	2,000	4,812
Nelson	88	600	3,476
New Kent	153	4,400	3,472
Orange	59	3,800	30,503
Page	25	2,800	29,806
Powhatan	113	1,700	6,577
Prince Edward	136	1,400	2,937
Prince George	162	4,700	451
Prince William	69	1,700	12,337
Pulaski	157	800	385
Rappahannock	52	600	5,140
Rockbridge	62	1,700	13,253
Rockingham	25	18,500	196,933
Shenandoah	25	4,900	52,161
Spotsylvania	105	900	4,037
Stafford	158	1,100	444
STATE TOTAL	**4,002**	**143,500**	**888,889**
STATE AVERAGE	**100**	**3,588**	**22,222**

Table 10 shows the reduction in costs for various typical mileages.

Table 10. Reduction in Costs by Using Poultry Litter Based on Phosphorous (with Phytase) as Fertilizer

Mileage	Cost Reduction per Acre
25	$10.65
50	$8.72
75	$6.80
100	$4.87
125	$2.95
150	$1.02
163	$0

ALTERNATIVE 2: CORN FOR POULTRY LITTER EXCHANGE PROGRAM

The next alternative builds on the information compiled for the first alternative, but takes it one step further. In alternative one, transportation costs are computed based on hauling without a backhaul. According to poultry litter brokers in the Shenandoah Valley, currently there is no consistent backhaul for poultry litter. However, on a small scale some litter brokering firms have begun backhauling grain for various purposes to the Shenandoah Valley. This use of a backhaul lowers the cost of transporting poultry litter from $.11 per ton per mile to $.07 per ton per mile. This is a significant cost reduction which would significantly increase the breakeven mileage computed in alternative one.

The exchange system alternative looks at the possibility of hauling poultry litter to corn for grain producers and then backhauling corn to poultry integrators in the Shenandoah Valley. Based on the information compiled in Chapters 2 and 3 it is possible to determine the feasibility of a corn for poultry litter exchange program.

Overview of a Grain for Poultry Litter Exchange Program

The grain for poultry litter exchange program would be a system that would allow poultry litter to be transferred to grain operations as a supplement to commercial fertilizers and corn for grain to be transferred to poultry integrators. To limit the extent of this project, the only type of grain to be considered for this program would be corn for grain and Shenandoah Valley poultry producers.

The program would basically work as follows: Corn for grain producers agree to purchase tested, known content, poultry litter delivered by an eighteen-wheeler, store it if necessary, and apply it on their operation. Each operation accepting poultry litter would be required to provide a nutrient management plan for the poultry litter they accept.

The corn producers who purchase the poultry litter would then be eligible to sell up to half of their anticipated corn production to poultry integrators in Virginia at a specified, pre-determined basis tied to futures market prices. The corn would have to meet the poultry industry standards including moisture content of 15% or less and zero tolerance for aflatoxin. These standards would be clearly determined and stated prior to participation in this exchange program and would be strictly enforced. The corn for grain would be backhauled on the same truck used to deliver the poultry litter, after the truck has undergone a sanitizing process such as rinsing with a high pressure washer to eliminate biosecurity problems.

The exchange program would run throughout the year, thus making storage of both poultry litter and corn necessary. All corn producers and poultry growers who want to participate in this program would deal with a centralized litter brokerage service. This centralized brokerage service could be an existing entity such as the Virginia Farm Bureau, Southern States, or existing litter brokers. All three of these have a vested interest in agriculture in the state and could perhaps facilitate this venture at lower costs due to economies of scale. However, the costs calculated in this projected are computed as if a new company was created to facilitate the exchange program. Producers would sign up for this program prior to each production season. Before each corn production season the centralized litter brokerage service would determine the amount of litter available from poultry growers and what days corn growers will accept the poultry litter and ship back corn. Poultry litter and corn will be hauled directly from producer operations. Shipping dates would be done based on a randomized process or by another process deemed to be fair to all parties.

The corn producers pay for the cost of the poultry litter as fertilizer and the poultry integrators purchase corn directly from the corn producers. This eliminates the need for the grain elevator to act as a middleman.

This program would benefit corn producers by potentially reducing the cost of fertilizer, eliminating the cost of taking grain to the elevator, and by potentially

allowing corn producers to increase prices received for corn. The exchange program would also benefit poultry producers by allowing them to remove excess poultry litter at little to no cost.

Using this general information as a framework for an exchange system, the potential economic viability of this program can be determined. Important information determined in previous chapters will be used to aid in the determination of the feasibility of this system. The next sections look at some of the issues involved in this type of exchange system in an attempt to better determine the potential for this exchange system.

The Role of the Corn Producer

If the corn producer decides to enroll in this program, they would be responsible for purchasing a set amount of litter and accepting it on certain dates. In order to enroll in the program they would have to sign a contract for a period of time (i.e. three to five years). The contract would specify price they would pay for poultry litter each year and the basis they would receive each year for corn. The price they would receive would be based on the futures price plus a pre-determined basis. Each year they will be assigned a time period to receive poultry litter. On this date they would also have committed a certain amount of corn for grain to be sold and shipped back to the Shenandoah Valley. The price received for the corn would be the closing futures price that day plus a pre-determined basis. Corn would have to meet the standards set by the poultry integrators.

The grain producer would have to make several important changes in operating procedures. The first of these changes is that they would need to develop a nutrient management plan with the help of extension personnel or other resources in order to use poultry litter as a fertilizer source. All operations accepting litter would be required to have this nutrient management plan.

The second requirement would be the need for storage space for the corn they are committed to sell to poultry integrators. They will be required to store corn until it is their turn to ship a specified amount to the poultry integrators. The survey results in Chapter 3 indicate the survey respondents are only using 45% of their grain storage capacity. The grain survey results also indicate Virginia producers can store over 50% of their production. Assuming typical Virginia corn producers have storage practices typified by those surveyed, there is enough existing storage for producers to store the corn they are committed to sell to poultry integrators.

The next major change for producers would be the need for corn producers to store poultry litter on their operation. Initial findings by the Department of Conservation and Recreation suggest that this could be done very inexpensively by

the use of plastic tarps under the stacked poultry litter and then covering the litter with plastic tarp material to prevent leachage of nutrients.

The biggest change for the producer would be in marketing practices. The producer would be able to eliminate the cost of taking the grain to market. The cost of taking grain to the market will be discussed in a later section. Storage costs might increase as well for some producers, however currently there are large amounts of excess storage capacity. However, they would know in advance the basis they would be receiving from poultry integrators. Corn producers and integrators would still use futures to set desirable price levels.

Analysis

There are several important aspects of this plan that need to be analyzed to determine the feasibility of the exchange system. These aspects include:

1) What is the new breakeven mileage for transporting poultry litter with a backhaul?

2) What are poultry integrators currently paying for corn for grain?

3) Could Virginia corn producers provide corn for grain to poultry producers at a cash price lower or equal to what they are currently paying?

The first issue for this program is the new breakeven mileage for delivering poultry litter with a backhaul. According to several industry sources, a backhaul would reduce the cost of hauling poultry litter to $0.07 per ton. If poultry litter is applied based on phosphorous with phytase, this would result in a new breakeven mileage *for hauling poultry litter* of :

($/acre savings) x (acre / tons of poultry litter) x (tons of poultry litter/$ shipping cost / mile) = BREAKEVEN MILEAGE

($12.57/acre savings) x (1 acre / .7 tons) x (1 ton/ $ .07/mile) = 257 miles

This new breakeven mileage based on a delivery rate with backhaul would allow poultry litter to be shipped from the Shenandoah Valley to all production areas for corn for grain in Virginia. In 1997 the number of harvested acres in Virginia was 325,000. This means at an application rate of .7 tons of poultry litter per acre (based on phosphorous, with phytase) the corn for grain industry could accept up to 227,500 tons of poultry litter for fertilizer. This would mean 9,100 truck loads of poultry litter would be delivered to corn for grain operations. In 1997 Virginia produced 30,225,000 bushels (or 755,625 tons) of corn for grain. If 9,100 truck loads of poultry litter were delivered to Virginia grain operations, the same trucks could backhaul up to 227,500 tons (8,125,000 bushels assuming 56

lbs per bushel of corn for grain) or 30% of Virginia corn for grain production back to poultry integrators in the Shenandoah Valley.

Now that the breakeven mileage has been determined, the second aspect of the litter/grain exchange is the price producers will receive for corn. The corn pricing aspect of the exchange system requires the determination of the price poultry integrators would be willing to pay for corn. Poultry integrators currently import corn from Ohio by rail car. The Shenandoah Valley is along the Norfolk and Southern railway, thus they draw their corn from along the path of the Norfolk Southern rail line, which goes through Ohio. The corn is delivered in 50 car units and is sometimes split between poultry integrators. On average nearly 4 of these units are delivered per week. A method was developed to determine cash prices poultry integrators are paying for corn, based on information provided by Harris-Crane, Inc. in North Carolina.

Table 11. POULTRY INTEGRATOR CASH PRICE PER BUSHEL WITH DELIVERY FOR CORN FOR GRAIN WITH VARIOUS VIRGINIA CASH PRICES WITHOUT DELIVERY (1993-1997 FIVE YEAR AVERAGE)

Basis = Cash Price minus Futures Price

Cash Month	Week	Corn Futures Contract Month	Corn Futures Tues. Closing Price (cents)	Ohio Train Corn Basis (cents)	Computed Integrator Cash Price without Delivery (cents)	Integrator Cash Price with Rail Delivery Charge of 40 cents (cents)	Integrator Total Basis (cents)	Culpeper Tues. Cash Prices Received (cents)	Tappahan-nock Tues. Cash Prices Received (cents)	Petersburg Tues. Cash Prices Received (cents)	Wakefield Tues. Cash Prices Received (cents)	Average Tues. Cash Prices Received (cents)	Difference Between Integrator Price with Delivery and Average Virginia Price (cents)
Sept.	1	Dec	271	+10	281	321	+50	289	269	272	267	274	47
	2		271	+10	281	321	+50	290	264	269	266	272	49
	3		269	+10	279	319	+50	279	263	269	272	271	48
	4		267	+10	277	317	+50	284	266	274	270	274	44
Oct.	1	Dec	265	-15	250	290	+15	279	262	269	270	270	20
	2		273	-15	258	298	+15	279	266	274	274	273	25
	3		272	-15	257	297	+15	275	265	275	275	273	25
	4		273	-15	258	298	+15	276	268	282	279	276	22
Nov.	1	Dec	272	-15	257	297	+15	279	268	286	286	280	17
	2		270	-15	255	295	+15	279	269	287	284	280	15
	3		272	-15	257	297	+15	281	268	291	283	281	16
	4		273	-15	258	298	+15	274	273	295	289	283	15
	5		274	-15	259	299	+15	288	277	294	290	287	12
Dec.	1	Mar	284	-5	279	319	+35	284	287	301	296	292	27
	2		293	-5	288	328	+35	291	290	306	298	296	32
	3		263	-5	258	298	+35	293	271	286	280	283	16
	4		---	---	---	---	---	---	---	---	---	---	---
Jan.	1	Mar.	260	-2	258	298	+38	289	291	305	301	297	2
	2		286	-2	284	324	+38	286	284	313	311	299	26

Table 11. POULTRY INTEGRATOR CASH PRICE PER BUSHEL WITH DELIVERY FOR CORN FOR GRAIN WITH VARIOUS VIRGINIA CASH PRICES WITHOUT DELIVERY (1993-1997 FIVE YEAR AVERAGE)

Basis = Cash Price minus Futures Price

Cash Month	Week	Corn Futures Contract Month	Corn Futures Tues. Closing Price (cents)	Ohio Train Corn Basis (cents)	Computed Integrator Cash Price without Delivery (cents)	Integrator Cash Price with Rail Delivery Charge of 40 cents (cents)	Integrator Total Basis (cents)	Culpeper Tues. Cash Prices Received (cents)	Tappahan-nock Tues. Cash Prices Received (cents)	Petersburg Tues. Cash Prices Received (cents)	Wakefield Tues. Cash Prices Received (cents)	Average Tues. Cash Prices Received (cents)	Difference Between Integrator Price with Delivery and Average Virginia Price (cents)
	3		308	-2	306	346	+38	308	317	323	326	319	28
	4		290	-2	288	328	+38	301	302	308	307	305	24
Feb.	1	Mar.	287	0	287	327	+40	303	302	308	311	306	21
	2		300	0	300	340	+40	324	320	331	322	324	16
	3		290	0	290	330	+40	308	310	320	316	314	17
	4		293	0	293	333	+40	310	311	320	316	314	19
Mar.	1	May	299	0	299	339	+40	314	312	319	316	315	24
	2		301	0	301	341	+40	313	308	316	312	312	29
	3		278	0	278	318	+40	291	286	294	291	291	28
	4		298	0	298	338	+40	314	306	315	312	312	26
	5		306	0	306	346	+40	311	310	320	318	315	31
Apr.	1		313	+2	315	311	+42	315	319	321	321	319	36
	2		321	+2	323	363	+42	319	315	324	325	321	42
	3		320	+2	322	362	+42	324	313	322	321	320	42
	4		304	+2	306	346	+42	330	320	331	328	327	19
May.	1	July	305	+2	307	347	+42	327	315	327	322	323	24
	2		308	+2	310	350	+42	327	317	329	325	325	25
	3		311	+2	313	353	+42	328	319	331	328	327	27
	4		310	+2	312	352	+42	325	340	328	326	330	22

Table 11. POULTRY INTEGRATOR CASH PRICE PER BUSHEL WITH DELIVERY FOR CORN FOR GRAIN WITH VARIOUS VIRGINIA CASH PRICES WITHOUT DELIVERY (1993-1997 FIVE YEAR AVERAGE)

Basis = Cash Price minus Futures Price

Cash Month	Week	Corn Futures Contract Month	Corn Futures Tues. Closing Price (cents)	Ohio Train Corn Basis (cents)	Computed Integrator Cash Price without Delivery (cents)	Integrator Cash Price with Rail Delivery Charge of 40 cents (cents)	Integrator Total Basis (cents)	Culpeper Tues. Cash Prices Received (cents)	Tappahan-nock Tues. Cash Prices Received (cents)	Petersburg Tues. Cash Prices Received (cents)	Wakefield Tues. Cash Prices Received (cents)	Average Tues. Cash Prices Received (cents)	Difference Between Integrator Price with Delivery and Average Virginia Price (cents)
	5		314	+2	316	356	+42	335	351	335	330	338	18
June	1	July	302	+5	307	347	+45	330	292	326	319	317	30
	2		316	+5	321	361	+45	368	295	326	318	327	34
	3		305	+5	310	350	+45	328	291	322	320	315	35
	4		310	+5	315	355	+45	325	256	328	315	306	49
July	1	Sept.	278	+5	283	323	+45	333	252	333	321	310	13
	2		284	+5	289	329	+45	320	249	316	318	301	29
	3		270	+5	275	315	+45	340	269	329	320	315	1
	4		281	+5	286	326	+45	320	298	299	298	301	25
	5		282	+5	287	327	+45	310	298	311	308	307	20
Aug.	1	Sept.	269	+4	274	314	+44	308	304	287	288	297	17
	2		272	+4	276	316	+44	305	281	282	285	288	26
	3		274	+4	278	318	+44	301	257	277	282	279	39
	4		278	+4	282	322	+44	321	286	275	272	289	34
	5		253	+4	257	297	+44	294	275	275	270	279	19
Average	**---**	**---**	**286**	**0**	**286**	**326**	**+40**	**304**	**290**	**303**	**300**	**300**	**26**

Table 11 provides some important calculated values. The procedures used to calculate the numbers in Table 11 can be explained using the first line as an example. The first line of Table 11 represents prices paid in the first week of September. The integrator cash price is based on the futures contract month closest to but not including the delivery month. The cash price paid by poultry integrators is determined using the five year average (1993-1997) nearby spot close for Tuesday, adjusting for the five year average (1993-1997) F.O.B. Ohio train basis, and then adding $.40 per bushel, which is the cost of rail delivery to Harrisonburg, Virginia. The next columns in the first data row are the five-year average (1993-1997) cash prices paid to Virginia farmers at various locations. The prices for the four delivery areas are averaged to determine average Virginia Tuesday cash price received for the first week of September for 1993-1997. The average Virginia cash price received is then subtracted from the integrator price with rail delivery to determine the average difference between integrator price with delivery and the average Virginia cash price paid. Virginia producers would have to pay this amount or less in transportation costs per bushel in order to make this exchange program work.

Table 11 shows some important patterns and trends as well. It is clear that around harvest time the Ohio Train Corn basis is at its highest point. Several sources within the Virginia poultry industry indicate harvest time is the only time they generally accept Virginia grain. In September, the difference between the amount paid by Virginia poultry integrators and the Virginia cash prices received by farmers is at its greatest level. Thus, at harvest time the low cost of Virginia corn makes it feasible to transport Virginia corn to poultry integrators at a cost equal to or less than rail corn from Ohio. The Ohio Train Corn Basis has a very distinct seasonal pattern. It is greatest just before harvest in late summer and then is below zero from fall until mid-winter (October through January). In late winter (February and March) the basis is zero. Finally as it approaches spring and summer, it rises above zero until it peaks in September.

It is also interesting to look at the prices received by producers in different areas of the state. There are few major differences throughout the state with one notable exception. Prices paid at Tappahannock tend to be $.10 lower than prices throughout the other locations. The reason for this discrepancy is due to the fact that the region surround Tappahannock tends to be a captive market. Producers have few other options other than to sell their corn at this elevator. As a result they tend to receive lower prices than sellers to elevators which are competing for corn.

Table 11 shows the results of calculations for the price Virginia poultry integrators pay for corn including transportation costs. Table 11 clearly shows that on average, for the past five years, poultry integrators have been paying $3.26 per bushel of corn including transportation costs. During this same time period Virginia corn growers have been receiving an average of $3.00 per bushels. Thus,

if producers can transfer corn to the Shenandoah Valley at a cost less than $.26 per bushel this program would benefit Virginia corn producers.

This leads to the question could Virginia corn producers provide corn for grain to poultry integrators at a cost equal to what they are currently paying? In order to answer this question it is necessary to compute the added and reduced costs of the poultry litter for corn exchange program.

The exchange program would reduce producer costs of taking grain to the market since the grain would be hauled directly to the user. The distance to market was determined using the survey information in Chapter 3. In the survey, producers indicate how much and where they take corn to market. Using the survey responses it was possible to determine the average distance from the county where the operation was located (using the county seat) to the market location they indicated for corn. Mileages from the county seat to the grain market were determined using the computer mapping service, *Mapquest, 1998*. It was then assumed that the distance to market for the survey respondents was typical of Virginia corn producers. In the survey, the average distance to market was 35 miles one way or 70 miles round-trip. Some big buyers do provide trucks in the field for prices shown in Table 11. In this case, the grain producer would not have a decrease in production costs. However, due to the scope of this project it was assumed all grain producers are responsible for taking their own grain to the market.

The average cost of taking corn to current markets used by producers was computed by using the average corn production for a typical Virginia grain operation. Based on survey results in Chapter 3 and 1997 yields a typical farm has 143 acres, producing 14,229 bushels per year based. This is the equivalent of 398 tons of corn, which would require 16 eighteen-wheeler truck loads for a total of 1120 miles for 16 round trips.

Truck costs for an 18-wheeler are based on the following costs and assumptions:

Truck Cost	($150,000 at 8.5% interest for 10 years)	$16,984
Taxes	(6% annually)	9,000
Depreciation	(based on 20 years)	7,500
Labor	($6.00 per hour)	768
TOTAL		$33,484 annually

With annual costs of $33,484 and 398 tons hauled 1120 miles, the cost per mile per ton is $.075. At these costs, hauling costs would be reduced by $.15 per bushel ((70 miles 8 $.075 per mile/ton * 25 tons) ÷ 893 bu/ton).

The $.075/ton/mile cost begs the question why commercial rates are $.11 per mile. There are several responses to this question. The first is that commercial

trucking businesses have very capital intensive start-up costs and price to allow working capital in case of the need for a capital investment. Also the costs above do not include the insurance costs and costs to a producer for maintain a commercial driving license. In addition there is the issue of storing a truck which is only used several times per year. Finally, many grain producers do not want their working capital tied up in a costly investment.

The primary increase in production costs is the cost of washing the trucks out after removing poultry litter and before hauling grain. Cleaning the trucks would be recommended due to biosecurity issues. The costs of cleaning the trucks are included here, however at this present time poultry integrators may not require cleaning the trucks before loading the grain. Representatives from two major poultry integrators in Virginia indicated they would consider accepting grain in trucks that had hauled litter without being cleaned. Although they are somewhat concerned about the biosecurity issues, the poultry integrators are aware most biosecurity from poultry litter are managed by deepstacking the litter for several days. The heat from this generally eliminates most biosecurity issues according to the poultry industry members interviewed. Two litter brokers in the Shenandoah Valley also indicated that they occasionally deliver corn to poultry integrators in trucks which have also hauled poultry litter without being cleaned.

Another poulty integrator expressed concerns about cleaning trucks before hauling litter and indicated this might be accomplished by rinsing the trucks with hot water using a high pressure water. The poultry litter brokers indicated when they do clean their trucks, this is the preferred method of cleaning and it takes ½ to 1 hour to clean the truck. The brokers indicated they used a 2500 PSI high pressure washer. Wilmar, a large seller of industrial cleaning equipment, indicated average price for a new electric or gas heated pressure washer of $3250 with an expected 10 year life. The size of this pressure washer is such that it would be able to be hauled in the truck if a producer did not have one. Also, this process would just be a rinsing process which would not include the use of commercial disinfectants, thus eliminating the potential environmental problems.

Cost of Washing 18-Wheeler Which Hauled Poultry Litter

Avg. Cost to Grain Producer per bushel is $.53 per ton
(includes cost of $3250 for 2500 PSI heated gas or electric pressure washer at $3250 which , depreciation over 10 years, and 1 hr labor per truck which carries 250 trips of 25 tons per year)

Washer Cost ($3250 at 8.5% for 3 years)	$1,231
Depreciation (6% annually)	650
Labor ($5.75 per hour)	1,438
TOTAL	$3,319

Cost per Ton =$ 3,319 annual cost / 6250 tons = $.53 cost per ton

Total Cost = $.53 cost/ton * 1 ton/2000 lbs * 56 lbs/bushel of corn for grain

Reduction = $.01 / bushel of corn for grain

Breakeven Transportation Costs:

Table 12. Net Change in Corn Price Before Transportation Cost

5 yr. Average Price Paid for Corn by Poultry Integrator	$3.26/bu
5 yr. Average Price Received by VA Corn Grower	- 3.00/bu
Decrease in Marketing Costs (hauling to local market)	+ .15/bu
Increase in Marketing Costs (cleaning litter from truck)	- .01/bu
Net Change in Corn Price per Bushel before Transportation Cost	$ +.40/bu

From Table 12 it is clear that transportation costs must equal $.40 or less per bushel of corn to be shipped to the Shenandoah Valley at a price equal to Ohio rail prices. Although the *average* difference in the price paid for corn by the poultry integrator and the price received by the Virginia corn grower is $.26, around ½ of the time the difference in market prices is actually less than $.26. It will be important for poultry integrators to see obvious benefits of this program in order for them to be willing to pay more for corn on these weeks.

Using the margin calculated in Table 12, it is possible to calculate breakeven mileage with a backhaul.

($/bu margin) x (bu / lbs of poultry litter) x (lbs poultry litter/ton) x (tons of poultry litter/$ shipping cost / mile) = BREAKEVEN MILEAGE

= ($.40/bu) x (1 bu/56 lbs) x (2000 lbs/ton) (1 ton/$.07/mile)

= 205 miles

The breakeven mileage for the poultry litter for corn portion of the exchange program is 205 miles. Setting this equal to the equation for the poultry litter part, gives a final breakeven mileage of 210 miles for the program. This means that at a distance of 210 miles or less corn can be shipped to the Shenandoah Valley at a cash price equal to or less than the average price the poultry industry has paid for the past five years. At 210 miles the cost of poultry litter is less than the cost of commercial fertilizer and corn can be transported at a price equal to poultry integrator prices. The breakeven mileage does not include the potential increased handling costs for the poultry integrator of trucks verses rail cars. Several people in the poultry industry gave conflicting ideas about whether or not trucks actually increase handling costs. Thus, these calculations were based on the assumption trucks do not increase handling costs for poultry integrators. Handling costs of grain would be an important consideration in further research. However, based on the costs included, at 210 or less miles from Harrisonburg this program could assist Virginia grain producers by lowering costs or increasing prices. Table 13 shows the cost reductions and price increases for several standard mileages. Thus, as a free market system the poultry litter for corn for grain program appears to be economically viable.

Table 13. Summary of Net Increases per Corn Bushel Based on 1997 Yields

Mileage	Reduction in Costs	Increase in Price	Net Increase
		---$ per bushel---	
25	.12	.35	.47
50	.11	.30	.41
75	.10	.25	.35
100	.08	.20	.28
125	.07	.15	.22
150	.06	.10	.16
175	.04	.05	.09
200	.03	.00	.02
210	.02	-.02	0

Using the information in Table 14 it is possible to determine that the grain for litter exchange program could potentially involve up to 153,400 acres of corn for grain in Virginia. This was calculated by adding all the 1997 harvested corn for grain acres within 205 miles of the county seat of the Augusta, Page or

Rockingham counties. This is roughly 47% of the total acres harvested of corn for grain in Virginia in 1997. This number is higher than what would likely occur because some producers would not want to participate and others would not be able to because they would be unable to accept large trucks on their facilities.

These 153,400 acres could take up to 107,380 tons of poultry litter if it was applied on a phosphorous-limiting basis with phytase. Application of poultry litter would reduce overall the consumption of commercial fertilizer in Virginia by 13,422,500 lbs. This number was calculated by computing the amount of commercial fertilizer necessary for these acres based on the information found in Table 4. The amount of commercial supplemental fertilizer for this acreage was determine using the information from Table 8. The amount of commercial fertilizer used with poultry litter applied on a phosphorous basis using phytase for 153,400 acres was then subtracted from the amount of commercial fertilizer necessary if only commercial fertilizer was used. This final value gives the total reduction in commercial fertilizer.

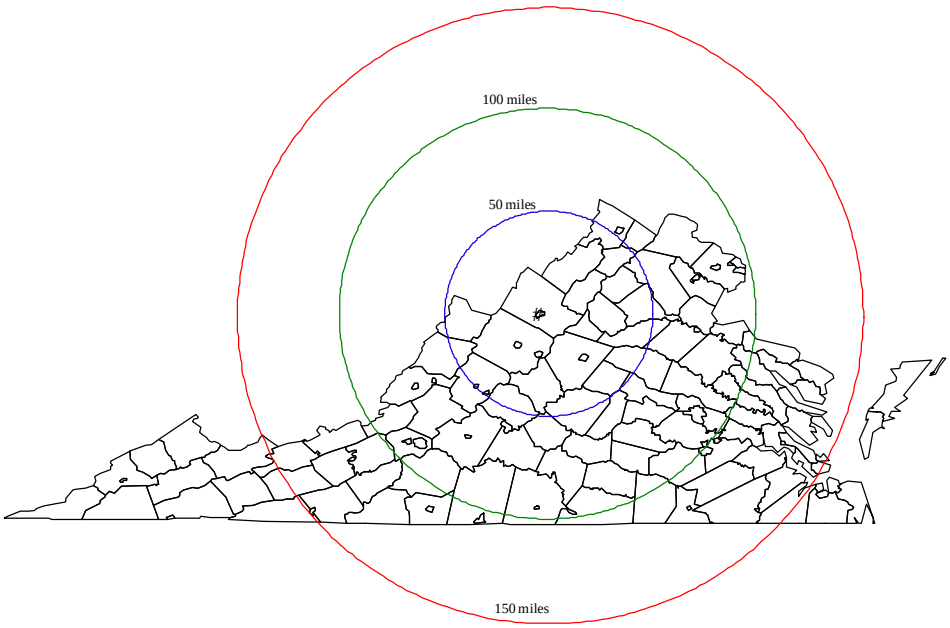
The poultry litter shipped would be 4,295 loads on an 18-wheeler walking truck with a capacity of 25 tons. This is equivalent to 3,834,821 total bushels of corn or 27% of total production for the counties included in Table 14. If each truck ran 240 days per year (accounting for holidays, weekends and maintenance down-time) it would be necessary for this program to involve 18 twenty-five ton eighteen-wheelers with walking trailers. The cost of 18 new trucks would present extremely large start-up costs. These start-up costs lead to the possibility of existing litter brokers or other who currently have trucks facilitating this program.

Table 14. Locations within Breakeven Mileage and Total Transportation Savings for Exchange

Delivery Point	Mileage	1997 Harvested Corn for Grain Acres	Total Savings ($)
Amelia	163	2,100	9,624
Appomattox	122	900	5,933
Augusta	25	10,600	120,257
Bedford	126	900	5,756
Bland	193	500	1,557
Botetourt	105	1,200	8,910
Buckingham	113	1,100	7,736
Campbell	112	1,700	12,039
Caroline	150	6,900	36,018
Charles City	162	4,200	19,454
Charlotte	164	700	3,174
Clarke	74	1,900	16,994
Craig	170	500	2,120
Culpeper	36	7,200	77,803
Cumberland	115	900	6,242
Dinwiddie	169	2,500	10,723
Fauquier	44	10,700	111,430
Floyd	155	800	3,980
Frederick	64	2,400	22,642
Goochland	102	2,800	21,202
Greene	31	500	5,526
Halifax	200	2,100	5,817
Hanover	141	8,800	49,817
Henrico	128	1,500	9,447
King George	115	4,000	27,740
Loudon	98	12,900	100,207
Louisa	87	1,500	12,461
Madison	49	5,700	57,963
Montgomery	132	2,000	12,204
Nelson	88	600	4,955
New Kent	153	4,400	22,321
Nottoway	185	500	1,753
Orange	59	3,800	36,780
Page	25	2,800	31,766
Pittsylvania	143	2,500	13,908
Powhatan	113	1,700	11,956
Prince Edward	136	1,400	8,268
Prince George	162	4,700	21,770
Prince William	69	1,700	15,621
Pulaski	157	800	3,902
Rappahannock	52	600	6,013
Rockbridge	62	1,700	16,204
Rockingham	25	18,500	209,883
Shenandoah	25	4,900	55,591
Spotsylvania	105	900	6,683
Stafford	158	1,100	5,311
STATE TOTAL	**5,062**	**153,400**	**1,257,458**
STATE AVERAGE	**110**	**3,307**	**27,336**

Figure 1 shows a map of Virginia counties with the linear mileages from Harrisonburg indicated. Note this map only includes linear mileages, however Table 14 uses actual driving distances.

Figure 1. Virginia Map With Linear Distances from Harrisonburg, VA



The map above based on linear mileage shows the entire state could receive poultry litter at a cost equal to or less than commercial fertilizer. However, when driving distances are used, the areas which are around the 100 mile area on the linear map are a little under 200 miles when driving distances are used. It is also important to note, Virginia is bordered by several states which produce poultry. These states are also looking to dispose of poultry litter as well and some of them are actually closer than the Shenandoah Valley to some Virginia localities.

Although transportation costs are likely the primary restrictive factor, there are several other restrictive factors which should be considered. These restrictive factors include farm size, storage capacity, and drying capabilities among others. Although there are 153,400 corn acres within the breakeven mileage, not all of these producers will be able to participate. In the survey from Chapter 3, almost 54% of respondents had production of less than 200 corn acres. Would these smaller producers want to participate? Most likely some of them would not.

Many of the smaller corn producers currently use the feedgrain they produce as livestock feed. Also other producers will have operations that will not be able to accept eighteen-wheeler trucks due to the on-site facilities or roads leading to the operation. Storage capacity would likely not restrict the exchange program. As previously indicated, there are large amounts of excess storage capacity throughout the state.

However, drying capacity would likely restrict this program. According to the survey results in Chapter 3, only 20% of respondents had grain drying facilities on their operations. However, this figure represents all respondents. Of those reporting corn production, nearly 50% had grain drying facilities on their operation. Nearly all of those reporting drying facilities on their operation were larger in size than 200 acres. In the survey completed in Chapter 3 there were a total of 30 farms that had greater than 200 corn acres, excess storage capacity, and drying facilities. The total production for these farms was 1,080,760 corn bushels. If each of these producers committed 50% of production, they would be able to collectively commit 540,380 bushels to this program. Grain drying facilities could be a restrictive factor for this program and are an area for more research efforts.

Thus if it was assumed that 50% of corn operations within the breakeven mileage had storage and grain drying facilities, this would enable around 75, 000 acres to be eligible to participate in this program. This is roughly ¼ of the corn for grain producers in the state. The trucks hauling the litter to corn producers could bring back around 1.1 million bushels of corn to poultry integrators in the Shenandoah Valley. The corn production brought back would roughly be about ¼ of the total production of the participating corn producers. Thus, the corn producers would only be able to commit to selling around ¼ of their total production. If these producers committed half of their production the exchange program would remove around 69,750 tons of litter from the Shenandoah Valley. In this process corn producers would collectively save around $440,000.00 (1.1 million bushels at $.40 per bushel from Table 12).

Implications

Even though this exchange program will work as a free market system, it will not function well enough to allow all Virginia corn for grain producers to participate. Although it is possible to ship poultry litter to almost all parts of the state (with the benefit of a backhaul), the cost of transporting corn to the Shenandoah Valley is too great to compete with Midwestern producers, beyond 210 miles.

Figure 2. Transportation Network

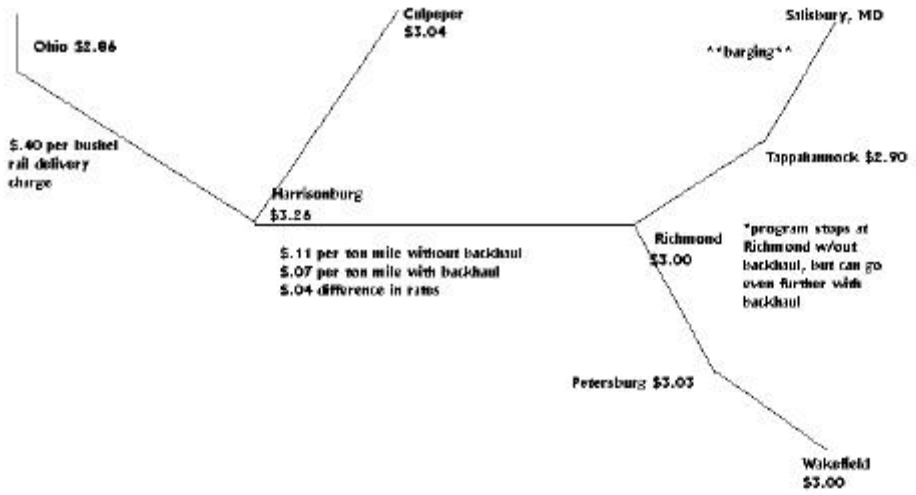


Figure 2 shows the current transportation network for corn delivered to Harrisonburg, Virginia from Ohio and the market prices received for corn at four different selected Virginia sites. The market prices for each location are based on the average futures price for the past five years. Figure 2 also indicates the transportation prices. The prohibitive transportation costs of corn have several implications. The first implication involves efforts to lower costs of poultry litter to compensate for increased transportation costs of corn for grain. There is cost-share money available from the state to aid in the management of poultry litter. The information provided in Figure 2 suggests a $.04 per ton mile subsidy would allow poultry litter to be delivered through the state at a cost comparable to commercial fertilizer. Overall this subsidy would have to reduce the amount of fertilizer cost for the grain producer at least $13.00 per acre in order for all Virginia grain producers to be able to participate using a demand-end subsidy. This subsidy would allow corn producers to be able to use poultry litter as a substitute for commercial fertilizer at a cost equal to or less than commercial fertilizer. Once the subsidy from this state is gone, it would not be economically feasible to continue this program beyond 210 miles. Thus, if a subsidy of this type was used it would be important to complete more research in this area on market-based solutions, subsidies, taxes, and regulatory strategies which would be beneficial to grain and poultry producers.

The analysis of the corn for litter exchange program clearly shows that an exchange program is viable up to 210 miles. Beyond this mileage it would be possible to deliver litter at a cost equal to or less than commercial fertilizer costs with a backhaul. However, corn for grain would not be an economically viable option beyond 210 miles. If another suitable backhaul beyond 210 miles could be found, transporting litter could still be economically viable to all corn for grain producers in the state. Examples of other backhaul options are pine shavings and peanut hulls, which are used for bedding in poultry houses. These options are already being used by some poultry growers and producers in the state. Once again, this is another area where additional research efforts could be beneficial.

SUMMARY AND CONCLUSIONS

Preliminary cost calculations indicate the alternative of hauling poultry litter only or a poultry litter for grain program have the opportunity to benefit some Virginia corn producers and the poultry industry in the state. These options were developed in an effort to aid Virginia grain producers. There are additional alternatives not examined in this paper which might be beneficial to Virginia producers of wheat and soybeans as well. An additional alternative not examined in this project is the option of using poultry litter as a substitute for commercial fertilizer on several different crop types in Virginia including grain which require nitrogen, phosphate, and potash (not just corn for grain as in the first alternative). Further research in this area could indicate if it is possible to dispose of all the poultry litter on agricultural fields without the use of a subsidy or cost to the poultry grower. This would be done while at the same time providing producers poultry litter as a substitute for commercial fertilizer at a cost equal to or less than commercial fertilizer.

There are several groups involved in this program which have issues and questions beyond the scope of this project. The five major groups and major issues are:

Fertilizer dealers- An area of further research would be to examine how this industry would react in Virginia to a decrease in fertilizer sales of around 13 million pounds. It would also be significant to determine if there is interest within this industry to get more involved with poultry litter and even potentially facilitate a litter for grain program.

Grain Elevators- It will be important to determine what their price response will be to this program. It will also be important to try to determine if producers not even participating in this program will potentially receive better prices due to the increased demand for corn due to the exchange program.

Poultry Integrators- The requirements for Virginia corn acceptance needs to be further researched. It is also necessary to determine actual costs of unloading trucks versus rail cars and any other concerns they might have.

Existing and Potential Litter Brokers- It is unclear who would facilitate this program and at what cost. Estimated costs are included in brokerage fees for poultry litter however, there will need to be a facilitating organization who can assure the corn producers and poultry integrators that the litter and corn will be delivered as promised. This exchange program could potentially be run by existing litter brokers, a new litter brokerage service, fertilizer dealers, or an organization such as the Virginia Farm Bureau. The amount these organizations would charge to facilitate the exchange is crucial to determine better cost estimates.

Corn Producers- The exchange program will have large impacts on production and marketing practices for producers. Better estimates of the number of corn producers who would be willing to participate in this program are needed. Further research should be conducted to determine actual costs of implementing the program (i.e. performance of poultry litter with phytase as fertilizer, actual time required for two fertilizer applications, etc.).

The alternatives presented here were designed specifically to benefit corn producers in Virginia. These alternatives suggest several valid options for corn producers to implement in order to attempt to lower costs and achieve better prices. The corn industry needs to be very proactive in completing more research and educating producers. Producers need to be educated in the best management practices possible for the application of both poultry litter and commercial fertilizer supplements. It will be important that they are educated in the best possible way to handle applications so as to alleviate any unnecessary environmental or yield concerns and to be able to complete educational efforts as quickly as possible. It is also important that producers are educated in the standards for corn set by the poultry industry and the reasoning for these precise standards. As with any potential change, there may be hesitancy to participate in a program like this, however proper education can help to eliminate any unfounded fears. Research regarding other alternatives to encourage producers to use poultry litter, such as crop insurance for poultry litter users and others alternatives, also needs to be closely considered. The analysis in the previous section clearly indicates large amounts of corn consumption occurs in the Shenandoah Valley. The poultry sector provides valuable a valuable resource in poultry litter and a unique marketing opportunity for grain producers.

A corn for poultry litter exchange program is a concept that needs further examination. A program like this may be one of the few opportunities the grain industry has to take advantage of the Shenandoah Valley grain market. The exchange program could give the industry the strength it needs to overcome competitive weaknesses with Midwestern producers. An exchange program would be a mutually beneficial program for the corn industry and the poultry industry in Virginia. In addition, the citizens of the Commonwealth of Virginia would benefit from this program by the prevention of nutrient leaching and runoff into ground and surface water.

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APPENDIX A

Regional Corn Consumption by Livestock , Dairy and Poultry Sector: 1989-1997									
	--- bushels ---								
Northern	1989	1990	1991	1992	1993	1994	1995	1996	1997
Beef Cattle	621	551	541	546	549	543	567	602	628
Broilers	13,410	14,659	16,365	17,342	18,601	19,652	19,798	20,579	20,173
COF	613	498	517	536	593	613	613	555	479
Dairy	4,556	4,462	4,689	4,437	4,335	4,172	4,191	4,109	3,922
Hogs	582	587	575	598	568	558	481	468	492
Horses	630	719	807	896	985	1,074	1,162	1,251	1,347
Layers	1,585	1,659	1,659	2,157	1,788	2,074	1,985	2,190	2,045
Turkeys	6,992	6,954	7,112	7,973	8,633	9,000	9,708	10,429	10,631
TOTAL	28,989	30,089	32,266	34,485	36,053	37,685	38,504	40,183	39,716
Western	1989	1990	1991	1992	1993	1994	1995	1996	1997
Beef Cattle	320	283	279	281	283	280	292	310	323
Broilers	911	996	1,112	1,178	1,263	1,335	1,345	1,398	1,370
COF	271	221	229	237	263	271	271	246	212
Dairy	1,641	1,608	1,689	1,598	1,562	1,503	1,510	1,480	1,413
Hogs	126	127	124	129	122	120	104	101	106
Horses	166	189	212	236	259	282	306	329	354
Layers	797	834	834	1,084	899	1,043	998	1,101	1,028
Turkeys	2,439	2,426	2,481	2,781	3,011	3,139	3,386	3,638	3,708
TOTAL	6,670	6,683	6,959	7,525	7,662	7,973	8,211	8,603	8,515
Central	1989	1990	1991	1992	1993	1994	1995	1996	1,997
Beef Cattle	660	585	575	580	584	577	602	640	668
Broilers	1,583	1,731	1,932	2,048	2,196	2,320	2,338	2,430	2,382
COF	445	362	375	389	431	445	445	403	348
Dairy	3,651	3,576	3,758	3,556	3,474	3,343	3,359	3,293	3,143
Hogs	306	308	302	314	298	293	252	246	258
Horses	415	473	531	590	648	707	765	823	886
Layers	220	231	231	300	248	288	276	304	284
Turkeys	0	0	0	0	0	0	0	0	0
TOTAL	7,280	7,265	7,705	7,777	7,880	7,974	8,037	8,140	7,969

Eastern	1989	1990	1991	1992	1993	1994	1995	1996	1997
Beef Cattle	24	21	21	21	21	21	22	23	24
Broilers	1,746	1,908	2,130	2,258	2,422	2,558	2,577	2,679	2,626
COF	26	21	22	23	25	26	26	23	20
Dairy	1,135	1,111	1,168	1,105	1,080	1,039	1,044	1,024	977
Hogs	290	293	287	298	283	279	240	233	245
Horses	71	81	91	101	111	121	131	141	151
Layers	3	3	3	4	3	4	4	4	4
Turkeys	0	0	0	0	0	0	0	0	0
TOTAL	3,294	3,438	3,721	3,809	3,944	4,047	4,042	4,127	4,047
Southwestern	1989	1990	1991	1992	1993	1994	1995	1996	1997
Beef Cattle	792	702	690	696	701	693	723	768	801
Broilers	722	790	881	934	1,002	1,058	1,066	1,108	1,087
COF	540	439	456	473	523	540	540	628	422
Dairy	932	912	959	907	886	853	857	840	802
Hogs	56	57	56	58	55	54	46	45	48
Horses	359	409	459	510	561	611	661	712	766
Layers	9	10	10	12	10	12	11	13	12
Turkeys	0	0	0	0	0	0	0	0	0
TOTAL	3,410	3,319	3,510	3,591	3,738	3,821	3,906	4,115	3,938
Southern	1989	1990	1991	1992	1993	1994	1995	1996	1997
Beef Cattle	306	272	267	269	271	268	280	297	310
Broilers	716	782	874	926	993	1,049	1,057	1,098	1,077
COF	237	193	200	208	230	237	237	215	185
Dairy	562	550	578	547	535	514	517	507	484
Hogs	301	303	297	309	293	288	248	241	254
Horses	105	120	135	150	165	179	194	209	225
Layers	185	193	193	251	208	242	231	255	238
Turkeys	25	25	26	29	31	33	35	38	38
TOTAL	2,437	2,439	2,570	2,688	2,725	2,810	2,799	2,861	2,811

Southeastern	1989	1990	1991	1992	1993	1994	1995	1996	1997
Beef Cattle	134	118	116	117	118	117	122	130	135
Broilers	322	352	393	416	446	471	475	494	484
COF	86	70	73	75	84	86	86	78	67
Dairy	1,282	1,256	1,320	1,249	1,220	1,174	1,179	1,156	1,104
Hogs	5,427	5,473	5,364	5,575	5,290	5,205	4,480	4,360	4,582
Horses	96	109	123	136	150	163	177	190	205
Layers	117	122	122	159	132	153	147	162	151
Turkeys	0	0	0	0	0	0	0	0	0
TOTAL	7,463	7,501	7,511	7,728	7,440	7,370	6,666	6,570	6,728
***All Disclosed**	59,542	60,734	64,242	67,602	69,443	71,681	72,165	74,598	73,724
TOTAL	64,004,000	65,483,000	68,450,000	73,110,000	74,608,000	75,658,000	77,025,000	80,084,000	79,342,000

*All Disclosed is not equal to total due to reporting disclosure regulations. All Disclosed is approximately 93% of Total.
**Zeros indicate less than 1000 bushels.

Regional Consumption by Livestock, Dairy and Poultry Sector: 1989-1997									
--- bushels ---									
Northern	1989	1990	1991	1992	1993	1994	1995	1996	1997
Beef Cattle	146	144	142	144	144	143	149	158	165
Broilers	6,071	6,636	7,409	7,850	8,420	8,896	8,962	9,316	9,132
COF	96	78	81	84	93	96	96	87	66
Dairy	1,531	1,499	1,576	1,490	1,457	1,401	1,401	1,380	1,318
Hogs	132	132	129	133	126	123	105	102	107
Horses	122	138	155	174	191	209	225	23	261
Layers	606	635	560	825	684	792	722	838	780
Turkeys	3,548	3,529	3,608	4,045	4,380	4,566	4,926	5,292	5,394
TOTAL	12,252	12,792	13,660	14,747	15,496	16,227	16,586	17,196	17,224
Western	1989	1990	1991	1992	1993	1994	1995	1996	1997
Beef Cattle	75	74	73	74	74	74	77	81	85
Broilers	412	451	450	533	572	604	609	633	620
COF	43	35	36	37	41	43	43	39	29
Dairy	552	540	568	537	525	505	505	497	475
Hogs	29	29	28	29	27	27	23	22	23
Horses	32	36	41	46	50	55	59	64	69
Layers	304	319	282	415	344	398	363	421	392
Turkeys	1,237	1,231	1,259	1,411	1,528	1,593	1,718	1,846	1,881
TOTAL	2,684	2,715	2,736	3,082	3,162	3,298	3,395	3,603	3,575
Central	1989	1990	1991	1992	1993	1994	1995	1996	1,997
Beef Cattle	156	154	151	153	153	152	158	168	175
Broilers	717	784	875	927	994	1,050	1,058	1,100	1,078
COF	70	57	59	61	68	70	63	63	48
Dairy	1,227	1,202	1,263	1,194	1,168	1,123	1,123	1,106	1,056
Hogs	69	70	68	70	66	65	55	53	56
Horses	80	91	102	114	126	137	148	160	172
Layers	84	88	78	115	95	110	100	116	108
Turkeys	0	0	0	0	0	0	0	0	0
TOTAL	2,403	2,444	2,595	2,635	2,670	2,707	2,706	2,767	2,695

Eastern	1989	1990	1991	1992	1993	1994	1995	1996	1997
Beef Cattle	6	5	5	5	5	5	6	6	6
Broilers	790	864	964	1,022	1,096	1,158	1,167	1,213	1,189
COF	4	3	3	4	4	4	4	4	3
Dairy	381	373	393	371	363	349	349	344	328
Hogs	66	66	64	66	63	61	52	51	53
Horses	14	16	17	20	22	23	25	27	29
Layers	1	1	1	1	1	1	1	1	1
Turkeys	0	0	0	0	0	0	0	0	0
TOTAL	1,262	1,329	1,448	1,490	1,554	1,603	1,604	1,646	1,610
Southwestern	1989	1990	1991	1992	1993	1994	1995	1996	1997
Beef Cattle	187	184	181	184	184	182	190	202	210
Broilers	327	357	399	423	454	479	483	502	492
COF	85	69	71	74	82	85	85	77	58
Dairy	313	307	322	305	298	287	286	282	270
Hogs	13	13	12	13	12	12	10	10	10
Horses	69	78	88	99	109	119	128	138	149
Layers	3	4	3	5	4	5	4	5	5
Turkeys	0	0	0	0	0	0	0	0	0
TOTAL	997	1,012	1,078	1,102	1,142	1,168	1,186	1,215	1,194
Southern	1989	1990	1991	1992	1993	1994	1995	1996	1997
Beef Cattle	72	71	70	71	71	71	74	78	81
Broilers	324	354	395	419	449	475	478	497	487
COF	37	30	31	33	36	37	37	34	26
Dairy	189	185	194	184	180	173	173	170	163
Hogs	68	68	66	69	65	63	54	53	55
Horses	20	23	26	29	32	35	38	41	44
Layers	71	74	65	96	80	92	84	98	91
Turkeys	13	13	13	15	16	16	18	19	19
TOTAL	794	819	862	915	929	963	956	989	966

Southeastern	1989	1990	1991	1992	1993	1994	1995	1996	1997
Beef Cattle	31	31	31	31	31	31	32	34	35
Broilers	146	159	178	188	202	213	215	223	219
COF	14	11	11	12	13	14	14	12	9
Dairy	431	422	443	419	410	394	394	389	371
Hogs	1,234	1,235	1,200	1,242	1,172	1,146	979	948	998
Horses	19	21	24	26	29	32	34	37	40
Layers	45	47	41	61	51	58	53	62	58
Turkeys	0	0	0	0	0	0	0	0	0
TOTAL	1,919	1,926	1,929	1,980	1,907	1,888	1,722	1,705	1,730
***All Disclosed**	22,311	23,036	24,307	25,950	26,860	27,854	28,155	29,121	28,994
TOTAL	23,978	24,743	26,007	27,963	28,763	29,902	30,145	31,498	31,116

*All Disclosed is not equal to total due to reporting disclosure regulations. All Disclosed is approximately 93% of Total.
**Zeros indicate less than 1000 bushels.

Form Approved
OMB No. 0535-0002
Expiration Date: 02-28-98

1997 GRAIN DISPOSITION

VIRGINIA
STATISTICS
SERVICE

AGRICULTURAL

P.O. Box 1659
Richmond, VA 23218
(Phone) 804-786-3500
(Fax) 1-800-899-8566

Dear Producer:

Virginia Agricultural Statistics Service would like to thank you in advance for your cooperation with this study, as your participation is essential to develop a current assessment of the grain harvesting, storage and disposition practices currently being used by Virginia farmers. The results from this study will be used by Virginia Tech to develop marketing strategies and educational programs that can best benefit Virginia's farmers.

The information you furnish is **kept confidential**, and is used only in combination with other reports for state totals. Response to this survey is voluntary and not required by law.

Respectfully,

Steven Manheimer, State Statistician

County in Which Most Of Your Farm Is Located

PLEASE REPORT FOR THE ACRES YOU OPERATE:

1. How many **TOTAL ACRES** of land are in this operation?	105
2. Of the total acres in this operation, how many acres would be considered **CROPLAND ACRES**? *(Include land in hay and cropland in government programs)*	106

	Barley	Wheat	Corn	Soybeans	Sorghum
3. Report **TOTAL ACRES** harvested in 1997	100	200	300	400	500
Total production ..... *bushels*	101	201	301	401	501
OR					
Yield per acre ..... *bushels*	102	202	302	402	502
4. Under ideal conditions, how many acres can be combined in one day?	103	203	303	403	503
Number of combines?	104	204	304	404	504

5. **a.** Do you have grain drying facilities on your farm? (____) NO	600
b. How many bushels of corn did you dry in 1997?	601
c. How many bushels of corn per hour can you dry from 22 percent moisture to 15 percent moisture?	602
6. Please report **TOTAL GRAIN STORAGE CAPACITY** for all crops on your operation	506

	Barley	Wheat	Corn	Soybeans	Sorghum
7. How many bushels of your 1996 harvested crops were stored?	107	207	306	407	507
8. How many months did you store your 1996 harvested crops until all sold or fed	108	208	308	408	508

-continued on back-

9. Please report the equipment used to haul **GRAIN FROM FIELD:**

		Barley	Wheat	Corn	Soybeans	Sorghum
a. Two-ton	Number of trucks .	109	209	309	409	509
	Capacity .. *bushels*	110	210	310	410	510
b. Ten-ton	Number of trucks .	111	211	311	411	511
	Capacity .. *bushels*	112	212	312	412	512
c. Eighteen	Number of trucks .	113	213	313	413	513
	Capacity .. *bushels*	114	214	314	414	514
d. Hopper	Number of wagons .	115	215	315	415	515
	Capacity .. *bushels*	116	216	316	416	516
e. Other	Number of trucks .	117	217	317	417	517
	Capacity .. *bushels*	118	218	318	418	518

10. Please report the equipment used to haul **GRAIN TO MARKET in 1997:**

		Barley	Wheat	Corn	Soybeans	Sorghum
a. Two-ton truck:	Number of	119	219	319	419	519
	Number of	120	220	320	420	520
b. Ten-ton truck:	Number of	121	221	321	421	521
	Number of	122	222	322	422	522
c. Eighteen	Number of	123	223	323	423	523
	Number of	124	224	324	424	524

d. Hopper wagon:	Number of	125	225	325	425	525
	Number of	126	226	326	426	526
e. Other *(Please*	Number of	127	227	327	427	527
	Number of	128	228	328	428	528

11. Please report where most of your **1996** production was sold:

	Company Name	Location (Town, City, or County)	Number of Bushels
Barley.....	129	130	131
Wheat.....	229	230	231
Corn.....	329	330	331
Soybeans....	429	430	431
Sorghum.....	529	530	531

Reported By
Dated

Public reporting burden for this survey is estimated to average ten minutes per response, including the time for reviewing instructions gathering and maintaining the data needed, and completing the questionnaire. Send comments regarding this burden estimate or any other aspect of this survey, including suggestions for reducing the burden, to the Office of Management and Budget, Paperwork Reduction Project (0535-0002), Washington, D.C. 20503. Please DO NOT mail the questionnaire to this address.

APPENDIX C

VIRGINIA ACTS OF ASSEMBLY -- CHAPTER
An Act to amend the Code of Virginia by adding in Article 3 of Chapter 3.1 of Title 62.1 a section numbered 62.1-44.17:1.1, relating to poultry waste management.
{H 1207}
Approved

Be it enacted by the General Assembly of Virginia:

1. That the Code of Virginia is amended by adding in Article 3 of Chapter 3.1 of Title 62.1 a section numbered 62.1-44.17:1.1 as follows:

§62.1-44.17:1.1 Poultry waste management program.

A. As used in this section, unless the context requires a different meaning:

"Commercial poultry processor" means any animal food manufacturer, as defined in §3.1-884.18, that contracts with poultry growers for the raising of poultry.

"Confined poultry feeding operation" means any confined animal feeding operation with 200 or more animal units of poultry.

"Nutrient management plan" means a plan developed or approved by the Department of Conservation and Recreation that requires proper storage, treatment and management of poultry waste, including dry litter, and limits accumulation of excess nutrients in soils and leaching or discharge of nutrients into state waters.

"Poultry grower" means any person who owns or operates a confined poultry feeding operation.

B. The Board shall develop a regulatory program governing the storage, treatment and management of poultry waste, including dry litter, that:

1. Requires the development and implementation of nutrient management plans for any person owning or operating a confined poultry feeding operation;

2. Provides for waste tracking and accounting; and

3. Ensures proper storage of waste consistent with the terms and provisions of a nutrient management plan.

C. The program shall include, at a minimum:

1. Provisions for permitting confined poultry feeding operations under a general permit; however, the Board may require an individual permit upon determining that an operation is in violation of the program developed under this section;

2. Provisions requiring that:

a. Nitrogen application rates contained in nutrient management plans developed pursuant to this section shall not exceed crop nutrient needs as determined by the Department of Conservation and Recreation. The application of poultry waste shall be managed to minimize runoff, leaching, and volatilization losses, and reduce adverse water quality impacts from nitrogen;

b. For all nutrient management plans developed pursuant to this section after October 1, 2001, phosphorus application rates shall not exceed the greater of crop nutrient needs or crop nutrient removal, as determined by the Department of Conservation and Recreation. The application of poultry waste shall be managed to minimize runoff and leaching and reduce adverse water quality impacts from phosphorous;

c. By December 31, 2005, the Department of Conservation and Recreation, in consultation with the Department of Environmental Quality, shall (i) complete an examination of current developments in

scientific research and technology which shall include a review of land application of poultry waste, soil nutrient retention capacity, and water quality degradation, and (ii) adopt and implement regulatory or other changes, if any, to its nutrient management plan program that it concludes are appropriate as a result of this examination; and

d. For all nutrient management plans developed pursuant to this section after December 31, 2005, and not prior thereto, phosphorous application rates shall conform to the provisions of subdivision 2 b of this subsection and shall be in accordance with other regulatory criteria and standards, if any, amended or adopted by the Department of Conservation and Recreation pursuant to subdivision 2 c of this subsection to protect water quality or to reduce soil concentrations of phosphorous or phosphorous loadings. The application of poultry waste shall be managed to minimize runoff and leaching and reduce adverse water quality impacts from phosphorous.

D. The program shall reflect Board consideration of existing state-approved nutrient management plans and existing general permit programs for other confined animal feeding operations, and may include such other provisions as the Board determines appropriate for the protection of state waters.

E. After October 1, 2001, all persons owning or operating a confined poultry feeding operation shall operate in compliance with the provisions of this section and any regulations promulgated thereunder.

F. Any person violating this section shall be subject only to the provisions of §§62.1-44.23 and 62.1-44.32 (a), except that any civil penalty shall not exceed $2,500.

G. On or before January 1, 2000, or prior to commencing operations, each commercial poultry processor operating in the Commonwealth shall file with the Board a plan under which the processor, either directly or
under contract with a third party, shall:

1. Provide technical assistance to the poultry growers with whom it contracts on the proper management and
storage of poultry waste in accordance with best management practices;

2. Provide education programs on poultry waste nutrient management for the poultry growers with whom it contracts as well as for poultry litter brokers and persons utilizing poultry waste;

3. Provide a toll-free hotline and advertising program to assist poultry growers with excess amounts of poultry waste to make available such waste to persons in other areas who can use such waste as a fertilizer consistent with the provisions of subdivision C 2 or for other alternative purposes;

4. Participate in the development of a poultry waste transportation and alternative use equal matching grant program between the Commonwealth and commercial poultry processors to (i) facilitate the transportation of
excess poultry waste in the possession of poultry growers with whom it contracts to persons in other areas who
can use such waste as a fertilizer consistent with the provisions of subdivision C 2 or for other alternative purposes, and (ii) encourage alternative uses to land application of poultry waste;

5. Conduct research on the reduction of phosphorus in poultry waste, innovative best management practices for poultry waste, water quality issues concerning poultry waste, or alternative uses of poultry waste; and

6. Conduct research on and consider implementation of nutrient reduction strategies in the formulation of feed. Such nutrient reduction strategies may include the addition of phytase or other feed additives or modifications to reduce nutrients in poultry waste.

H. Any amendments to the plan required by subsection G shall be filed with the Board before they are implemented. After January 1, 2000, each commercial poultry processor shall implement its plan and any amendments thereto. Each commercial poultry processor shall report annually to the Board on the activities it has undertaken pursuant to its plan and any amendments thereto. Failure to comply with the provisions of this section or to implement and follow a filed plan or any amendments thereto shall constitute a violation

of this section.

2. That the State Water Control Board shall adopt the regulations required by §62.1-44.17:1.1 no later than October 1, 2000. The Board shall impanel an advisory group to assist in the development of the program in accordance with its public participation guidelines. Membership of the group shall be balanced among organizations and persons expressing an interest in the program and shall include a minimum of three representatives of poultry growers, three representatives of commercial poultry processors, and three representatives of environmental organizations.

3. That the Director of the Department of Conservation and Recreation, with the consultation of the Director of the Department of Environmental Quality and the Commissioner of Agriculture and Consumer Services, shall, by December 20, 1999, recommend to the Governor, the Senate Committee on Agriculture, Conservation and Natural Resources, the House Committee on Conservation and Natural Resources, and the House Committee on the Chesapeake and Its Tributaries ways that the Commonwealth should assist poultry growers and processors to improve the economic feasibility of transporting and selling poultry waste, and pursue alternative uses for poultry waste, including the establishment of the equal matching grant program referred to in subdivision G 4 of §62.1-44.17:1.1.

4. That on or before December 31, 2003, the Director of the Department of Environmental Quality, in consultation with the Director of the Department of Conservation and Recreation and the Commissioner of Agriculture and Consumer Services, shall report to the Governor and the General Assembly on the effectiveness of the plans implemented by commercial poultry processors pursuant to subsection G of § 62.1-44.17:1.1 in assisting poultry growers with whom they contract with the proper management, storage, disposal, and transportation of poultry waste, including excess poultry waste, for the protection of water quality.

Beth Ann Pelletier

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OBJECTIVE: To obtain a position in the agriculture sector related to market and price analysis.

EDUCATION: Master of Science in Agricultural and Applied Economics, August 1999
Market and Price Analysis, Thesis Option
Virginia Polytechnic Institute and State University, Blacksburg, VA
Grade Point Average: Overall 3.55 (of 4.0)

Thesis Work:
Analysis of the current grain handling systems and practices in Virginia. Evaluation of alternative grain marketing practices and production practices in order to improve competitive position of the grain industry in Virginia.

Related Course Work:

Futures and Options	Agricultural Marketing
Microeconomic Theory	Econometrics
Mathematical Programming	International Economics

Bachelor of Science in Agricultural and Applied Economics, December 1995
Market and Price Analysis Option, Business Minor
Virginia Polytechnic Institute and State University, Blacksburg, VA
Grade Point Average: In Major 3.8 (of 4.0) Overall 3.38 (of 4.0)

EMPLOYMENT: Graduate Research Associate, Virginia Polytechnic Institute and State University
Blacksburg, VA January 1997-present
- Teaching Assistant for junior-level microeconomic theory course in spring of 1997.
- Research focusing on efficient alternative grain handling systems in Virginia.

Management Development Associate, Branch Banking and Trust
Winston-Salem, NC January 1996-July 1996
- Analyzed and coapproved consumer loan requests under $100,000.
- Assisted clients with relationship banking needs and service issues.
- Helped conduct weekly sales meetings.

Resident Advisor, Virginia Polytechnic Institute and State University
Blacksburg, VA August 1994-December 1995
- Coordinated discipline and personal development in coed residence hall.
- Planned and initiated individual growth activities for residents.

Agricultural Statistician Intern, National Agricultural Statistical Service, USDA
Richmond, VA May 1994-August 1994
- Assisted in collection and interpretation of data.
- Aided design and data analysis for annual bulletin and brochures.

HONORS AND ACTIVITIES:

New Life Campus Fellowship (Life Group Leader)
Golden Key National Honor Society
Chi Delta Alpha Service Sorority-Committee Chairperson (1993-95)
W.R. Winslow Trust Scholarship (1993-94)
Southern States Scholarship Recipient (1995)
Luther Raper Scholarship (1994-95)

PERSONAL: spouse Timothy Pelletier