3-1980

Emergency Feed Grain Storage for New England

William J. Hanekamp
University of Connecticut - Storrs

Stanley K. Seaver
University of Connecticut - Storrs

Research Report 59, March 1980

Emergency Feed Grain Storage for New England

By William J. Hanekamp and Stanley K. Seaver
Department of Agricultural Economics and Rural Sociology

STORRS AGRICULTURAL EXPERIMENT STATION
COLLEGE OF AGRICULTURE AND NATURAL RESOURCES
THE UNIVERSITY OF CONNECTICUT, STORRS, CONNECTICUT 06268

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

The New England grain and feed dealers supplied most of the data upon which this report is based. As always the cooperation was excellent and the authors wish to thank each cooperating feed mixer for his time and effort in making available data regarding his firm's operations.

This study was conducted in cooperation with the Massachusetts Agricultural Experiment Station as part of an investigation of feed transportation. The larger study was supported by a research grant from the New England Regional Commission. The interest and cooperation of George Sahady of the Regional Commission is greatly appreciated.

Thanks are due Anne Redmerski and Lura Hanekamp for their patience in typing the original draft and numerous revisions and Arland Meade for his editorial assistance.

The research reported in this publication was supported in part by Federal Funds made available through the provisions of the Hatch Act.

Received for publication October 26, 1979.

Emergency Feed Grain Storage for New England

By William J. Hanekamp and Stanley K. Seaver
Department of Agricultural Economics and Rural Sociology

Introduction

Over the last 20 years the formula feed manufacturing industry of New England has been plagued by a series of rail shut downs. In the middle 1950's, severe winter storms crippled rail service for weeks; in 1969 harsh winter conditions in combination with rail union disputes stalled rail service for months; and in 1977, 1978, and 1979, long-haul rail service was paralyzed. Each of these crisis periods caused significant disruptions in the production schedules of the region's formula feed industry. Inventories of many feed ingredients were drained, feed production schedules were altered, and deliveries of mixed feed to poultry and dairy farmers were delayed for extended periods.

The disruptions which characterized the feed production process during these acute winter seasons underline a major concern among public and private members of New England's agricultural community. There is a growing belief that agriculture can no longer depend on the regional feed manufacturing industry to unilaterally execute emergency feed processing plans. The costs of guaranteeing an emergency flow of feed ingredients and mixed feed to livestock producers are rising, which places a greater financial burden on individual firms. As a result, attention is now focusing on alternative systems to insulate the grain trade from further breakdowns of transportation services.

The objectives of this study focus on three critical areas of the reserve storage issue. They include: (1) determination of the existing grain storage capacity of the mixed feed manufacturing industry of New England, (2) determination of the ability of the industry to insure itself a steady supply of grains and feedstuffs to continue feed manufacturing operations, and (3) identification of the alternatives available to the industry to achieve a satisfactory reserve storage capability.

FEED INGREDIENT STORAGE IN NEW ENGLAND, JANUARY 1, 1977

The commercial feed mixing industry of New England maintains an ingredient storage capacity of approximately 107,000 tons. This capacity represents silos and other enclosed facilities used to stock livestock feed inputs. Among the ingredients stored are whole corn, hominy, soybean meal, middlings, brewers grain, millers grain, and gluten feed.

Storage capacities for the region show significant variations by state. Maine and Connecticut, for example, account for 70 percent of the regions total capacity. With a significant poultry industry operating in the two states, they represent the principle storage areas for whole corn. In contrast the state of Rhode Island maintains limited storage capacity. With no major commercial feed mixing plant operating in the state, storage in Rhode Island is confined to those agribusiness firms serving as wholesale or retail finished feed outlets (Table 1).

TABLE 1. Feed Storage Capacity in New England, By States, January 1, 1977.

	Commercial Feed Mixing Plants' Storage Capacity		
State	Corn	Other Grains	Total
	---------tons---------		-tons-
Maine	41,841	7,146	48,987
Vermont	3,100	14,348	17,448
Massachusetts/ New Hampshire	10,328	6,195	16,523
Rhode Island	—	—	—
Connecticut	20,936	3,164	24,100
NEW ENGLAND	76,205	30,853	107,058

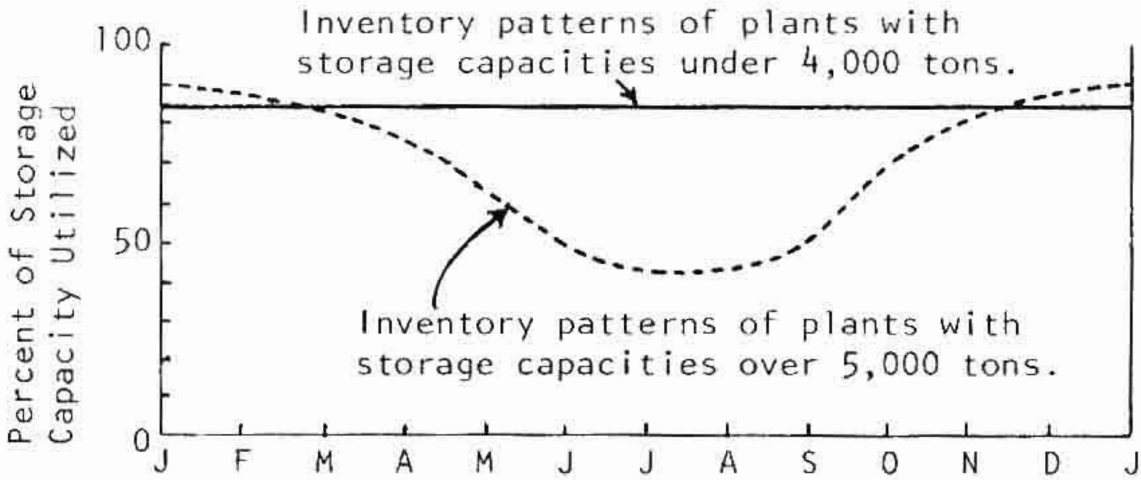
Source: Survey of New England Feed Manufacturing Plants — April 1977.

Seasonal Storage

During the calendar year the levels of feed ingredients held in storage fluctuate. The seasonal shift in storage is, in part, a product of the size of the individual firm. Feed mixing plants with limited storage capacities generally maintain supplies near capacity throughout the year. More variable storage utilization is practiced by plants with large storage capacities. Typically these larger enterprises show acute cyclical shifts in the use of storage capacities during the year.

Figure 1 illustrates the standard storage utilization patterns of New England feed mixing plants. For the majority of the firms with capacities

Figure 1. Seasonal Utilization of Storage Capacities by New England Feed Mixing Plants, 1976.



under 4,000 tons, inventories average 85 percent of capacity and seldom were allowed to fall below 70 percent. Stocks below the 70 percent level generally were a product of disruptions in normal operating procedures. For firms with storage capacities in excess of 5,000 tons, the utilization of facilities ranged from 45 to 90 percent. There were only a few exceptions to this pattern. The exceptions were generally recorded by those firms with storage capacities of 5,000 to 7,000 tons with milling capacities of 400 tons per day. Their cyclical shifts in storage occasionally dipped to 60 percent of capacity.

Although storage patterns fluctuate by size of operations, the majority of feed mixing plants fully utilized their storage facilities during late November through the end of February. In terms of total volume, it represented an inventory on hand of 91,000 tons for the region (Table 2). The accumulation of this

TABLE 2. New England Feed Production And Ingredient Storage Position 1977.

State	Total Storage Capacity	Estimated Supplies in Storage	Average Weekly Demand for Finished Feed	Supplies Available to Support Production Schedules
		Winter		Winter
	tons	tons	tons	-days-
Maine	48,987	41,639	15,952	18.3
Vermont	17,448	14,831	10,060	10.3
Massachusetts/ New Hampshire	16,523	14,045	8,761	11.2
Connecticut/Rhode Island	24,100	20,485	10,182	14.1
NEW ENGLAND	107,058	91,000	44,955	14.1

Source: Survey of New England Feed Manufacturing Plans — April 1977.

volume was a response in part to (1) the availability of fall harvest supplies in the midwest, and (2) the difficulties of keeping feed procurement channels open during the entire winter season.

Even with feedstuff reserves at optimum storage levels, it still represents a limited supply of feed ingredients. Weekly production schedules for example require 45,000 tons of ingredients to be on hand. At this level supplies in storage can guarantee ingredient demand for no more than 14.1 days.

The inventory reserve position, however, varies significantly among the individual states of New England. In the winter season, feed mixers in Vermont, for example, can maintain production schedules for ten days, the lowest in New England. In contrast the largest feedstuff reserves are held in Maine with 18.0 days supply. For Connecticut, inventories held in the winter are sufficient to support feed mixing schedules for 14.1 days.

Rail Service to New England

The shipment as well as the storage of feed ingredients represents a critical component in the manufacture of livestock feed in New England. For over four decades the dominant mode of transporting feed ingredients into the region has been rail. It represents the primary link from the grain supply centers of the Midwest to eastern users.

Movement of feedstuffs travels over a variety of railroad routes. The primary routes eastward include the direct link from Toledo, Ohio, to New England, and the northern route connecting Detroit, Michigan, to Montreal, Canada. Through the years the service over these northeastern routes has been subject to breakdowns and transit delays. Under normal service conditions, grain shipments eastward require 7 to 14 days to reach their destination points. However, there have been numerous occasions when feed mixing firms have experienced transit delays of 25 to 32 days (Table 3).

TABLE 3. Railroad Delivery and Delay Time Recorded by New England Feed Manufacturers.

State	Normal Transit Time	Maximum Transit Time	Unexpected Delays in Shipments
	......days......		
Maine	7-10	32	22-25
Vermont	14	30	16
New Hampshire	10-12	30	18-20
Massachusetts	7-10	30	20-23
Rhode Island	...	...	...
Connecticut	7-10	25	15-18

Source: Survey of New England Feed Manufacturing Plants — April 1977.

The cause for such delays is due to a host of rail movement and service factors. Among the most common are misclassification of rail cars at switching yards, limited availability of hopper cars at supply points, delays in transferring cars from terminal yards to receiver spur tracks, and periods of unseasonably bad weather which disrupts normal rail operations. The threat of these unexpected delays holds important implications to the maintenance of normal finished feed production schedules. Occasional delays in feedstuff shipments will not cripple mixing operations. But if the frequency of delay becomes acute, supplies in storage become a critical factor in maintaining continuous mixed feed production schedules.

Extended breakdowns in rail service can create a serious feed shortage in New England since each state maintains a limited inventory of feed ingredients to service its livestock economy. Extended delays paralleling those shown in Table 3 show the potential for feed ingredient shortages in New England. No state maintains sufficient feed ingredient reserves to supply its local normal mixed feed market (Table 4).

TABLE 4. Maximum Delays, Storage Supplies and Periods of Shortage.

State	Maximum Transit Delays	Storage Supplies Available	Periods of Shortages
		Winter	Winter
	days		
Maine	25	18.3	6.7
Vermont	16	10.3	5.7
Massachusetts/ New Hampshire	20	11.2	8.8
Connecticut/ Rhode Island	18	14.1	3.9

Storage Requirements — A New Perspective

With the potential of rail service breakdowns extending for periods of 25 to 32 days, (Table 3), the existing storage capacities of the region's formula feed mixing industry are inadequate. A review of the finished feed production schedules, based on 1975 demand, shows the need for an additional storage capacity of 40,100 tons (Table 5) to guarantee an emergency reserve during periods of acute and extended rail service shutdowns. Of the individual states, Maine recorded the highest storage needs, 15,200 tons. The state of Vermont required 8,200 tons of additional storage capacity, Masachusetts/New Hampshire 11,000 tons and Connecticut 5,700 tons of reserve storage.

TABLE 5. Additional Reserve Storage Capacity Required to Eliminate Potential Shortages.

State	Storage Capacities
	-tons-
Maine	15,200
Vermont	8,200
Massachusetts/ New Hampshire	11,000
Connecticut/ Rhode Island	5,700
NEW ENGLAND	40,100

1977 — A CASE STUDY

In the winter of 1977, the Northeast experienced an acute breakdown in rail service. Heavy snows and ice curtailed operations in key switching yards (Cleveland, Ohio; Buffalo, New York; and Montreal, Canada), and stalled the movement of traffic along numerous mainline routes. It resulted in extended delays in the arrival of goods to numerous industrial and agricultural customers. Delays in service paralled those hypothesized in the preceding section.

The breakdown in rail service to New England's feed mixing plants was most severe during late January and early February. Thousands of tons of feed ingredients were tied up on railroad tracks. With these rail shipments paralyzed, local feed mixing mills rapidly exhausted their supplies of feed ingredients. Production schedules were revised and altered to combat the service delay, but many feed mixing firms still experienced critical shortages.

The extent of the ingredient shortages varied significantly between states as shown in Table 6. In Vermont, for example, local mills experienced shortages of at least one major feed ingredient. These ingredients were either completely depleted or fell below 10 percent of normal storage levels. The periods of shortages ranged from 7 to 30 days. For the states of Maine, Massachusetts, and New Hampshire, reports of inventory shortages equal to 10 percent of normal stocks ranged from 4 to 14 days. Connecticut feed mixing firms, however, were more fortunate. Inventories of feedstuffs never fell below 30 percent of normal levels. It must be noted that this inventory in reserve was still low. It only represented a six-day supply of ingredients.

The shortages in feed ingredients forced many firms to undertake emergency actions in the winter of 1977. Trucking of ingredients from alter-

TABLE 6. Storage Required to Prevent Feedstuff Shortage in the Winter of 1977.

State	Ingredient Reserve Storage			
	Corn	Soybean	Soft Grains	Total
	tons			
Maine	11,700	1,600	2,200	15,500
Vermont	...	...	12,600	12,600
Massachusetts/ New Hampshire	3,030	270	5,700	9,000
Connecticut/ Rhode Island	---	---	---	---
NEW ENGLAND	14,730	1,870	20,500	37,100

Source: Survey of New England Feed Manufacturing Plans — June 1977.

native sources of supply, rerouting of railcars, substitution for depleted ingredients, limiting customer orders and transferring of ingredient supplies among neighboring plants became necessary to continue production schedules. These adjustments enabled the feed mixing firms of Vermont, New Hampshire, Connecticut, and Massachusetts to mix feed rations throughout the crisis period. For Maine, however, plants were less effective in maintaining production schedules. Approximately 50 percent of the commercial feed mixing plants of the state were temporarily shut down. The periods in which plants ceased feed mixing operations varied from one shift to four days. The depletion of supplies of whole corn (yellow No. 2), a major feed ingredient in poultry rations, was the primary factor in the decision to shut down.

The Economic Impact

The burden of maintaining livestock feed production schedules fell entirely on the formula mixed feed manufacturing industry. Continuation of production schedules in the winter of 1977 resulted in increased costs of operation for each New England feed mixing plant.

Among the major costs incurred by local feed mixing firms was the underutilization of labor. A survey of the feed mixing industry showed that each firm in the region — whether temporarily shut down or under limited production schedules — retained all hired personnel on the payroll. The full crews were kept on hand in order to respond immediately to the arrival of delayed rail shipments.

A less visible cost to the feed mixing plants was the inability to maintain standard formulas. Often high cost ingredients were substituted for lower cost ingredients to maintain proper nutrient and protein standards. This resulted in high cost formulations. In general, these added costs were absorbed directly by the mixing firm.

Another component in the scenario of winter production costs was the procurement of emergency supplies of feed ingredients. Many feed mixing plants shifted from midwestern sources to suppliers in New York and Pennsylvania for immediate delivery. As a result of the accelerated purchasing activities, prices of ingredients in these two markets rose sharply forcing New England firms to pay premium prices. Moreover, New England mixers had to bear the cost of trucking emergency supplies to their plants. Common and wildcat carriers were contracted for the long-haul movements from New York and Pennsylvania.

The activities of the firms in seeking alternative operational strategies however did not spare the industry from the cost penalties of a crippled railroad industry. The firms absorbed the costs of transit delays of cars as well as the costs associated with rerouting rail cars to avoid traffic tie-ups. In addition approximately 80 percent of the firms in the region were assessed additional demurrage fees. The high demurrage charges were directly attributable to the unexpected arrival of large numbers of rail cars at the feed milling sites at one time. The feed milling facilities typically were not equipped to unload the lots of arriving cars within the prescribed unloading times.

It is difficult to quantify the total dollar costs of all the emergency actions undertaken by the feed mixing industry. Many of the costs were not identifiable due to the variation in accounting systems used by individual firms. It therefore was difficult to separate the real costs for analysis. One major cost component easily defined, however, was the demurrage charged New England mills.

The estimated total demurrage charge attributable to the disruptions of normal rail service was approximately $160,000 (Table 7). For some firms, demurrage was minor while others reported demurrage as high as $50,000. The plants of Vermont and Maine absorbed the largest share of this cost. The fees represented the charges for the three month period of January-March. For the

TABLE 7. Demurrage Charged New England and Feed Mixing Firms During January-March 1977*.

State	Demurrage Charged
	-dollars-
Maine	59,050
Vermont	65,500
Massachusetts/ New Hampshire	26,500
Connecticut	7,900
NEW ENGLAND	158,950

* One firm did not respond to the survey of New England mills.

Source: Survey of New England Feed Manufacturing Plants — June 1977.

majority of firms March was the high cost period due to the queuing problems of delayed car arrivals. With the limited storage and unloading facilities the cars could not be efficiently handled. In total, these costs represented a significant burden on an industry confronted with an array of financial hardships due to the inclement weather.

Recovery of Losses

The 1976 tariff regulations did not allow for the correction of accumulating demurrage costs in the winter of 1977. Provisions within the tariff in fact placed the burden of the cost directly on the railroad customers. Delays and tie-ups of rail cars on shipper and receiver tracks were totally the responsibility of the railroad users, not the responsibility of the carriers.

Action by railroad users was taken to seek relief from the high demurrage charges. Presentations were made before the Interstate Commerce Commission (ICC) requesting the demurrage costs be shared by the railroad carriers. The ICC responded to the requests of the railroad users in the spring of 1977, by authorizing an amendment to the existing tariff regulations. This amendment provided a 50 percent reduction in the demurrage fees charged railroad users. Rate adjustments reduced the $30 and $20 per day demurrage levies to $15 and $10 per day respectively. These reductions applied to charges incurred between late December to mid-March of 1977.

Establishment of the amendment to adjust the demurrage costs during the winter of 1977 was only a temporary action. It did not establish a policy for future years. Accordingly, the long-term transportation problems which face New England's industrial and agricultural industries still remain.

Expanding Storage Capacity

The establishment of reserve storage of feed ingredients represents an alternative to combat unreliable rail service. New England, as shown in previous data, is in a reserve storage deficit position (Tables 5 and 6).

Reserve storage could be expanded under two plans. The first involves the utilization of subterminal elevators under a unit-train transportation system to move grain to New England locations. The second entails the construction of specialized grain storage facilities to function as emergency grain supply centers.

SUBTERMINAL RESERVE STORAGE

Examination of the feasibility of developing a subterminal system to service New England's feed grain buyers was undertaken in a separate study entitled "Unit Train Grain Subterminals To Service New England's Feed Manufacturing Industry — An Economic and Locational Analysis."[1] This work focused on the economic advantages associated with installing a unit train transportation service to move feed grain. A byproduct of the total program was the expansion of grain storage throughout New England.

A subterminal facility is an agri-industrial complex composed of grain unloading equipment and grain silos. The operational specifications require sufficient storage capacity to house grain (corn) in excess of 9,000 tons. It is the utilization of this storage capacity which improves the reserve storage position of a region.

The construction of unit train subterminal facilities in New England will significantly improve the ability of local feed mixing industry to combat future feed grain shortages. For the districts of southern New England, central New England, and Maine, it represents sufficient storage to combat the shortages recorded in the winter of 1977. A subterminal facility is not economically feasible for Vermont but reserve storage of 18,000 tons is still needed to combat all potential local grain shortages.

Financial Cost

The capital outlay required to finance the total subterminal project totals 6.5 million dollars. It represents the total investment cost to construct four facilities to service the local feed manufacturing industries of central New England, southern New England, Maine and northern Vermont (Appendix 1).

Annual operating expenditures vary according to the volume of grain which is received and distributed by the subterminal facilities. Volumes of grain equal to 1975 feed grain import levels place plant costs at 1.55 million dollars. The cost to distribute the centrally stored grain to local feed manufacturers totals 1.73 million dollars (Appendix 1).

The overall cost of the grain subterminal project is an investment to reduce the costs of transporting feed grain into New England. Preliminary unit train tariff rates offered by Conrail and Canadian National rail carriers in June of 1977 placed transportation cost savings in the range of the projected subterminal development and operational costs (Appendix 2). In total the expansion of storage capacity under a grain subterminal collection and distribution plan showed no direct cost to the local feed manufacturing industry except in Vermont.

---

[1]Unpublished manuscript, W.J. Hanekamp, The University of Connecticut, Storrs Agricultural Experiment Station, Storrs, Connecticut.

WINTER RESERVE STORAGE FACILITIES

Unlike the multipurpose uses of a grain subterminal facility, a winter storage facility serves but one function. It serves to store feed grains to combat potential feed grain shortages. The winter grain storage complex is an insurance investment for the feed manufacturers of New England.

Construction of emergency reserve storage to meet 1977 conditions is required in three districts to service the region's feed mixers. Facilities need to be located in northern Vermont, Maine and southern New England with a total storage capacity of 37,000 tons. Reserves of this level would be sufficient to insulate New England against the feed shortages which were experienced in 1977.[1]

Financial Cost

Construction of district feed grain facilities for winter storage is a capital intensive program. In order to meet the estimated reserve requirements, the total silo capacity needed for winter storage is between 34,000 and 37,000 tons. The construction cost is estimated to range between 2.8 and 3.5 million dollars (Table 8).

TABLE 8. Estimate Capital Outlay for Winter Silo Storage Facilities, 1977[1].

State	Estimated Capital Investment - dollars	
	-minimum-	-maximum-
Maine	1,320,000	1,383,000
Vermont	705,000	1,125,000
Massachusetts/ New Hampshire	303,000	982,000
Connecticut/ Rhode Island	---	---
NEW ENGLAND	2,828,000	3,490,000

1These costs are for facilities at new locations and hence include site, railroad siding, all new loading and unloading equipment and similar other costs. If storage for 40,000 tons, which includes Connecticut, were built at existing plants, costs would be reduced approximately one million dollars. The cost, by states, for providing the volume of storage indicated in Table 5 is as follows: Maine, $687,750; Vermont, $366,250; Massachusetts/New Hampshire, $491,250; and Connecticut, $255,000; or a total of $1,791,250.

The annual costs to operate the facilities include depreciation, taxes, insurance, interest on investment capital, and the interest on the value of the feedstuffs held in winter storage. Labor costs are minor since skeleton crews are sufficient to operate the facilities for no more than three months.

The expected short term costs result in estimated annual expenditures between $533,000 and $686,000 (Table 9). The largest cost component is for fixed expenditures. Although the facility is not operational during nine months, March to November, the fixed costs of operation still accumulate.

1Even though Connecticut had no 1977 shortage, additional capacity is required as shown in Tables 4 and 5.

TABLE 9. Estimated Annual Costs of Operation, 1977, Winter Silo Storage.

Cost Categories	Maine		Vermont		Massachusetts/ New Hampshire	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Fixed Costs						
Depreciation & Interest (A.E.C.)	157,320	176,000	77,676	135,506	83,287	108,158
Taxes & Insurance	51,408	57,512	25,383	44,280	27,216	35,343
Variable Costs						
Labor	10,400	10,400	10,400	10,400	10,400	10,400
Interest on Inventory[1]						
8% per annum						
10% per annum	37,400	38,750	19,750	31,500	22,500	27,500
Total Cost	256,128	282,662	133,209	221,686	143,403	181,401

NEW ENGLAND (minimum-maximum, $352,740-685,749)[2]

[1] *3.6 percent of Capital Investment. Value of Feedstuffs — $100/ton — F.O.B. New England)*

[2] *Some additional operating costs would be incurred with building emergency storage as indicated in footnote Table 8. These costs have not been estimated but would be considerably less than $532,740.*

Comparison of Two Alternatives

The construction of grain subterminal facilities to serve grain traders in New England is an economically attractive program. It establishes reserve storage in the region with a minimum direct capital investment. Although the direct cost is minimal due to the potential savings which result from the cost economies of a unit train delivery system, there are notable organization problems attached to a regional and district subterminal project.

Under a subterminal program, major changes need to be implemented in traditional feed purchasing procedures. Firms served by the subterminal could no longer act independently as buyers in the feed grain market. Instead, each would need to participate in collective purchasing arrangements with neighboring firms to guarantee shipment tonnages sufficient for a full unit-train. Additionally, purchase arrangements would need to be developed under long-term contracts. Many local feed manufacturing firms are reluctant to accept centralization of purchasing activities.

New England firms view the individual freedom to speculate on price cycles, fluctuations and trends in the market place as an important factor in developing a successful business. Loss of freedom reduces the managerial competition and skill which is an integral part of the feed manufacturing business. Few wish to eliminate it as a profit-earning instrument. Potential profit earnings due to timely grain purchases can easily offset any transportation cost reductions that result from a unit train tariff rate. This dichotomy in economic advantages creates a notable barrier to the acceptability of a subterminal project by individual firms within New England.

In contrast, the winter silo program offers great flexibility in developing a procurement and storage program. Movements of feed grain into the reserve storage facilities are not tied to large volume shipments. Moreover shipments of one car or multi-car loads can be received and unloaded at the facility. Such flexibility offers firms the freedom to enter the grain market to take advantage of time and location price variations. There is no requirement to contract with a central supplier who can guarantee large volumes for delivery.

Providing reserve storage at central locations, however, still remains a capital intensive project. There exists a direct capital and operation cost to the region but, as noted, this can be minimized by locating storage at existing feed mixing plants. The acceptability of either alternative rests on the methods of financing and the development of support from federal and state agencies.

Summary

Storage facilities presently utilized by the formula feed mixing industry are inadequate to house an emergency supply of ingredient materials. Evidence shows conclusively that an expanded storage capability is required in New England. Estimated additional storage requirements total 40,100 tons: 15,200

tons in Maine, 8,200 tons in Vermont, 11,000 tons required for Massachusetts and New Hampshire combined, and 5,700 tons for Connecticut.

The economic feasibility of establishing emergency storage was reviewed under two plans. One entailed the use of unit train grain subterminals as reserve storage centers. The alternative plan examined the feasibility of utilizing storage silos as district emergency storage sites. Capital requirement estimates were also made for storage located at existing plants.

Under the plan to construct district silos to house emergency stocks, capital investment requirements range from 2.8 to 3.5 million dollars, at 1976 prices. Expected annual costs to operate the elevators varied from a low of $533,000 to a high of $686,000. In terms of a premium cost to guarantee an emergency supply for the region, it represents a maximum cost of $0.35 per ton based on 1975 feedstuff consumption requirements.

Reserve storage requirements, however, are significantly reduced under the plan to establish grain subterminal elevators to service grain shipments by unit train. The daily operation of these facilities insured the feed mixing industry a reserve of 23,600 tons in subterminal storage. Accordingly this reserve in conjunction with the existing storage capacity can service emergency feed requirements in southern and central New England, and Maine. Additional capital investments, however, are required in Vermont. A 1.8 million dollar capital outlay is needed to construct a facility which can offer the local feed mixing industry a sufficient storage capability. Expenditures to support its operation result in an annual cost of approximately $121,000 at 1976 price levels.

Implementation of a reserve storage program in concert with the grain subterminal system is a cost efficient system. The additional capital outlay required in Vermont represents an annual cost to the region of approximately $0.07 per ton based on 1975 feedstuff consumption requirements. In comparison to the district silo plan a savings of $0.28 per ton is realized by the region.

The acceptability of the two plans is also contingent on organizational parameters. The subterminal project requires the centralization of grain purchasing decisions. As a result the freedom of participating firms to make individual purchasing decisions in response to price variation is curtailed significantly. The centralization of activities is not as rigid under a reserve grain program. Individual firms still maintain autonomy in developing and carrying out purchasing decisions in the grain market place.

Individual firms building emergency storage at existing locations seems to be the most desirable system. Both capital requirements and operating costs are minimized. It also retains the greatest amount of flexibility. Government participation would be required in order to assure access to supplies during emergencies by firms not building additional storage. The greatest disadvantage is the lack of assurance that sufficient storage will be built to provide protection for all of New England.

APPENDIX 1

The Economic Structure of a New England Unit Train Grain Elevator Industry, 1976.

		OPERATING COSTS								Capital Investment
				Distribution Costs			Total			
		Plant Costs		Direct Delivery		Shrinkage	Operating Costs			
Location	Tonnage	Annual	ATC[1]	Annual	ATC	Annual[2]	Annual	ATC		Subterminal Operation
		dollars								
Augusta, Me.	477,880	681,651	1.43	238,940	2.00	238,940	1,878.483	3.93		2.400.000
Fitchburg, Ma.	163,956	313,240	1.91	389,063	2.37	81,978	784,282	4.78		1,150,000
Willimantic, Ct.	167,076	315,757	1.89	204,100	1.22	83,538	603,395	3.61		1,150,000
St. Albans, Vt.	95,004	245,110	2.58	183,350	1.93	47,502	475,962	5.01		1,800,000
New England	903,916	1,555,758	1.72	1,734,406	1.92	451,958	3,742,122	4.14		6.500,000

1 All ATC's are average total cost per ton.

2 Shrinkage cost is $.50 per ton. To obtain ATC add ATC plant and ATC delivery cost plus $.50 or divide annual total operating cost by tonnage.

APPENDIX II

Potential Savings Resulting From Proposed Conrail Rates, New England, 1977[1].

Destination	Total Grain Subterminal Operating Cost	Proposed Unit Train Rate	Existing Tariff Rate[2]	Economic Savings	Total Savings[3]
	-Per Ton-	-Per Ton-	-Per Ton-	-Per Ton-	(000's)
	Dollars				
Augusta, Me.	3.93	12.70	20.00	3.37	1.611
Willimantic, Ct.	3.61	11.25	16.00	1.14	191
Fitchburg, Ma.	4.78	11.25	16.45	.42	69
St. Albans, Vt.	5.01	11.05	15.30	–.76	–72

1Only savings from Toledo, Ohio are calculated since existing rates from Ft. Wayne, Indiana and Decatur, Illinois were not readily available.
2Existing rate as of January 7, 1977.
3Total dollar savings based on 1975 corn shipments of 477,880 tons.