

THE MARKET POTENTIAL AND ECONOMIC FEASIBILITY
OF A WOODEN PALLET BIN LEASING SYSTEM

by

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Thesis submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

Master of Science

in

Forest Products

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June, 1985

Blacksburg, Virginia

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(ABSTRACT)

The concept of a bin leasing system represents an effort to use bins more extensively. In a leasing system one inventory of bins would be used by two or more annual users. System benefits would be lower per-use costs for the user and the opportunity for the lessor to make a profit.

In order to establish a working data base of information, a mailed questionnaire was sent to 333 fruit and vegetable processors. The response rate on the survey was 45%.

A typical bin is built of hardwood lumber, lasts about seven years, and costs an average of \$36.53. Seventy-eight percent of the owners considered bin repair a problem, 85% thought bin transport was expensive, 96.5% agreed that bins were a significant investment. Overall, 66% considered bin leasing a viable option to ownership.

Eastern North Carolina was chosen as the most promising leasing system location. The system will cater to cucumber/pepper processors and sweet potato packers. The method chosen to establish the system is to contract with one or more large companies to supply, on a lease basis, the required replacement bins for future years.

A sample system was designed based on cost and revenue information received from area bin owners. Calculations yielded a net present value of \$31,056.99 for a 15 year run of the system when using a discount rate of 12.5%.

The effects of changes in key variables were analyzed. The most dramatic changes in NPV were due to changes in bin life and per-bin revenues.

ACKNOWLEDGEMENTS

Without the guidance, support, and friendship of Dr. Steve Sinclair, my committee chairman, this research project could not have been completed. My sincere thanks go to Steve for all of his help.

I am extremely grateful for the generous and helpful support of National Pallet Leasing Systems, Inc. and . As a research sponsor, has been outstanding in his enthusiasm, insight, and leadership.

I also thank my committee members, Dr. Paul F. Anderson and Dr. Walter B. Wallin, for their guidance and input. It has been a privilege working with both of them.

I especially appreciate all of the gracious help I received from . is very much more than a secretary. She made the completion of this project almost pleasurable.

Finally, I would like to thank my parents, for helping me get here, and and all the members of the VPIRFC for helping to make being in graduate school not only bearable, but actually enjoyable.

PREFACE

Two sections of this thesis have been prepared as individual manuscripts for consideration for publication. The requirements of the thesis and of the manuscripts have created unavoidable redundancies.

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INTRODUCTION

Problem statement and project background

National Pallet Leasing Systems, Inc. (NPLS) was established as a service corporation in the materials handling industry. NPLS began the first nationwide pallet leasing pool using a 48" x 40" "PEP" pallet. Pallet leasing has been a successful venture for NPLS. The company is now seeking new areas for the application of its experience and service. The attention of NPLS has been drawn to agricultural pallet bins as a possible target for a leasing pool arrangement. A pallet bin is, as the name implies, a pallet mounted container, constructed from a variety of materials, used for the bulk shipment and storage of manufactured and agricultural goods (Figure 1).

Before a pallet bin leasing program can be initiated, there are many questions that must be resolved concerning applications, bin design, and so on. In an effort to answer these questions, NPLS approached Virginia Tech with the proposal that the market potential and economic feasibility of a pallet bin leasing system in the eastern U.S. be investigated as a graduate research project. The research project agreed upon between the Department of Forest Products and NPLS has four phases, although only the first two phases are being implemented in the project this thesis describes. These two phases include the establishment of an information data base, including information on materials used in bin construction, bin size, use, cost,

etc., and an economic and market evaluation of proposed bin leasing systems.

Literature Review

The initial development of information concerning agricultural bin use consisted mainly of a review of secondary sources of data such as books, journal articles, and federal and state publications. Although most of the sources listed are from the 1960's and 1970's, the information is apparently the most recent available. The O'Brien et al. (8), Ryall and Lipton (9), and Ryall and Pentzer (10) volumes are comprehensive, contemporary overviews of the fruit and vegetable industries, containing basic sections on the use of pallet bins. The sources listed in these books were used as a starting point for the literature review.

Bin construction

Pallet bins can be made from lumber, plywood, veneer, corrugated fiberboard, wire mesh, plastic or any combination of these (2). Common fastenings, often used in combination with cornerposts, angle irons or some other framing member, include nails, common "U" or angle bolts, conventional or "tee" nuts, wood screws, wire or rivets. Other construction methods include wire loop or staple hinges, wire tied corners, klimp fasteners, ordinary hinges, rigid hook and eye, or steel

helix assemblies. In some cases, the bin is not permanently attached to the pallet base. Further, bins can be either expendable or reusable, with reusable bins sometimes built as collapsible units to save space when not in use. In certain circumstances bins are coated with preservative treatments or water repellents to protect the container during outside exposure or water immersion.

The National Wooden Pallet and Container Association (NWP&CA) comments "that pallet containers in . . . agricultural service are subject to constant and unusual stresses—from loading and pickup on uneven ground, from constant loading and dumping, from exposure to the elements, and use with water dump and conveyor systems" (2). Additionally, some field systems utilize boom-lift trucks which grasp the top of the bin for maneuvering, creating unusual stresses (3). The obvious abuse dealt to the pallet bin has prompted investigations into the best designs for agricultural use. Heebink (4) concluded that a lumber bin with vertical side boards, horizontal framing, and diagonal supports, or a plywood bin with good corners and fasteners, was the best choice. Although the use of the plywood bin seems to be increasing, Dr. Walter Wallin, Adjunct Professor of Wood Mechanics at Virginia Tech, and Dr. Frederick Cooler, Fruit and Vegetable Extension Specialist in the Department of Food Science and Technology, agree that, at least in Virginia, the lumber bin is the most predominant in use today.

Bin dimensions

Bin volumes, while relatively equal between crops and regions, are nonetheless stated in different units depending on the conventions of the industry involved. In the citrus industry the bins replaced the manually transported field box; bins are now specified by the number of boxes they hold; a ten box bin is typical (3). Similarly, bins used for apples, tomatoes, etc. are often described by bushel equivalents.

Due to the differing resistances of specific crops to bruising, pallet bins do vary slightly in depth for some varieties. In his studies of the use of pallet bins for produce shipping, Shaffer (11) found that a bin with 42" x 47" base dimensions would be the most versatile for both truck and rail shipments. Despite this fact, the American Society of Agricultural Engineers has, since 1969, promoted the use of two standardized bins, neither of which is 42" x 47". The specific sizes of these bins by outside base dimensions are 47.25" x 47.25" for the square bin and 47.25" x 39.375" for the rectangular bin. Both bins are limited to a height of 28.35" or 52.35" (1). Unfortunately, the standardization efforts have been resisted by the different bin requirements related to crop, grower, and processor needs.

Agricultural bin use

The mechanization of the fruit and vegetable industry that began in the early 1960's has led to the development of extremely fast harvesting equipment. For instance, a lettuce harvester developed in California is capable of cutting more than 10,000 heads per hour (5). These accelerated production rates have fostered a need for faster methods of gathering and transporting the harvested produce. In most instances, this need has been filled by the use of pallet bins in harvesting operations. Some of the crops that are now handled in pallet bins include apples, cantaloupes, carrots, cucumbers, grapes, grapefruit, honeydew, lemons, lettuce, nectarines, onions, oranges, peaches, pears, plums, potatoes, squash, tomatoes, watermelons, and even some of the tree nuts. Although it seems that stacking some of these crops to depths of 20" to 30" in a bin would cause damage, research has shown that, when using proper equipment, "less fruit damage occurs in properly filled pallet boxes than in [the smaller, manually transported] field boxes" (10).

Recognized advantages of pallet bin use

The advantages to be gained by the grower or processor who uses pallet bins rather than palletized or unpalletized cardboard or wooden boxes are numerous. First and foremost, the ease of mechanical handling of pallet bins decreases loading and unloading times,

decreases labor requirements, and decreases container requirements; all of these lead to lower costs. Also, bin use leads to increased rates of processing line production. Further, the sturdy bins stack better than the other systems, optimizing the safety and operation of all storage areas. The NWP&CA claims two additional advantages of bin use. First, the NWP&CA believes that "for long hauls to markets, trucks loaded with pallet bins meet weight capacities before volume limits" (2). Second, the NWP&CA states that "pallet containers provide more uniform cooling of crops kept in storage than individual picking boxes or crates" (2). In this case the NWP&CA is supported by the research of Hinsch and Rij (5), who found that head lettuce in pallet bins remained satisfactorily cool in simulated cross-country trips.

Bin use problems and solutions

Shaffer (11) reported that if the 570,000 bushels of potatoes, apples, and citrus that were shipped in boxes in 1965 had been shipped in pallet bins instead, the savings would have totaled \$63,521,000. This figure only accounts for savings of time, labor, and containers. If the cost of returning the bins, empty, to the places of origin had been included, the savings, if any, would have been far smaller. The greatest disadvantage of the use of pallet bins for hauling fruit and vegetables is "the problem of returning empty bins to the shipping point" (9). Shaffer (11) illustrated the point by showing that after hauling potatoes in bins from Idaho to the upper-midwest, it was

cheaper to dispose of the good bins than to pay the return freight. Other disadvantages of the pallet bin system are the unacceptability to retailers as a display vehicle for fresh produce, the large capital investment required, and the possible incompatibility with other systems.

With regard to the high cost of returning empty bins to the shipping site, certain solutions have been offered. One such solution is the use of collapsible bins, which would increase the number of bins carried per return truckload. A second answer is the use of disposable, pallet mounted fiberboard bins. While Shaffer (11) reported that making such a bin strong enough to stack would also make disposal uneconomical, recent developments, such as the "Produce King-Pack", an octagonal, stackable, 36" deep, 1000 lb. capacity bin that is delivered and stored flat, have made long distance hauling of lettuce, watermelons, potatoes, onions, carrots, and citrus in disposable bins economically feasible (12, 6). Another suggestion of Shaffer's was that the development of pallet bin pools could "make their shipping method available to more firms and reduce the overall investment in pallet containers" (11).

Outlook for leasing

This review of existing literature concerning the use of agricultural pallet bins has revealed several interesting facts. The use of wooden pallet bins is an established practice between the

growing site and the processor and in the processing or packing facilities. Overall, the accessibility of information, the size of the fruit and vegetable industry, and the nature of the recognized limits to pallet bin use indicate that there will be no lack of potential bin leasing markets.

Objectives of project

The principle objective of this study was to determine the feasibility of a pallet bin leasing system among agricultural producers. The successful completion of this study required three specific steps. The first involved gathering information from available literature, surveys, and personal interviews concerning the current use and manufacture of pallet bins. The second consisted of identifying the potential leasing system areas based on geographic, seasonal, and/or other characteristics. The third step was an investigation of the potential profitability of the system deemed most likely to succeed.

Summary of methods

Most of the secondary sources of data used to obtain an initial understanding of agricultural pallet bin use reported bin use research from the West Coast. In order to gather information specific to East Coast bin users, to acquire a thorough understanding of actual bin use

as it exists in the East today, a mailed questionnaire (Appendix 1) was used.

The survey was designed to gather data concerning who uses pallet bins, how and when bins are used, what crops are shipped in bins, how long the crops remain in bins, what construction materials are used, what is the design and size of the bin, who owns the bin, and how much the bin costs. A pretest was sent out and then, after necessary revisions, the main mailing. The processors surveyed were listed in The Directory of the Canning, Freezing, Preserving Industries, 1982-83 (7).

In addition to the mail survey of processors, information concerning bin design and use was gathered by telephone and personal interviews with bin manufacturers, growers, bin sales companies, vegetable buyers, and state departments of agriculture.

Following the evaluation of the bin use survey, the survey results, along with data and information gained from personal interviews and secondary data sources, were used to identify the potential leasing system areas. Many conditions contribute to creating a situation where bin leasing is favorable. For instance, a number of crops being harvested at different times, by different growers, in one geographic area might represent an area deserving further investigation. Similarly, a sequence of crops harvested sequentially in terms of time and geography possesses potential as a leasing opportunity. In any case, the sizes and types of bins, the number of bins, and the timing and use patterns for the bins needed to be pinpointed. This

information was supplied in part by the original questionnaire, with supplementary information from additional interviews or surveys.

In order for pallet bin leasing to be judged promising in a given area, certain qualifications had to be met:

1. There must be widespread acceptance of bin use in the area.
2. The area must have significant crop production volumes.
3. One bin design must be applicable to a significant identifiable fraction of the potential lessees, if not all of them.
4. The major crops in the area preferably should be harvested at different periods during the year.
5. Established bin use in the area should have decipherable systems of ownership and control.

Gathering the cost information necessary to operate the exchange system was the next task. The obvious costs included the initial cost of the bin, plus repair, freight, insurance, tax, and management costs. The gathering of cost data could be a very deceptive process. By overlooking an item, the feasibility of the entire system could be jeopardized. The surest way to obtain the cost figures was to go directly to the intended participants for the information they could provide and use this data to build upon NPLS's knowledge of leasing systems.

The final phase of the project involved synthesizing the logistic and cost data gathered in the first and second sections into a complete, specific system. This final plan included distances, costs, revenues, use periods, and other pertinent information. Using

available methods, this complete system was then analyzed from a fiscal standpoint.

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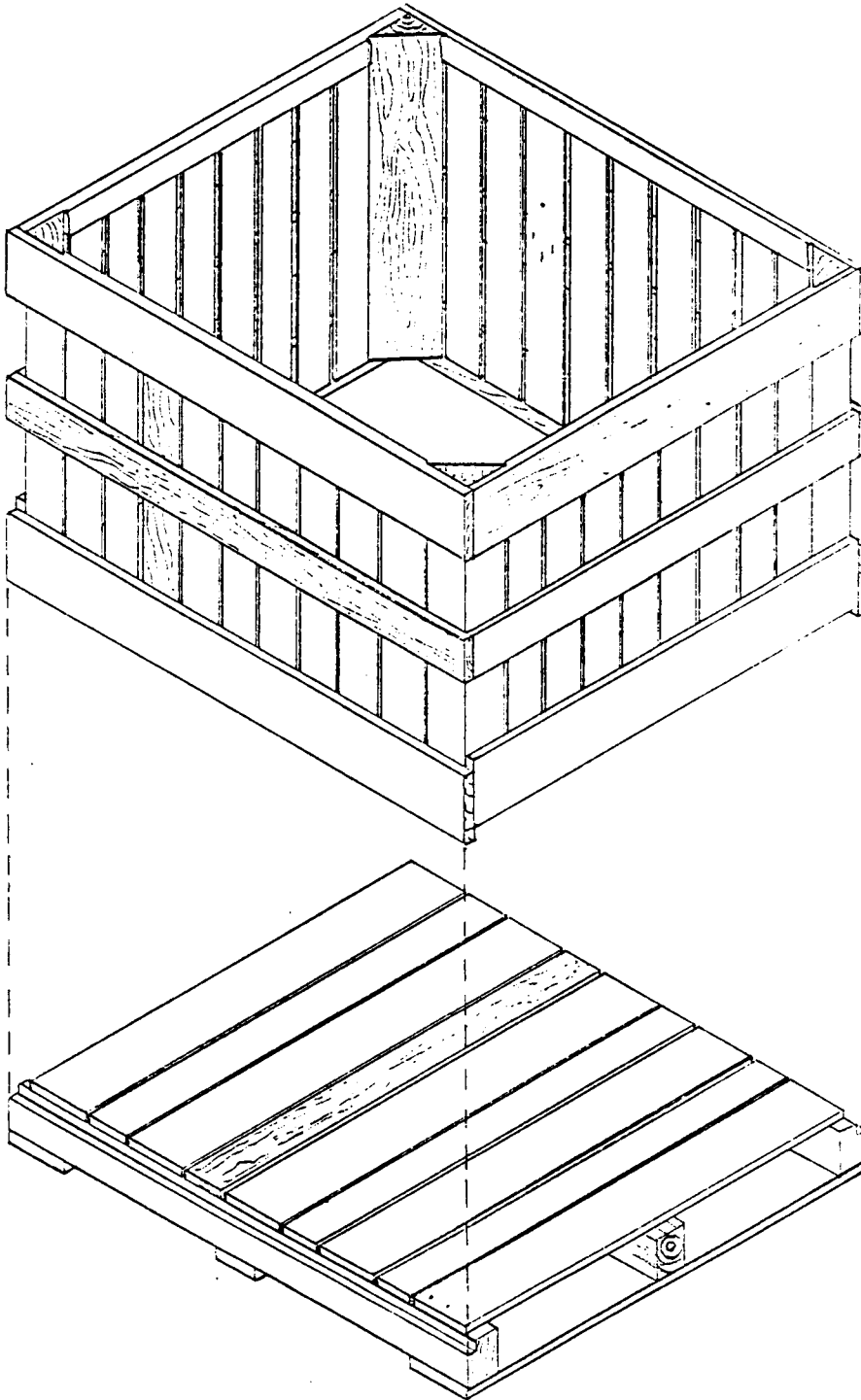


Figure 1. A typical wooden pallet bin, having vertical sideboards and horizontal or "E" framing.

THE AGRICULTURAL MARKET FOR WOODEN BINS:
AN IMPORTANT SPECIALTY MARKET FOR PALLET PRODUCERS

(Prepared for submission to the Forest Products Journal)

Abstract

After a long period of strong growth the wooden pallet industry has encountered a period of overcapacity. This is leading to aggressive pricing, which is in turn leading to poor profits. Specialty markets are increasingly important as pallet producers try to improve profits. One market or niche that is available is the manufacture of agricultural pallet bins.

A survey was conducted to gather pertinent bin use data. Three hundred thirty-three mail questionnaires were sent to fruit and vegetable processors believed to use pallet bins. Sixty-one of the questionnaires comprised a pre-test of processors in Texas and Michigan. The 272 processors in the main mailing were located along the East Coast. The response rate was 45%. The respondents represent a total ownership of 883,901 bins. The average reported bin price was \$36.53. Fifty-five percent of the respondents reported bin lives over seven years, 45% had bins that lasted less than seven years.

At a conservatively estimated yearly bin replacement level of 10%, the survey respondents represent an annual bin market of 88,390 bins or \$3.23 million. The survey information was extrapolated to estimate the total East Coast, Texas and Michigan bin ownership at 1,962,260 bins.

The survey provided additional information concerning bin design, bin manufacture, and owner attitudes concerning bin use that would be useful to the pallet manufacturer planning to enter the wooden pallet bin market.

Technology Transfer

A long period of strong growth in the wooden pallet industry has resulted in industry overcapacity. Aggressive pricing among competitive firms is leading to poor profits. Specialty markets are increasingly important in the producers' attempts to increase profits.

The construction of wooden pallet bins for the fruit and vegetable growing, packing, and processing industries represents a specialty market niche for pallet manufacturers. A survey of a fraction of the bin using processors identified an estimated yearly replacement market, containing only survey respondents, of \$3.23 million. Estimates show the actual East Coast market to be more than twice that size.

Introduction

Pallet manufacturing is a major wood-based industry in the U.S. Between 1960 and 1980, the percent of hardwood lumber production consumed by pallet producers grew from 14% to 31.9% (10). In addition, it is estimated that 277 million pallets were produced in 1980 (15). The total value of shipments for the wooden pallet industry in 1982 was \$1,011 million (2).

The large total size of the pallet industry is not reflected in the size of individual pallet manufacturers. In 1977 there were approximately 1,290 pallet manufacturers in the U.S. employing about 23,000 people (11). These numbers reveal an average employment of only 18 people per manufacturer. In fact, 29% of all pallet assemblers employ less than five people (15). The composition of the pallet manufacturing business, comprised of many small, independent companies, allows manufacturing firms to enter and exit the marketplace at will.

The monetary well-being of the pallet industry is linked to the overall state of the economy. It has been said that pallet market trends mirror movements in the Leading Economic Indicator (1). Stated more precisely, pallet sales rise and fall in relation to manufacturing shipments (18). The pallet industry is presently burdened by significant overcapacity, and economic slowdowns have lead to aggressive pricing strategies and reduced profit per pallet for manufacturers (7). Moreover, the pallet industry in recent years has

experienced a slowdown when compared to the phenomenal growth of the 1970's (2).

One way that the pallet manufacturer could decrease vulnerability to economic cycles and moderate the effects of aggressive pricing is through better market segmentation efforts aimed at markets that have the potential for more flexible pricing than the market for standard pallets. One specific market segment or niche targeted by some pallet manufacturers is the agricultural market for wooden pallet bins.

Objectives

The principal objective of this research was to develop information concerning the market for wooden pallet bins among fruit and vegetable processors along the East Coast. The project sought information that would give the wood products industry a better understanding of bin use and bin markets. Such information should benefit the bin manufacturer, the bin user, and others concerned with the production, remanufacture, and consumption of wood products in materials handling. The overall objective was addressed through three sub-objectives which are listed below:

1. Determine the general characteristics of wooden agricultural pallet bins in terms of materials and construction.
2. Determine the characteristics of the current agricultural usage of wooden pallet bins, including the size and needs of the agricultural wooden pallet bin market.
3. Develop information concerning management attitudes regarding wooden pallet bin usage, and their potential impact upon the wooden pallet bin manufacturer.

Secondary data and background information

Pallet bins (Figure 1) facilitate the mechanical handling of bulk loads of irregularly sized and shaped materials (4, 6). Fruits and vegetables can be handled in bins if care is taken not to overload the bins (19). Over 20 varieties, from cranberries to watermelons, have successfully been handled in pallet bins (19, 20). In studies of the marketing of fresh tomatoes and watermelons, it was found that pallet bins were the least expensive handling method when compared to bulk or handstacked methods (16, 17). The results are similar for many varieties in the size range between tomatoes and watermelons (19, 20).

The advantages to be gained by the grower or processor who uses pallet bins rather than palletized or unpalletized cardboard or wooden boxes are numerous. The ease of mechanical handling of pallet bins decreases loading and unloading times, decreases labor requirements, decreases produce damage, and decreases container requirements (19). Also, bin use can lead to increased rates of processing line production and enhance the safety and operation of storage areas because they stack well (6). For long hauls to markets, trucks loaded with pallet bins meet weight capacities before volume limits, and pallet containers provide more uniform cooling of crops kept in storage than individual picking boxes or crates (6, 13).

The National Wooden Pallet and Container Association comments "that pallet containers in . . . agricultural service are subject to constant and unusual stresses—from loading and pickup on uneven

ground, from constant loading and dumping, from exposure to the elements, and use with water dump and conveyor systems" (6).

Additionally, some field systems utilize boom-lift trucks which grasp the top of the bin for maneuvering, creating unusual stresses (4, 8). The rough handling of pallet bins has prompted investigations into the best designs for agricultural use. Heebink (12) concluded that a lumber bin with vertical side boards, horizontal framing, and diagonal supports, or a plywood bin with good corners and fasteners, was the best choice.

The American Plywood Association points out that a bin with 40 inch by 47 inch bottom dimensions will efficiently fill flatbed or enclosed trailers as well as refrigerated railroad cars (4). The American Society of Agricultural Engineers specifies two standard bin base configurations, one 47.25 inches by 47.25 inches and one 47.25 inches by 39.375 inches (3).

Bins can be either expendable or reusable, with reusable bins sometimes built as collapsible units to save space when not in use (6). Some agricultural bin users prefer to purchase bins treated with a wood preservative (6, 22). Dipping the assembled bin appears to be the accepted method of preservative application (21, 22).

Primary data collection methods

Insufficient information was available in the literature to address the study objectives, therefore a primary data collection

effort was focused on the eastern United States. Fruit and vegetable processors in the states of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, Pennsylvania, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida were queried. Data from the pre-test, conducted in Texas and Michigan, has also been included when applicable.

The Directory of the Canning, Freezing and Preserving Industries, 1982-83 (14), is a comprehensive, up-to-date listing of companies in the fruit and vegetable processing industry. The Directory listed 333 processors in the states selected for the survey. All the processors were identified as the survey sampling frame. The total of 333 is less than the 683 food preserving firms (SIC 2033, 2034, 2035, 2037) listed in the 1977 Census of Manufacturers (5) for the states being considered. Of these potential bin users in the 1977 Census, 50.51% are small (less than 20 employees), and some of the small and larger firms process something other than fresh fruit or vegetables. The 333 processing firms selected are the larger and more prominent firms in the field, and constitute the major market for wooden pallet bins among fruit and vegetable processors on the East Coast.

The firms were contacted via mail survey due to several factors including the expense of phone and personal interviews. A mail survey also helps to insure anonymity for respondents, which is especially important among independent agricultural operations. In addition, the questions were mostly simple and straight forward, requiring no personal guidance.

In an effort to verify the appropriateness of the questionnaire material, a specialist in fruit and vegetable processing was consulted and a pretest was conducted (9). In order to maintain the full size of the actual mailing list, the pretest was sent to 61 processors in the states of Texas and Michigan. The two states were chosen because they have significant agricultural production and because they produce many of the same crops as the survey area. Follow-up postcards were sent two weeks after the survey pretest mailing.

Results and discussion

After minor revisions, the survey was sent to fruit and vegetable processors in June 1984. Two weeks later, follow-up postcards were mailed. Responses were received from 121 of the 272 processors contacted. If the results of the pretest are added when applicable, then the total response was 150 of 333 firms or 45%. Of the 150 responding companies, 90 answered that they did not use pallet bins in their operations. Usable responses from bin users were received from 60 firms.

Processors were asked to identify their previous year's sales levels. Eleven percent had sales below \$2 million, 17% had sales between \$2 million and \$5 million, 19% had sales above \$5 million and below \$10 million, 11% were between \$10 million and \$20 million. The 42% that had sales over \$20 million represent the bulk of the potential bin market.

Bin size and construction

The average reported weight of a full binload of fruit or vegetables was 1,104 pounds, however, the standard deviation of 502 pounds indicates considerable variation. The average bin height was 32.02 inches, varying both within single crops and between crops. For instance, among the 22 reporting apple processors, 12 different bin heights were given. Overall, heights ranged from a low of 18 inches for a Michigan apple processor to 45 inches for one pepper bin. Bin base dimensions were also diverse. The smallest and largest of the reported configurations were 36 inches by 36 inches and 47 inches by 72 inches, respectively. The most popular bin had a fork-entering face width of 40 inches to 42 inches and a depth of 47 inches or 48 inches.

The use of a lumber bin was reported by every East Coast respondent. Some East Coast firms also used plywood, and two Texas tomato processors used only plywood containers. Materials other than lumber or plywood, mainly metal, plastic, and cardboard, had very little use. Virtually no firms used collapsible or disposable bins.

Eleven processors reported treating their bins in some way. Three Florida processors, handlers of grapefruit, tomatoes, and peppers, reported that their bins were treated with a wood preservative. No patterns could be drawn among the other seven processors who treated their bins. Five firms reported using preservative treated bins. Two processors treated bins with fungicide. One company used painted bins.

Bin use

The crops listed as being transported in pallet bins were apples, blueberries, cabbage, carrots, cauliflower, cherries, cranberries, cucumbers, grapefruit, grapes, kidney beans, okra, onions, peaches, pears, peppers, potatoes, squash, sweet potatoes, and tomatoes. Forty-one percent of the crops listed only remain in the bins up to one week, 12% for one week to one month, 22% for between one and four months, and 25% for greater than four months. The crops that remain in the bins longest are apples, sweet potatoes, blueberries, and peaches. Harvest seasons were reported in every month of the year. Average bin idle time per year was reported to be 6.8 months.

For every respondent, the primary bin use was the transportation of the harvested crop from the field to the processor. In some cases the bins were actually used during the harvest in the field and in a few instances there was a repacking facility between the field and the processor. In the handful of cases where crops were stored for more than a week, the storage was done in the bins.

Many apple processors reported using water immersion loaders and unloaders. Apple, tomato, and grapefruit processors all reported using bin wall grasping equipment.

Bin price and market size

With the exceptions of a \$15 cardboard bin, a \$119 steel and plastic bin, and a plastic lined wooden bin that costs \$146.50, the average reported bin price was \$36.53; the median reported price was \$34.00 (Figure 2).

Fifty-four processors gave the number of bins they owned for a total of 883,901 and an average of 16,369 bins per firm (Figure 3). However, the distribution of ownership was skewed somewhat by a small group of processors that owned a large number of bins. The median number of bins owned was actually 2,000. There is a similar skewness of the data for the number of loaded bins that each firm annually processes. The average is 44,803 bins per year, but the median is only 12,200 (Figure 4).

The survey-provided information can be extrapolated to estimate the total bin ownership among East Coast, Texas and Michigan processors listed in the Directory of the Canning, Freezing, Preserving Industries (14). Sixty of the 150 firms responding to the survey answered that they did use bins, for a user to non-user ratio of 40%. This 40% of the respondents owned 883,901 bins collectively. Assuming bin ownership did not differ between respondents and non-respondents, the 40% ratio can be applied to the 333 firms in the sample frame, resulting in an estimate of 133.2 bin using firms for the area. This would represent 122% more bin using firms and could be used to estimate a total area ownership of approximately 1,962,260 bins. It may be

possible to use a ratio of the firms listed in the Directory of the Canning, Freezing, Preserving Industries to Census-listed firms to expand the total ownership estimate to a larger portion of the actual population of bin owners.

Bin life

The life expectancies of the bins varied widely (Figure 5). Twenty-nine percent of the respondents reported useful bin lives of less than four years. Seventy-three percent of these processors used bins for crops that remain in the bins less than one week. The short crop holding period leads to a high number of uses per year, reducing bin life. Conversely, 15 of the 20 bin users who reported bin lives longer than seven years leave the crop in the bins for longer than a month.

Another interesting comparison, similar to that above, can be drawn by comparing bin uses per year to bin life. Bin uses are developed by dividing months of yearly use by the time the crops remain in the bins. A bin that holds crops for one month and is used five months per year would therefore have five uses per year. The average number of uses per year for bins having less than two years of useful life was 28. For bins with lives above seven years the figure was 4.1 uses per year. Similar ratios were calculated for the five intermediate life period classes listed on the survey. The coefficient of correlation between uses per year and bin life was .91.

Bin life was also compared to bin price and no general conclusions could be drawn, indicating that useful bin life is most strongly influenced by uses per year.

Managerial attitudes about bin use

Managerial attitudes concerning bin use and ownership (Table 1) indicate that bins are an important aspect of the processors' operations and are apparently considered somewhat of a necessary evil. Seventy-eight percent of the owners consider bin repair a problem in their operations, and a bin manufacturer who produced a more durable bin at a reasonable price might develop an advantage in the marketplace. The expense of transporting empty pallet bins, considered significant by 85% of the respondents, could be reduced through the use of collapsible bins. The transportation costs necessitate the manufacture of nestable bins. The fact that 96% of the bin owners consider bins a significant investment may indicate that owners would be receptive to higher quality bins if they would lower overall costs.

Summary

The wooden pallet bin market appears to be a viable market niche for pallet and container manufacturers; however, to succeed in the bin market potential manufacturers must work closely with bin users to construct a bin that will meet their needs. Bin weight capacity, bin

dimensions, and many other factors were shown to vary between bin using firms. In order to penetrate the market, the manufacturer must find out exactly what is required by the customer.

Several factors of bin design and construction appear fairly constant. The bins will in most cases be made from hardwood lumber and most bins will be non-collapsible and reusable. A competitive bin price will be around \$34 to \$36.

The number of bin uses per year is the most important factor in bin life. A bin destined for a high number of uses per year will have to be sturdily built if expected to give many years of use. The manufacturer will have to actively inform customers of the capabilities of individual bins in specific situations.

Attitudes of bin owners indicate what directions the bin-maker might take in manufacturing and marketing efforts. The perception of bin repair as a problem might cause the manufacturer to construct super-durable bins, offer repair services, or stress the inevitability of repair to avoid customer bad will. A manufacturer might attempt to promote the largely unused collapsible pallet bin. The use of such bins would dramatically lower empty transport costs, attracting the bin owners disenchanted with those costs. Bin producers marketing to cost-conscious users might stress the advantages of bin use over traditional handling methods while promoting the use of more durable bins, even at a slightly higher cost.

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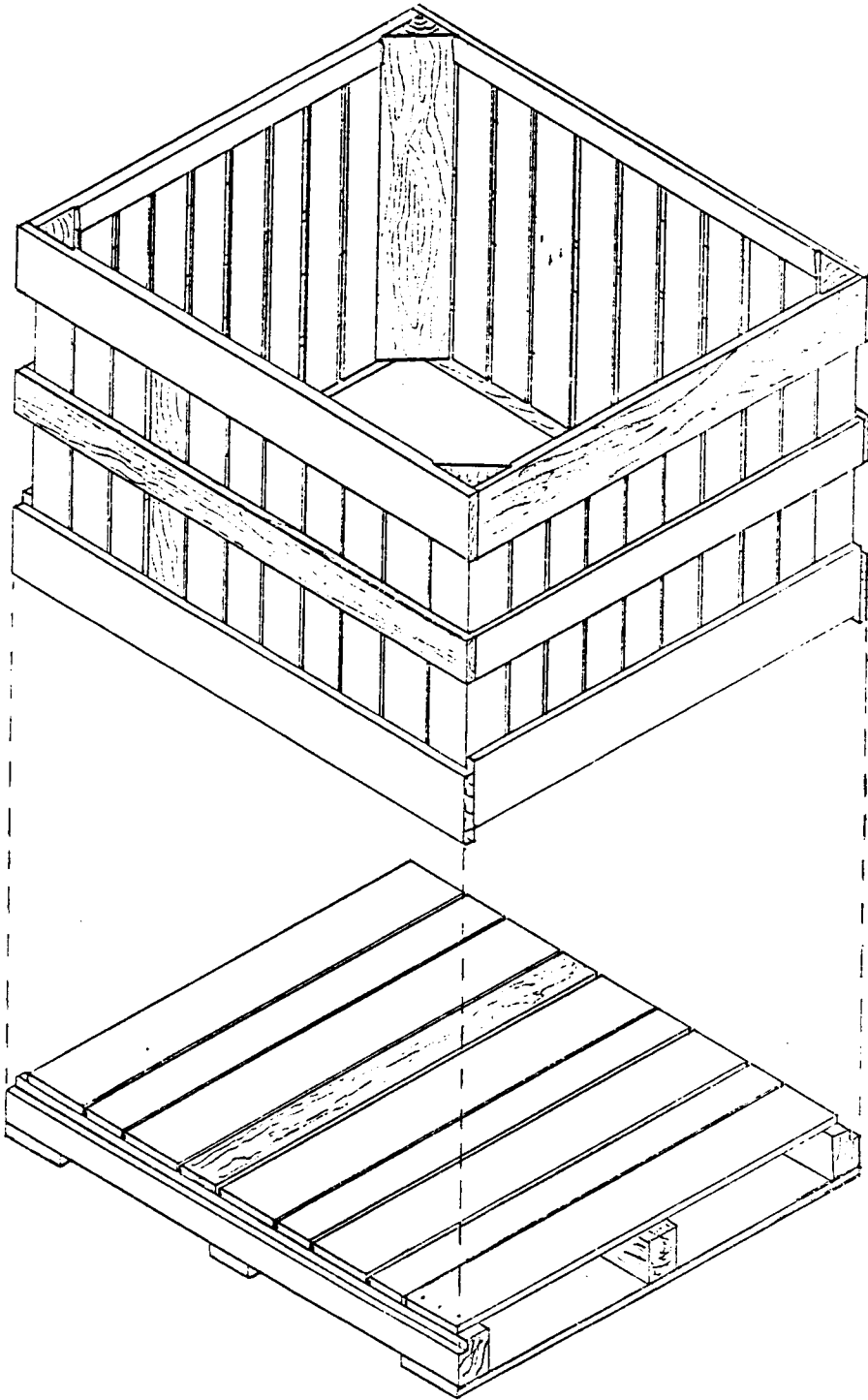


Figure 1. A typical wooden pallet bin, having vertical sideboards and horizontal or "E" framing.

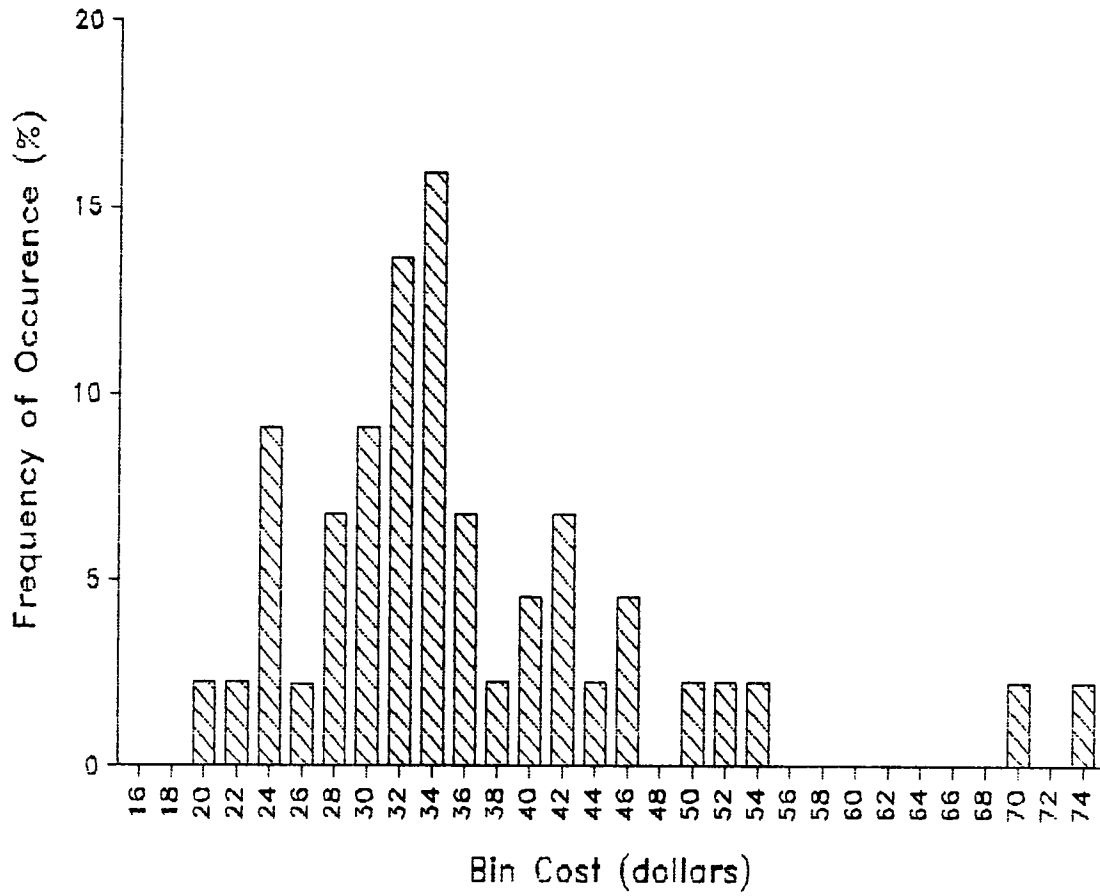


Figure 2. Histogram of reported purchase prices of new wooden pallet bins (delivered).

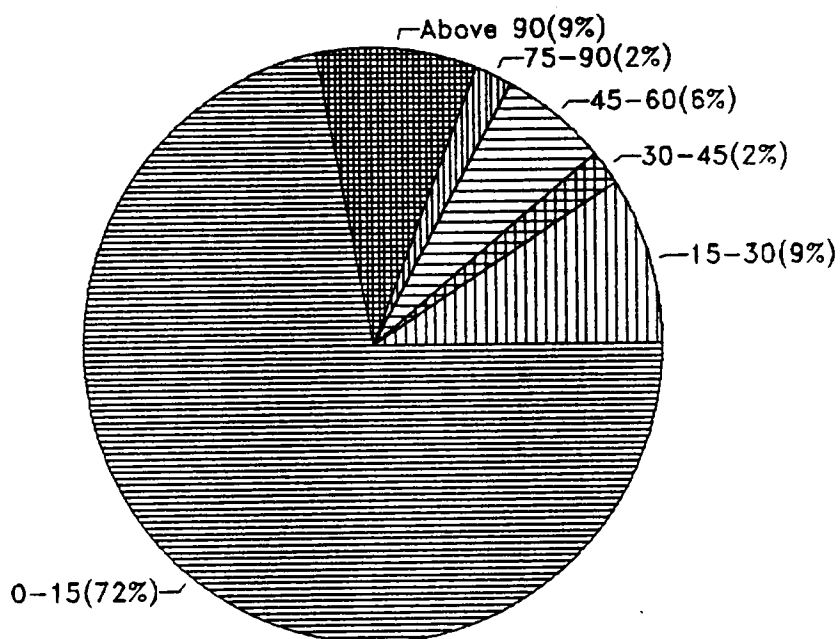


Figure 3. Reported numbers of bins owned by respondents (ranges in thousands), percentage of respondents in each range is shown in parentheses.

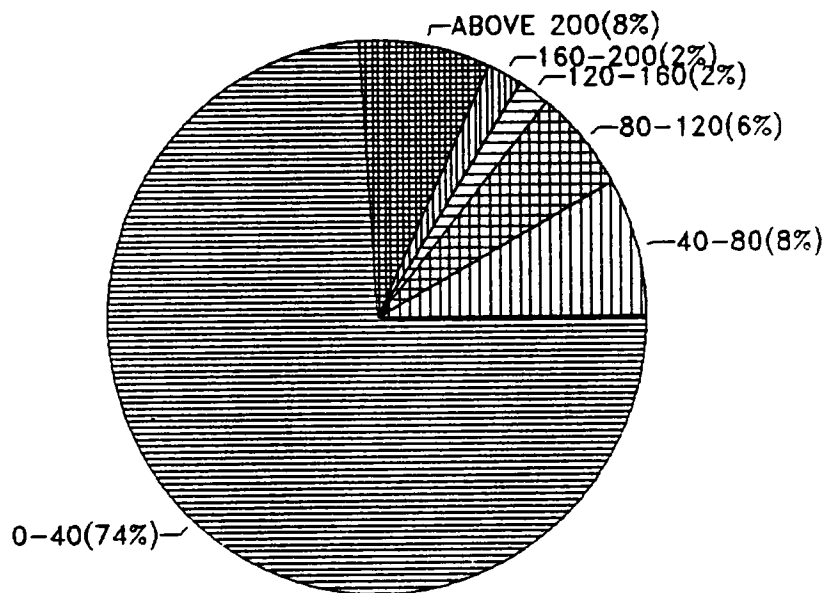


Figure 4. Total numbers of binloads processed by each respondent (ranges in thousands), percentage of respondents in each range is shown in parentheses.

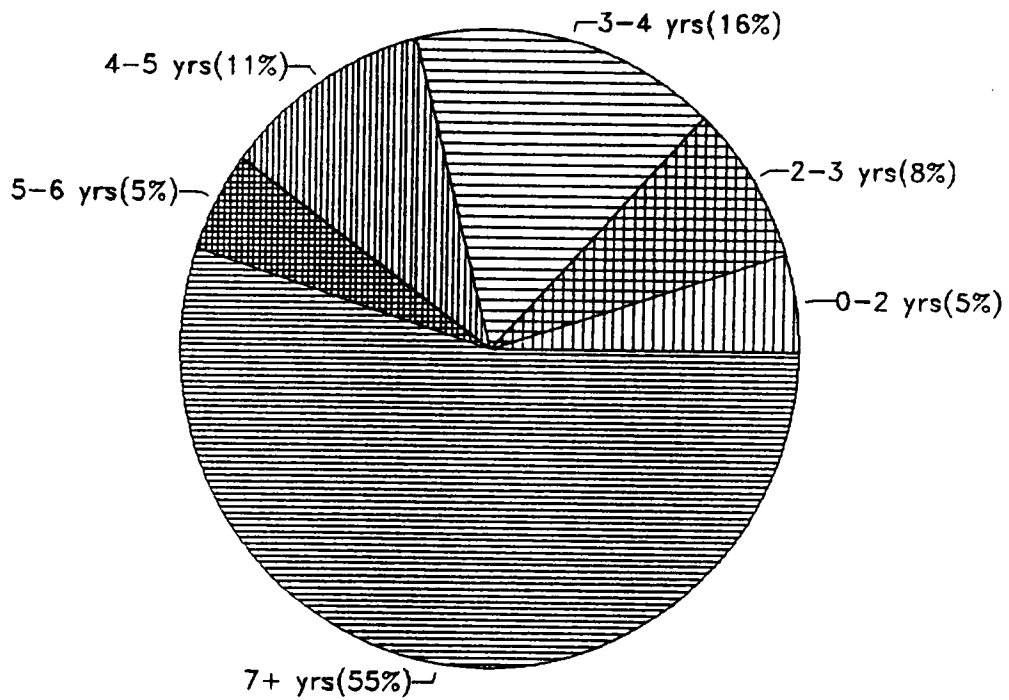


Figure 5. Reported useful bin lives, percentage of respondents in each range is shown in parentheses.

Table 1. Bin owner attitudes concerning bin use as shown by agreement with statements shown.

Survey statement	Attitude		
	Agree	No opinion	Disagree
Bin repairs are a problem	78%	11%	11%
Transporting empty bins is expensive	85%	11%	4%
Purchasing of bins represents a significant investment	96%	2%	2%
Significant amounts of management time are required to monitor bins	60%	12%	28%
If leasing or renting bins would reduce the investment of money and/or management time in bins, it would be a strong alternative to bin ownership	66%	15%	19%

SELECTION OF LEASING SYSTEM AREA AND MARKET ESTABLISHMENT TECHNIQUE

Introduction

A pallet bin leasing system initially seems readily adaptable to many crop handling situations. Growers and processors regularly transport and store crops in bins before processing or repacking. In some cases the elapsed time from harvest to processing is only a fraction of the year, leaving costly bins idle for the remaining months. If a lessor could control the use of the bins, distributing them to many short-term users during the year without a significant lessening of overall bin life, then the cost per bin use would be reduced.

While lessened bin costs are obviously attractive, they do not represent the only benefit of bin leasing. Leasing allows users to avoid the significant capital outlay required with bin purchases. Also, lessees do not have to worry about bin repairs, empty bin storage, or bin pool monitoring and control. Even when cost per use may not be reduced, as in longer term leases to as few as one bin user per year, leasing could still be a viable alternative to ownership due to the reduced management time and lower capital outlays required of the lessee.

Leasing systems have been organized for similar goods, such as pallets (7, 9, 11, 12), but little effort has been made to develop a pallet bin exchange or leasing system. It appears likely that several

factors have contributed to the absence of any successful effort to organize a bin exchange/leasing system. In many areas tradition, geography, weather conditions, or markets dictate only one major crop. With only one crop there is typically only one harvest season and limited opportunities for extension of bin use beyond the single harvest season. Even when more than one crop is produced in an area, the crops may have common harvest seasons which limit the possibilities for bin use extension. In addition, many agricultural areas use bulk handling or have well established and complex systems of bin ownership. Any of these conditions would denote a market area difficult to penetrate with leased bins.

Although there are additional deterrents to successful leasing, the requirements for a successful system are more important at this time. The characteristics that have lead to successful pallet leasing have included binding legal contracts defining the responsibilities and services required of each party, well designed systems of replenishment which insure that pallets will be available to clients when and where pallets are required, pallets built to rigid specifications, and reliable and rapid pallet repair and replacement (12).

In order for bin leasing to be viable, certain additional requirements would have to be met. The bin leasing system should be located in an area of concentrated crop production. It is very important that the area have a total production volume large enough to support a leasing system. Certain economies of scale are necessary, and insufficient production will not support a system. It would also

be desirable to have the respective crop harvest seasons distributed evenly throughout the year to allow the extension of bin use to several harvests.

A significant fraction of the crops produced in the area should currently be transported and stored in pallet bins. Attempting to initiate a bin leasing system in an area that does not use pallet bins would be very difficult. Additionally, there should be one bin-type that can be used for enough of the significant local crops and by enough of the potential local leasing system customers to make a single standard bin-type possible.

Finding a satisfactory area for a successful leasing system involves four tasks. The first task is that states having satisfactorily alternating harvest seasons need to be identified. The United States Department of Agriculture's Fresh Fruit and Vegetable Shipments (10) lists the volumes of each commodity that are shipped from each state during each month. This information, in combination with responses to the pallet bin users survey, makes it possible to identify states with many bin-handled crops being harvested at different times of the year. Once such potentially leasing-oriented states are identified, the areas within each state with highly concentrated production need to be located, and the volumes of each bin-handled crop grown in the area need to be estimated. Finally, local bin users need to be identified and contacted to verify bin use, crop volumes, harvest systems, harvest seasons, participation potential, and adaptability to leasing.

Many different sources were consulted to gather the necessary information. In order to illustrate the methods used, the first potential leasing system described, located in North Texas, will contain an explanation of our procedures in addition to the derived information and a discussion. All subsequent systems will be presented in a more condensed format of data and discussion.

North Texas System

The pallet bin users survey revealed that cucumbers, tomatoes, carrots, peppers, and onions are handled in bins by some Texas fruit and vegetable processors. Further, Fresh Fruit and Vegetable Shipments (10) shows that each of the crops is shipped, and therefore harvested, at different times of the year. The occurrence of many bin-handled crops being harvested in one state at different times of the year is conducive to the establishment of a bin leasing system.

In order to identify the concentrated production areas the Census of Agriculture, County Summary Data is used (1). The County Summary Data reports the total acreage of each crop that is grown in each county of the state. The concentrated production areas can be identified by mapping the major producing counties for bin-handled crops identified by the bin users survey and other sources. One such concentrated area in Texas includes the counties of Deaf Smith, Parmer, Castro, Bailey, Lamb, Hale, Floyd, Hockley, Lubbock, and Crosby (see Figure 1).

Estimating crop production

The process of estimating crop production for the potential system area is somewhat involved. As mentioned, the Census of Agriculture (1) only reports vegetable production in terms of acreage. Fortunately, the Crop Reporting Board of the U.S. Department of Agriculture (6) lists statewide totals, in tons, for yearly production of 22 principal fresh market vegetables. The conversion of county acreage totals and statewide weight totals into system production estimates was a three-step process. First, for each crop concerned, the total acres of production within the system and the total acres of statewide production were used to calculate a ratio of the system acreage as a percent of state acreage. The results for the ten county North Texas system are shown in Table 1.

The second step toward developing weight-based production estimates for the system was the establishment of a single best estimate for the statewide weights of production. Given that agricultural production does fluctuate, an average of the production in the years 1978 through 1981 was used as the statewide figure for each crop (Table 2).

Finally, by multiplying the system acreage ratio by the average state production, an estimate of the system's yearly production of each vegetable is calculated as shown in Table 3.

In order to show relative continuity of crop production, and therefore bin use within the system, it is necessary to divide the

average system production estimates into monthly production figures. Three sources were used to guide the allocation of the production totals by month, the pallet bin users survey, Fresh Fruit and Vegetable Shipments (10), and the directory of the Texas Citrus & Vegetable Association (2). The allocation estimates were made on a judgment basis and are illustrated in Table 4.

Discussion

Appendix 2 lists the seven processors identified within the area considered. In order to better appraise the bin leasing potential in the North Texas system, attempts to contact all seven processors were made. Five of the seven were reached and it seems that this area is not using bins to any significant extent.

The Barrett-Fisher Company and Dimco Industries are both primarily potato handlers and, as such, transport all of their produce in bulk. Blue Ribbon's Bill Odem responded that, in contrast to the handling methods previously reported by our survey respondents, Blue Ribbon handles all of its carrots and other produce in bulk. Similarly, Todd Produce and Griffin and Brandt, who collectively handle onions, peppers, potatoes, carrots, cantaloupe, and dry beans and peas, answered that they do not use pallet bins in their operations.

Five of the seven known processors reported that they did not use bins and it seems likely that the remaining two will be similar. The conclusion for this system is discouragingly obvious. Despite good

production volumes and adequately staggered harvest seasons, the anticipated levels of bin use are absent and the potential for a bin leasing system is very poor.

South Texas System

The South Texas System is located in the counties of Atascosa, Bexar, Dimmit, Frio, Maverick, Medina, Uvalde, and Zavala (see Figure 1). The crop production information for the area is shown in Tables 5 to 8.

Discussion

The potential for establishing a bin leasing system in the South Texas area is stronger than for the North Texas system. Within the eight county South Texas area ten packers or processors are located (Appendix 3). The seven packers or processors most likely to be bin users were contacted by telephone.

Three of the seven packers or processors contacted reported no pallet bin use. Joe Byrd Produce harvests spinach, kale, onions, cabbage, peppers, and greens. The spinach, kale, and greens are harvested into baskets in the field. The baskets are then hand loaded onto trucks for transport. When the onions are harvested they are placed in burlap bags and allowed to dry in the field. The bags are

then hauled as bulk loads to the processing plants. Cabbage is also bagged in the field, in mesh plastic bags, for transport to processing.

Robert Davila, at Winter Garden Growers, Inc., reported that all of the crops that firm handles are transported in bulk. Such was also the case at Otto Strube Farms, where trailer lifts and dump trucks are used to facilitate rapid and practically labor-free unloading of crops.

Three of the four processors that used bins in some way were not actually owners of wooden pallet bins. Henry J. Berry Co. handles fresh watermelon, cabbage, carrots, and onions in Uvalde, Texas. Berry ships all of their watermelons to market in pallet mounted, 36" deep corrugated paperboard bins. Some of the cabbage that Berry receives, which arrives from the field in bags or crates, is subsequently sent on to processors in plastic bins owned by Berry. Similarly, carrots are often shipped to other repackers or processors in a plastic lined cardboard bin. The source contacted at Berry reported that some handlers store onions in bins, although Berry does not do so.

The Del Monte cannery in Crystal City receives all of its beans, carrots, beets, and potatoes in bulk truck loads. However, the chile peppers and juice concentrates that are received are transported in pallet bins. These uses constitute small volumes and more than likely employ two different bin designs.

The T. J. Power & Co. branch within the South Texas system area responded that they do not use bins at that location but that their affiliate in Irving does. In all of the situations where bins are sometimes used or received, but are not the primary handling system, it

is possible that the benefits of a bin leasing system could enhance the attraction of bin use and create a demand for pallet bins.

The remaining company, Frio Foods in Uvalde, is the only "true" bin user located in the South Texas system area. The plant produces frozen broccoli, carrots, and squash, all of which are received in pallet bins owned by Frio Foods. The company owns 500 hardwood bins measuring 48" x 48" x 48". The cost of these larger-than-average bins is approximately \$50.

Frio's main justification for bin use is that it limits the damage to the broccoli plants. Broccoli is harvested in Texas from December to March, and in combination with the carrots and squash processed, leads to year-round bin use.

Since broccoli is not included in the summary data listed in Tables 5 through 8, a brief explanation of Texas production will be given here. The average broccoli production in Texas for the years 1978 through 1981 was 10,337 tons (6). The fraction of this total grown in the eight counties of the South Texas system, according to the 1974 census (1), is insignificant.

The fact that so little broccoli is grown in the system area is unimportant, though, because Frio ships its empty bins out for full returns of broccoli from locations as distant as 400 round-trip miles. The company uses a contract hauler with high capacity trailers to make the trips, which lowers costs somewhat.

The potential for expanded bin use exists in the South Texas area. Currently, 46,000 tons of onions and cabbage are harvested without bins

in a very labor intensive manner, as previously discussed. This represents approximately 90,000 potential 1,000 pound bin loads of produce per year. There is existing bin knowledge, bin acceptance, and bin use in the area. On the other hand, most of the crop handlers have made large investments in bulk handling and cheap labor is available. The processors all handle more than one crop and in most cases would use the bins year round, as Frio does.

In light of the existing information, bin leasing in this area will be considered possible but difficult to initiate.

Rio Grande System

The Rio Grande System is located in the counties of Starr, Hidalgo, Willacy, and Cameron (see Figure 1). Crop data for the area is presented in Tables 9, 10, 11, and 12.

Discussion

The Texas Citrus & Vegetable Association (2) lists 69 members that are located in the four county Rio Grande System. Twenty-five of the 69 processors or packers were contacted and questioned about pallet bin use. Of the 25 firms contacted, 18 were bin users (Appendix 4).

Eight of the bin-using companies handled only citrus fruits. All of the region's citrus is shipped fresh to consumers so these eight firms are packing firms. Since no citrus packer was contacted that did

not use pallet bins for transporting crops from the field to the packing shed, the eight responding packers will be considered representative of an area with virtual complete bin acceptance.

The number of bins owned by citrus packers ranges between 800 and 2,500 with four packers reporting quantities between 1,400 and 1,500 and an overall average ownership of 1,435 bins. The yearly volume per packer averaged 25,000 tons.

All of the citrus packers use wooden bins with 48" x 48" bottom dimensions. Five firms use 24" deep bins, two reported using 36" deep bins, and the remaining packer did not report bin dimensions.

The citrus harvest season in the Rio Grande Valley lasts from September until May (2). All eight packers operate steadily during the season, but commented that the bins are idle about four months per year.

The remaining 17 packers or processors that were contacted are concerned solely with vegetable crops. Seven of the vegetable packers or processors do not use bins. Instead, these firms use bulk handling to transport crops from the field.

The ten packers or processors that do use wooden pallet bins for vegetable crops transport avocados, beets, broccoli, cabbage, carrots, cauliflower, celery, cucumbers, greens, honeydew, peppers, squash, and turnips in the bins. The packers or processors all owned their own bins, though on very rare occasions some of the firms receive crops in other people's bins. The quantities of bins owned by each company ranged from 64 to 600 with an average ownership of 250 bins.

As with the citrus packers, the square bottomed bin is also the most popular among the vegetable firms. A 48" x 48" bin is used by five of the firms; the only other packer or processor that gave dimensions used a 48" x 40" bin. Bin depths ranged from 26" to 60" with no discernible favorite among users.

Like the citrus packers, these vegetable packers and processors use the bins mostly during the winter months. Harvest seasons ranged from four to ten months in length, with the bins idle during the hot summer months.

Most of the packers and processors contacted, both citrus and vegetable firms, claimed that their bins cost about \$60 or \$65. J. S. McManus Produce builds their own bins at a reported cost of between \$125 and \$200. John McManus commented that bin repair and bin return problems contribute to his unhappiness with pallet bins. If a leasing system were economically feasible, Mr. McManus answered that he would probably be a customer.

The total citrus production in the Rio Grande area is 737,602 tons. By using a ratio of 1,435 bins per 25,000 packed tons, it is estimated that 42,000 bins are used in the Rio Grande area solely for the citrus crop.

Additionally, it can be conservatively estimated that another 8,600 bins are used for the vegetable crop. This estimation is based on the following reasoning. First, since neither the citrus nor vegetable crop is kept in the bins for more than a few days, the ratio of bins owned to tons packed for citrus can be used for the vegetable

crop as well. Second, the total volume of vegetables transported in bins is estimated by summing up half of the area totals for all crops reportedly handled in bins. One-half of each total is used since only about half of the packers or processors contacted used bins. Finally, by applying the ratio to the net estimation of 150,000 tons of bin-transported crops, the 8,600 bin figure is derived.

The potential for a bin leasing system in the Rio Grande Valley is strong, and of the Texas systems examined, the Rio Grande system must be considered the best candidate.

Eastern North Carolina System

The Eastern North Carolina System covers a 23 county area of the state. The counties are Bertie, Bladen, Chowan, Columbus, Cumberland, Duplin, Edgecombe, Franklin, Greene, Halifax, Harnett, Johnston, Lenoir, Martin, Nash, Pasquotank, Perquimans, Pitt, Robeson, Sampson, Wake, Wayne, and Wilson (see Figure 2). Tables 13 through 16 give the crop production data for the location.

Discussion

Using the bin users survey, the Census of Agriculture (1), and Department of Agriculture data (6, 10) as indicators, the coastal plain of North Carolina was identified as a potential leasing system location. Telephone research was conducted using the North Carolina

Food Products Buyers Guide (3), the 1984 North Carolina Fruits and Vegetables Schedule of Movements (4), and a list of North Carolina Vegetable Contract Companies (5). The research revealed that the use of pallet bins is very widespread in Eastern North Carolina.

The figures for cabbage and cucumber production in Table 16 are split among two distinct harvest periods. This does not mean that none of the crops are being harvested during the between-season months, just that the majority of the produce is harvested during the months shown. Another problem that could arise from a look at the table is the misconception that sweet potatoes are harvested all year long. This is not the case. The harvest season for sweet potatoes lasts from September through October. However, since this table was prepared under the context of predicting pallet bin demand, and since sweet potatoes are stored in pallet bins for many months, the total production was spread over those months in order to represent the pallet bin use associated with the storage. None of the other vegetables are stored like the sweet potatoes, so none of the other weight totals are presented in the same manner.

Table 16 also shows the great total volume of sweet potatoes that is produced in the region, as did Table 15. The large production totals become even more interesting when it is revealed that the use of pallet bins is the norm for the transport and storage of sweet potatoes. The large volume of sweet potatoes grown and the total acceptance of pallet bins as a handling tool are very encouraging circumstances when leasing is being considered; things look even better

when the harvest seasons and volumes of other crops grown in the area are also added to the picture.

North Carolina, behind only Michigan, is the second largest producer of cucumbers in the nation. The 90.5 percent of the state's crop that is grown in the system area represents 94,432 tons of produce. Since the major harvest season for cucumbers in North Carolina starts in May and continues until early July, and since the sweet potato harvest doesn't start until September, the prospects for increasing bin use to more than one harvest looked good at this time.

The use of bins during the summer months, prior to the sweet potato harvest, would also include the transport of asparagus, carrots, grapes, peppers, potatoes, and tomatoes. All of these crops were handled in bins by at least one of the packers or processors contacted. The state-provided information mentioned above lists 48 potential bin using companies. Sixteen of those companies were contacted by telephone (Appendix 5). Only four of the firms questioned did not use pallet bins.

The specific numbers of bins owned by each packer or processor ranged from 100 to 18,000. The average ownership was 7,969 bins and the median 7,000. The general tendency was that the firms that handled sweet potatoes and/or cucumbers owned the greater number of bins while the processors of carrots, asparagus, etc. owned fewer bins.

Two packers reported using bins that could not be incorporated into an exchange system. One of the firms used no bottom deck boards under its bins, rendering many of the most common bin handling devices

useless. The second firm used a smaller bin than many of its competitors. Both of these companies also responded, however, that if a leased bin was more economical they would adapt to different designs.

The most commonly used bin was a 42" x 47" x 34" 20 bushel bin. Reported prices ranged from \$33 to \$50.

During the telephone interviews, those firms owning a large number of bins were asked what their yearly bin replacement quantities were. A firm owning 15,000 bins and a firm owning 18,000 both reported that they replace 1,000 bins per year. A third company, owning 14,000, replaces 500 bins annually. It must be kept in mind that these replacement quantities are only rough estimates, and the degree of bin repair and rebuilding prior to final replacement is unknown. The replacement figures are important because they represent one avenue of market penetration for a lessor, and are reported here for that reason.

A leased bin in the Eastern North Carolina system would probably be leased twice per year. The first use would be for early summer and summer vegetable harvests of cucumbers, cabbage, and other varieties; the second use would be for the fall sweet potato harvest and winter sweet potato storage. Since sweet potatoes are stored for up to a full year, with portions of the crop remaining in storage until June, a third bin use, in the early spring, would be difficult to arrange.

The telephone interviews revealed several additional pieces of information that are of interest to a potential lessor. The ownership of the bins used for crop transport can occur in many configurations. Charles F. Cates & Sons receives cucumbers, tomatoes, etc. in bins that

are 99% self-owned. H. P. Cannon & Son receives about half of its raw materials in its own bins and half in grower owned bins. Gray Cucumber Co. buys cucumbers and then ships them in bins that they don't own. Gray's cucumbers are received from the field in bags, sorted, and packed in Vlasic's bins for shipment to Vlasic. Gray is under exclusive contract to Vlasic to perform these operations.

The haul distances reported by the contacted firms were interesting. Most of the companies operate within radii of about 30 miles from their facilities. There are two exceptions. Charles F. Cates ships peppers and cucumbers to and from locations as distant as Michigan in pallet bins. Sometimes bins are transported empty even to the farthest locations. Cates does the long distance hauling when necessary to supplement or sell his own production. Similarly, the Campbell Soup facility at Maxton receives carrots and potatoes from Maine, Michigan, Wisconsin, and other states. These shipments are currently made in bulk and then transferred to bins for in-plant handling. In the future, Campbell hopes to change all of these shipments to arrive in the company's own bins.

Bin use is widespread in Eastern North Carolina. Bins are being used for storage or transport of crops almost year-round. More than in any other area yet examined, there seems to be an inclination toward long distance hauling in pallet bins. There are at least two nationwide corporations with facilities in the area. Both firms use bins extensively, and one of the companies has already expressed

corporate interest in a leasing system. All of these facts appear to be encouraging to a potential bin leasing system.

Delmarva System

This system overlaps areas from the states of Delaware, Maryland, and Virginia. The counties of Kent and Sussex in Delaware, Caroline, Dorchester, Somerset, Talbot, Wicomico, and Worcester in Maryland, and Accomack and Northampton in Virginia are included (see Figure 3). System acreage, production, and harvest periods are shown in Tables 17 to 20.

Discussion

Before beginning a discussion of this system's potential as a leasing area two format changes and some seemingly absent data must be explained. Because this system overlaps three states but does not contain all of those three states, the data in Tables 17 through 19 had to be separated by state. The separation is required if the calculations are to yield correct figures. The separation of data led to expanded table sizes. Table 18 had to be inverted because of the increased size. Table 18 contains the same information as Tables 2, 6, 10, and 14, but the axes of the table have been interchanged. Although the production of the Delmarva system is significant as a whole, none of the states by themselves are particularly large

producers of any of the crops being considered. Crop Reporting Board listings (6) that only list production quantities for the top ten or twelve states for each crop tend not to list Delaware, Maryland, or Virginia values. It is due to this lack of available information that there are gaps in the Delmarva system tables. Telephone surveying has revealed that the crops sometimes handled in bins in the area are those for which data is available.

Thirty-nine growers, packers, or processors were identified in the Delmarva area (8). Nineteen of the companies were contacted (Appendix 6). The information provided allows an overall description of bin use in the area to be made.

Nine of the packers or processors contacted reported using pallet bins. The crops transported in bins are cucumbers, peppers, tomatoes, and sweet and white potatoes. One peculiarity of the Delmarva system is that there are firms that do not use bins for hauling produce from the field but do own and use the bins for other transport purposes. Some of the cucumber packers haul from the fields to the packing houses or grading sheds in bulk. At the grading sheds the cucumbers that will be sent to the pickler are then loaded into bins for transport to the pickle processors. The procedure is used by a number of packers and represents one of the main methods of bin use in the area.

Another application of bins in the area was reported by Nottingham Bros. of Nassawadox, Virginia. A source at Nottingham commented that Safeway hauls cabbage from the Delmarva area to Safeway warehouses at Landover, Maryland, which is near Washington, DC, in a ten bushel

cardboard bin. This activity represents a potential bin exchange application and therefore an interesting topic for a potential lessor.

Aside from the above two slightly different bin applications, the utilization methods in the area are fairly normal. The average number of bins owned by bin-using packers or processors is 985. The median quantity owned is 500. A few different dimensional configurations were reported but all of the configurations are common ones. One packer owns and uses 2,000 homemade plywood bins. Other than the one exception, all of the bins are lumber; many users reported that Smalley Package Co. of Berryville, Virginia was their bin source.

Bin use in Delmarva begins in June and extends until early fall. Unlike other areas producing sweet potatoes, there is very little storage done in bins in this area. A couple of growers store sweet potatoes a month or two after the harvest, and one grower stores his white seed potatoes in bins for the winter.

One-third of the reporting bin owners owned less than 100 bins. All of the smaller owners were Virginia growers. Growers and/or small packers could not be identified in Delaware and Maryland, so there are probably more than 39 potential bin users in the system area. On the other hand, most of those not originally identified are probably small operators and likely own only a small number of bins.

Overall, the most prominent bin users and potential bin users in the area have been identified and contacted. Based on the ratio of potential owners to actual owners, and the average and median quantities owned, the area wide bin pool totals somewhere between 9,000

and 20,000 bins. Of the packers/processors questioned, most agreed that leasing would be attractive if economically feasible.

Summary and recommendations

Before summarizing the potential system data for the sites identified it is necessary to justify what may appear to be glaring oversights. The large agricultural industries of Florida, New Jersey, and the apple growing regions of the Appalachians all seem to be ripe areas for the establishment of leasing systems. All were eliminated for specific reasons. The first criterion used to identify potential areas was the response to the bin users survey. All of the areas identified, or the states the areas are located in, responded in healthy numbers to the survey. Only a limited number of responses were received from Florida processors. Further, it was advantageous to choose a market area where leasing was possible without being complicated. The sources used (1, 6, 10) showed a Florida agricultural scene that was intimidating in its activity and complexity. The state does possess potential for a successful bin leasing system, but for this study more approachable market areas were sought.

In contrast, the other areas mentioned, the apple regions and the large New Jersey agricultural area, were not suited to leasing due to insufficiencies of variety or season. The apple processors own large numbers of bins. However, the firms' locations prohibit the use of the bins for any crops other than apples, few other crops are grown in

those areas. Similarly, the many crops grown in New Jersey and other Northern locales are mostly harvested in a common season; there is little opportunity for bin use extension in such an area.

In addition to specifying the necessity to locate in an area of concentrated crop production, the introduction to this report stipulated five requirements for any potential leasing system:

1. There must be widespread acceptance of bin use in the area.
2. The area must have significant crop production volumes.
3. One bin design must be applicable to a significant identifiable fraction of the potential lessees, if not all of them.
4. The major crops in the area preferably should be harvested at different periods during the year.
5. Established bin use in the area should have decipherable systems of ownership and control.

The areas identified and investigated as potential bin leasing system locations fulfilled the above requirements to varying degrees. Table 21 shows how well each area met the requirements. The table includes two characteristics that are not listed as requirements but that would be desirable to the potential lessor. The existence of closely located additional market areas would make system expansion simple. For the table, an additional potential market within 300 miles is considered satisfactorily located. Also, the table shows whether there is an interstate or national bin-using corporation in the area; having such a large firm in the area would aid the lessor in certain strategies of market penetration or development.

The search for potential leasing system locations lead first to the State of Texas. The long growing seasons and high production volumes of the state appeared tailor made for leasing applications. The first area of concentrated crop production encompassed ten counties in North Texas. The area annually produced an estimated 67,852 tons of bin transportable varieties. Unfortunately, pallet bins were not used in the area. All of the local growers, packers, or processors contacted had made large investments in bulk handling systems which all but preclude successful bin leasing.

The situation and circumstances were similar for an area of highly concentrated production identified in South Texas. This eight county area produced 95,203 tons of crops per year that were harvested in almost ideal succession throughout the year. Once again, the major crop transporters in the area had accepted bulk loading over pallet bins as their method of choice for crop transport.

In the southernmost tip of Texas, in the citrus growing region of the Rio Grande valley, a location was identified where leasing potential exists. The Rio Grande system satisfactorily meets all five of the requirements outlined for successful pallet bin leasing. Two obstacles could be encountered by the potential lessor. Year-round bin use, at least for an entire leasing pool, would be unlikely. This is because the citrus crop, which accounts for 69% of the production tonnage, is harvested and requires bins for only seven months of the year. Any harvesting or bin-based transport that occurs during the

remaining five months of the year could not absorb the quantity of idle bins at the end of the citrus harvest.

The potential lessor in the Rio Grande area would encounter the greatest obstacle in trying to accommodate all of the lessees with one bin. For the citrus packers a 48" x 48" x 24" bin is universally applicable. Unfortunately, the vegetable packers and processors neither use the same bin as the citrus firms nor are as unified amongst themselves. Six vegetable firms reported bin dimensions. Five of those bins had 48" x 48" square bases. However, four different depths were reported. Even though a client list consisting only of the citrus growers in the area would probably be sufficient to create a successful leasing system, the large variety of bin sizes used by vegetable processors in the area would present a significant challenge to the lessor.

The next area examined as a potential site for pallet bin leasing was the vegetable producing region of Eastern North Carolina. Like the Rio Grande region, the Eastern North Carolina location meets the five requirements for a successful leasing system. Potential problems could exist concerning the year-round use of the entire stock of leasing bins due to the quantitative differences between harvest seasons.

The major bin-transported summer crops of the region are cucumbers and peppers. The majority of these crops are harvested between June and October. Beginning in September, the area's large crop of sweet potatoes is harvested into, transported, and stored in pallet bins. A

portion of the sweet potato crop is actually stored until the next year's harvest begins.

The fifth area examined as a potential site for a leasing system was the Delmarva peninsula. The bin-transported crops grown in the region are cucumbers, peppers, sweet and white potatoes, and tomatoes. The total weight production of these crops exceeds 157,000 tons; an exact figure cannot be obtained due to the lack of weight data for peppers. Sweet potatoes are not stored here to the extent that they are in North Carolina, and since little storage occurs, the bins that are used in the area are only utilized for six months at the most. From June through September the bulk of the cucumber and tomato crops are harvested, during October and November there are some sweet potatoes being harvested and moved. The cucumber firms also handle sweet potatoes, so any leasing system designed for the area would have to be primarily sold on the basis of reduced managerial and repair costs and lower capital expenditures for the lessee.

The bins used in the Delmarva area have the potential to be used during months other than those during which the local harvests occur. The apple growers, packers, and processors of Pennsylvania, Western Maryland, and Virginia harvest the largest parts of their crop during September, October, and November. Many packers and processors then may store portions of their crop from November until February or March. The large apple growing centers, where storage occurs, are about 150 to 200 miles from the center of the Delmarva system. If the costs of transporting bins from the peninsula to the apple packers were not

prohibitive, then leasing to the apple firms could extend bin use by about four months while eliminating the corresponding costs of empty storage. If this system could be arranged, then all of the requirements for an operable bin leasing system will have been met.

Recommended market area

The initiation of successful bin leasing is conceivable in the Rio Grande, Eastern North Carolina, and Delmarva areas. Considering the confines of this phase of this project it was decided that only the North Carolina system be investigated further in terms of pallet bin leasing. The Delmarva area is considered a primary expansion market for the Eastern North Carolina system. The Rio Grande system should be considered a suitable target for the start-up of a second system, once the logistics have been perfected in Eastern North Carolina. The eastern North Carolina area was chosen over the Rio Grande and Delmarva areas for six reasons:

1. The potential to use one bin design for all of the area's crops is greater than in the Rio Grande area.
2. The degree of bin acceptance among packers and processors is greater than in the Delmarva area.
3. The system area boasts the largest number of interstate firm facilities.
4. The area is located close to the Delmarva system area, which can serve as a possible expansion market.
5. The potential for additional expansion areas, such as the North Carolina apple region or South Carolina vegetable and fruit regions, is high.

6. The system area is close to Virginia Tech, providing better access for a more thorough analysis.

Establishing markets for leased pallet bins

The next issue that must be addressed concerns methods of initiating bin leasing systems. Establishing a leasing system requires two things. First, the potential lessor must acquire an inventory of rentable or leasable bins. Second, the lessor must rent or lease those bins to one or more bin users during the year. If for the time being the tasks of bin repair, idle bin storage, and bin transport are considered constants among all leasing systems, then the only variations between systems are in the methods of bin acquisition and the rental or lease arrangements made by the lessor. For this report, the distinction between renting and leasing will be that renting provides bins for one user for one season or harvest with no provision for yearly supply; further, the availability of bins at any one time for any one customer is not guaranteed. Leasing involves a contract which commits the lessor to provide the lessee with a specified number of bins at specified times each year.

Pallet bin rental

Assuming that any market area deemed worthy of a leasing system is already experiencing substantial bin use, and that the stocks of bins in the area during any one year are adequate for that year's harvest,

then the penetration or establishment of a leasing market can only be accomplished in a few ways. If a potential operator satisfies the necessary requirements of bin inventory establishment and rent/lease orientation in the simplest ways possible, then the system established will invariably be a true "rental" system. The system operator could purchase either new or used bins, but to simplify the system, and to preserve the pure rental orientation of the system, the operator would acquire the bins with no obligations to supply the bins to any specified users. With a bin inventory established, the operator would then begin to rent the bins.

At first, the operator would probably be busy only during periods of peak bin demand, when the local bin owners' stocks of pallet bins were not sufficient. In later seasons the operator might begin to establish other types of clients. As an established bin user lost bins through attrition, that user might turn to the operator to rent the bins required rather than purchasing more bins. Also, new growers, packers, or processors beginning operations in the area, or switching from another handling method to pallet bins, might rent the bins they need rather than purchasing them.

The rental system has four advantages as an initiation technique. First, the operator has a relatively large amount of freedom in choosing the system start-up size desired. While it would be unwise for the operator to purchase a number of bins larger than the local users may require, any desired number of rentable bins can be purchased allowing a match of capital availability to bin inventory size.

Second, the rental technique may require less work prior to system start-up than do other strategies because the operator need not be concerned with long-term contracts and negotiations, but must only identify an area with satisfactory potential demand for rented bins. Next, the rental strategy frees the operator from dependence upon, or control by, any individual packers, growers, or processors which could be involved in leasing contracts. Finally, since the system operator is able to buy new or used bins as desired, the quality of the established bin pool is controllable.

There are four disadvantages of the rental start-up method for bin leasing. To begin with, the method could experience a very slow start-up. The original investment in bins may not be recovered for some time. Also, there is no sure market for bins in the rental scenario; since the operator has no contracts with rental customers prior to system initiation, the success of the system is completely dependent upon the confidence and patronage of local bin users. The third deterrent to using the rental method is that it makes the original success of the system dependent upon bountiful agricultural production. If crops are not large, demanding more bins than are owned in the area, then no one may require rented bins. Finally, since this method of market penetration does not establish immediate clients, the operator will need to promote and publicize the system aggressively.

Buy-in and rental

One alternative to the straight rental method of system initiation involves the idea of buying the entire bin stocks of one or more of the prominent local bin using firms and contracting with the participating firm(s) to lease back the required number of bins per harvest. The system initiated in this way would be closely related to a renting system, since the lessor would be able to rent the bins to other users when the contracted firm(s) didn't need them. There would also be other advantages to this technique.

First, the lessor will automatically have one or more known customers, the firm(s) from which the bins were purchased. Second, the lessor may be able to acquire the bin inventory at costs below those for new bin purchase. Third, by initially dealing with the areas most prominent bin users, the lessor's presence and the services offered will be made more widely known. Finally, the slow start-up and the vulnerability to the changing preferences of the local bin users, which are problems typical of the straight renting strategy, will be minimized due to the immediate presence of one or more large yearly clients, the contracted firm(s).

The buy-in strategy for market penetration is a significant improvement over the rental method; however, there are two disadvantages. First, the lessor does not have as much freedom to choose the size of the bin pool; the pool size can be controlled only by contracting to purchase the bins from one or more firms whose

present inventories most nearly match the desired quantity. Second, the lessor forfeits the opportunity to purchase a stock of entirely new bins. Even though the quality of the bins can be determined through pre-sale inspection, there is very little chance that the average overall quality will approach new condition.

Replacement and rental

A third potential strategy, that like the buy-in method involves both leasing to a firm or firms under contract and renting to other firms, is the replacement strategy. If a lessor selected an area dominated by large firms owning large numbers of bins, then the market could be penetrated by replacement only. A conservative estimate is that bin using firms replace approximately ten percent of their bin stocks annually (our original users survey showed that 50% of bins were replaced prior to the seventh year). If a lessor contracted with a few large operations to lease their yearly replacement bins, then that lessor would be establishing itself strongly as a supplier to those firms while building a pool of new bins that could be leased or rented to other users at times of the year when the original customers do not require the bins. The reason that a lessor entering the market in this way would want to have large firms as original customers is that if the replacement needs of small companies were filled instead, the lessor would have to deal with many more accounts to create an equivalent bin

pool; the high number of accounts would lead to greater operating expenses.

Initiating a leasing system through bin replacement contracts offers the lessor a good deal of control over many important start-up parameters. First, the lessor can exercise control over the size of the original bin inventory and the size of the investment required by contracting to provide specific quantities of replacement bins. Later, by supplying additional yearly replacement needs, the bin inventory and leasing operation would grow. The increasing bin inventory would be advantageously linked to increasing levels of lessor experience. The lessor investment, and related overall risk, would also build in small increments rather than being required entirely at the outset. The lessor could also contract with companies whose major workloads are at different times of the year and use the same bin inventory to satisfy both customer segments.

The replacement technique for market penetration has few disadvantages. One existing problem is that, as with the other systems, the lessor ends up being somewhat dependent upon the companies with which original contracts are made. Also, as mentioned earlier, the scheme depends upon the presence of good sized, bin using firms in the area that are willing to participate in the system.

Large firm buy-in

The idea of purchasing the entire bin inventory of a nationwide or interstate bin-using corporation, or contracting to perform the bin management operations of such a company, constitutes both an additional market penetration strategy and, effectively, an additional potential system in itself. The initial cost of such a system could be very high. But if a partnership could be formed with a large, successful company, then the potential success of the leasing system would be greatly enhanced. Three such companies have been contacted in the course of this study. Campbell Soup, Del Monte, and Vlasic all own bins in many areas of the country. The bins are used in many instances for long distance hauling of produce. If a lessor could convince any of these companies that the lessor's materials handling expertise could lead to reduced bin use costs, then this "system" might be accepted by the company.

On the original pallet bin users survey respondents were given the opportunity to request survey results. Sixty-seven respondents did so. Included with each results report was a postcard which the respondents could return to Virginia Tech requesting that the bin user be contacted concerning more specific details of a possible bin leasing system. Thirteen of these cards were returned. Some of the larger companies seeking leasing information were Vlasic Foods, General Foods Corporation, and Seneca Foods Corporation. No action has as yet been

taken on these requests; however, a potential system including such clients would be very large.

Recommended method for establishing leasing

The large firm buy-in has a certain amount of potential in Eastern North Carolina. Vlastic Foods, Inc. owns 20,000 pallet bins which are used for cucumber, pepper, and tomato transport in North Carolina, Delaware, Maryland, and five other states. The bins are in use between April and November. A leasing firm could conceivably enter into a contract with Vlastic to perform the bin management operations of the company. However, since the preliminary and secondary research for this project was oriented toward an exchange system approach and not toward contract management services, this strategy is not going to be considered further at this time.

The action decided upon for the Eastern North Carolina area was to primarily explore a replacement and rental strategy. There are at least four firms in the area that are large enough to provide good leasing contracts for pallet bin replacement. Furthermore, the larger firms in the area are more specialized, concentrating on single crops and products. If the lessor contracted with one of the large cucumber/pepper firms, which require most of their bins in the early summer, then most of the bin inventory would be available for the beginning of the sweet potato harvest in September and almost all of the bins would be available for the storage season. The same concept would, of

course, work in reverse. Other than the firms contracted with for replacement, there are plenty of potential lessees in the area. The many smaller packers or processors add up to a good sized market. Also, it may be possible that the interstate firms, such as Vlastic, would lease the bins they required for harvesting and transporting crops in the Eastern North Carolina area, rather than continuing their present practice of hauling in bins from out of state.

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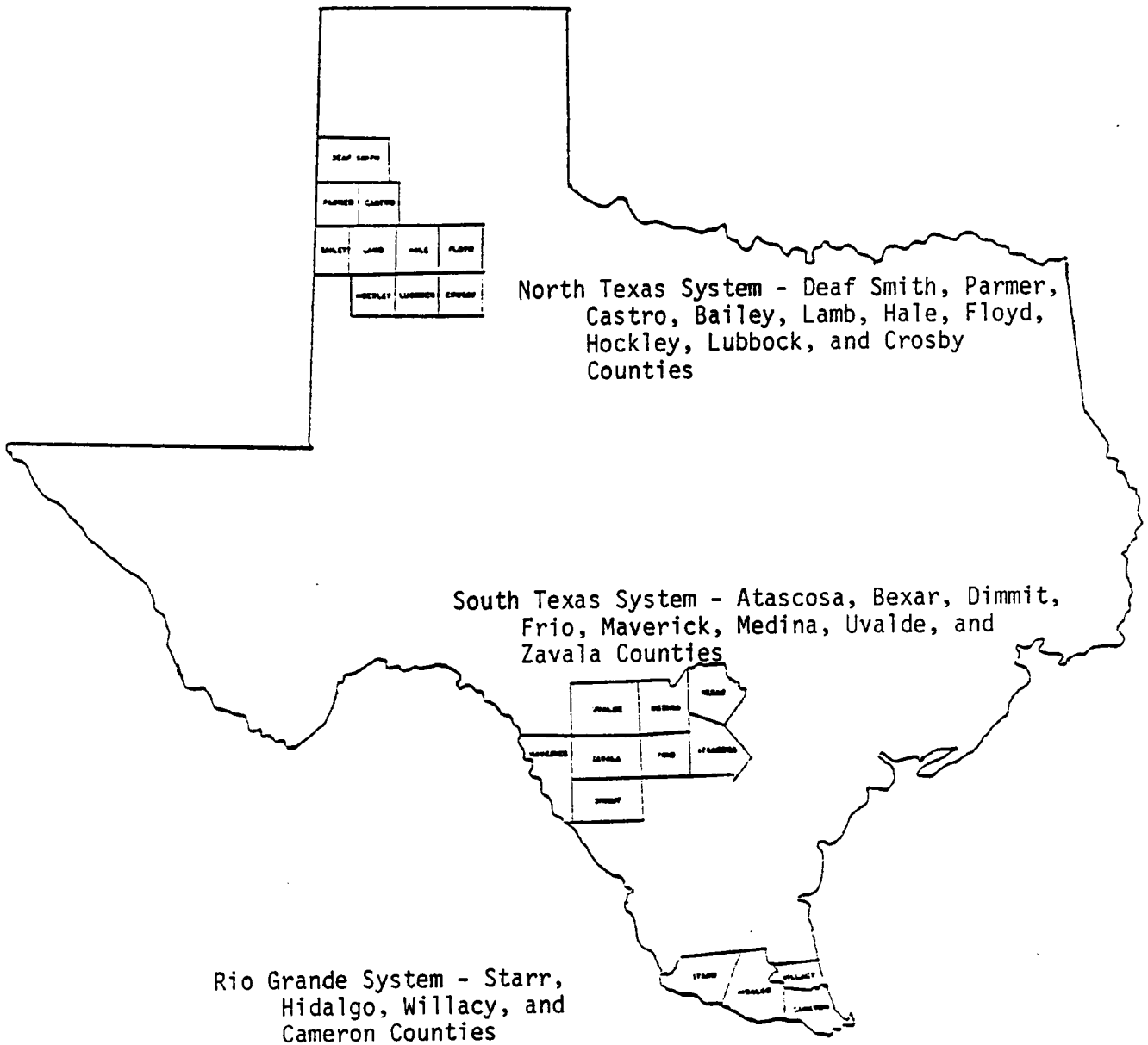


Figure 1. Potential North Texas, South Texas, and Rio Grande pallet bin leasing system locations.

Table 1. North Texas system acreage as a percent of state acreage for each crop (1).

Crop	Total system acreage	Total state acreage	System acreage as a % of state acreage
Peppers	1,207	6,929	17.42%
Tomatoes	257	6,385	4.03
Cucumbers	2,625	13,712	19.07
Carrots	940	15,338	6.13
Onions	4,334	28,245	15.34

Table 2. Average statewide Texas production by crop 1978-81 (6).

Crop	Yearly weight totals (tons)				Average production (tons)
	1978	1979	1980	1981	
Peppers	32,400	39,700	35,500	41,350	37,238
Tomatoes	42,200	41,500	32,940	19,120	33,940
Cucumbers	96,400	77,390	81,630	61,060	79,120
Carrots	155,350	108,800	102,450	137,500	126,025
Onions	242,350	251,200	266,650	209,400	242,400

Table 3. Estimated North Texas system production by crop (1, 6).

Crop	System acreage as a % of state acreage	Average production (1978-81) (tons)	System average production (tons)
Peppers	17.42%	37,238	6,487
Tomatoes	4.03	33,940	1,368
Cucumbers	19.07	79,120	5,088
Carrots	6.13	126,025	7,725
Onions	15.34	242,400	7,184

Table 4. Estimated North Texas monthly harvest and storage totals by crop (tons) (1, 2, 6, 10).

Month	Peppers	Tomatoes	Cucumbers	Carrots	Onions	Total
Jan				1,259	1,487	2,746
Feb		27		1,421	3,458	4,906
Mar		27		1,483	3,607	5,117
Apr	130	27	272	533	3,979	4,941
May	1,168	137	3,938	232	3,607	9,082
Jun	1,168	274	1,660	62	4,016	7,180
Jul	195	273	453	31	3,904	4,856
Aug	195	136	1,946	108	3,793	6,178
Sep	649	26	785	108	3,421	4,989
Oct	1,167	137	905	368	3,384	5,961
Nov	1,167	274	4,074	1,205	1,748	8,468
Dec	648	30	1,055	915	780	3,428

Table 5. South Texas system acreage as a percent of state acreage for each crop (1).

Crop	Total system acreage	Total state acreage	System acreage as a % of state acreage
Cabbage	2,275	18,090	12.58
Cantaloupe	1,317	21,547	6.11
Carrots	2,784	15,338	18.15
Cucumbers	3,181	13,712	23.20
Onions	2,334	28,245	8.26
Tomatoes	283	6,385	4.43

Table 6. Average statewide Texas production by crop, 1978-81 (6).

Crop	Yearly weight totals (tons)				Average production (tons)
	1978	1979	1980	1981	
Cabbage	247,050	155,950	205,750	419,450	207,050
Cantaloupe	114,300	105,400	101,350	97,950	104,750
Carrots	155,350	108,800	102,450	137,500	126,025
Cucumbers	96,400	77,390	81,630	61,060	79,120
Onions	242,350	251,200	266,650	209,400	242,400
Tomatoes	42,200	41,500	32,940	19,120	33,940

Table 7. Estimated South Texas system production by crop (1, 6).

Crop	System acreage as a % of state acreage	Average production (1978-81) (tons)	System average production (tons)
Cabbage	12.58%	207,050	26,047
Cantaloupe	6.11	104,750	6,400
Carrots	18.15	126,025	22,874
Cucumbers	23.20	79,120	18,356
Onions	8.26	242,400	20,022
Tomatoes	4.43	33,940	1,504

Table 8. Estimated monthly South Texas harvest and storage totals by crop (tons) (1, 2, 6, 10).

Month	Cabbage	Cantaloupe	Carrots	Cucumbers	Onions	Tomatoes	Total
Jan	4,402		3,728		801		8,931
Feb	3,594		30		1,862	15	9,451
Mar	4,402		3,934		1,942	30	10,308
Apr	4,246		1,350	661	2,142	45	8,444
May	3,126	538	686	4,791	2,062	180	11,383
Jun	573	3,418	183	2,019	2,162	271	8,626
Jul	208	1,997	91	551	2,102	331	5,280
Aug	287	326	320	2,368	2,042	120	5,463
Sep	52	109	320	955	1,942	42	3,420
Oct	339		1,144	1,101	1,822	196	4,602
Nov	1,563		3,568	4,956	941	256	11,284
Dec	3,256		3,568	955	200	18	7,997

Table 9. Rio Grande system acreage as a percent of state acreage for each crop (1).

Crop	Total system acreage	Total state acreage	System acreage as a % of state acreage
Cabbage	13,995	18,090	77.36
Carrots	9,950	15,338	64.87
Cucumbers	5,721	13,712	41.72
Honeydew	3,171	3,999	79.29
Peppers	4,104	6,929	59.23
Grapefruit	51,997	52,867	98.35
Oranges	34,272	34,281	99.97

Table 10. Average statewide Texas production by crop, 1978-81 (6).

Crop	Yearly weight totals (tons)				Average production (tons)
	1978	1979	1980	1981	
Cabbage	247,050	155,950	205,750	219,450	207,050
Carrots	155,350	108,800	102,450	137,500	126,025
Cucumbers	96,400	77,390	81,630	61,060	79,120
Honeydew	30,000	40,000	33,600	34,000	34,400
Peppers	32,400	39,700	35,500	41,350	37,238
Grapefruit*					478,987
Oranges*					266,598

*1978 Census data.

Table 11. Estimated Rio Grande system production by crop (1, 6).

Crop	System acreage as a % of state acreage	Average production (1978-81) (tons)	System average production (tons)
Cabbage	77.36	207,050	160,174
Carrots	64.87	126,025	81,752
Cucumbers	41.72	79,120	33,009
Honeydew	79.29	34,400	27,276
Peppers	59.23	37,238	22,056
Grapefruit	98.35	478,987	471,084
Oranges	99.97	266,598	266,518

Table 12. Estimated monthly Rio Grande harvest and storage totals by crop (tons) (1, 2, 6, 10).

Month	Cabbage	Carrots	Cucum- bers	Honey- dew	Pep- pers	Grape- fruit	Oranges	Total
Jan	27,069	13,326				80,555	34,014	155,864
Feb	22,104	14,225				80,084	35,180	151,593
Mar	27,069	14,061				59,828	34,114	135,072
Apr	26,108	4,823	1,188		441	36,273	14,125	82,958
May	19,221	2,453	8,615	1,036	3,970	9,893	1,599	46,787
Jun	3,524	654	3,631	17,511	3,970			29,290
Jul	1,281	327	990	8,074	441			11,113
Aug	1,762	1,145	4,258	655	441			8,261
Sep	320	1,145	1,716		2,206	471	11,460	17,318
Oct	2,082	4,088	1,981		3,970	24,967	39,178	76,266
Nov	9,610	12,753	8,912		3,970	78,671	45,308	159,224
Dec	20,022	12,753			2,206	100,340	50,638	185,959

Eastern North Carolina System - Bertie, Bladen, Chowan, Columbus, Cumberland, Duplin, Edgecombe, Franklin, Greene, Halifax, Harnett, Johnston, Lenoir, Martin, Nash, Pasquotank, Perquimans, Pitt, Robeson, Sampson, Wake, Wayne, and Wilson Counties

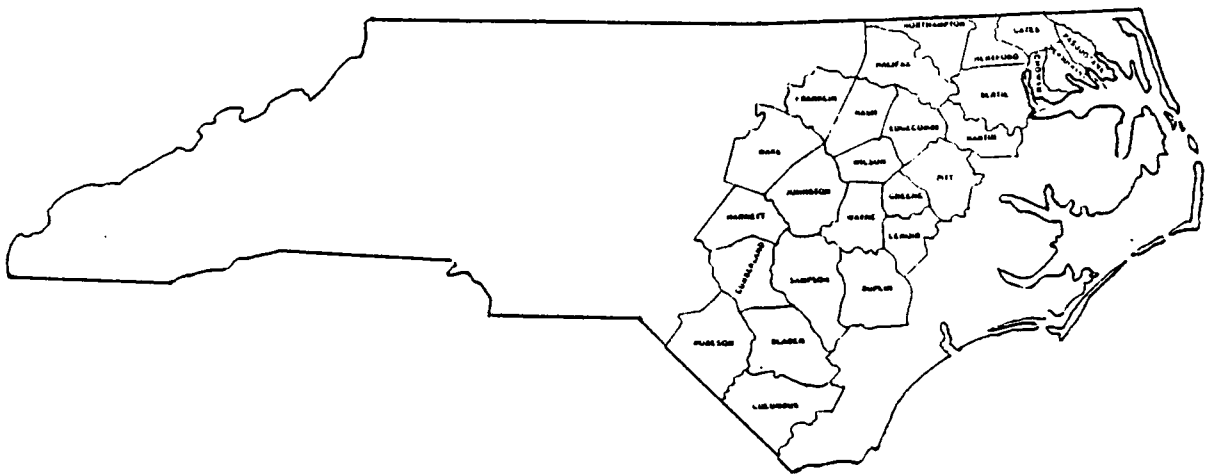


Figure 2. Potential Eastern North Carolina pallet bin leasing system location.

Table 13. Eastern North Carolina system acreage as a percent of state acreage for each crop (1).

Crop	Total system acreage	Total state acreage	System acreage as a % of state acreage
Snap Beans	1,293	3,289	39.3
Cabbage	2,512	4,871	51.6
Cucumbers	14,330	15,828	90.5
Peppers	6,892	7,327	94.1
Tomatoes	268	1,664	16.1
Sweet Potatoes	42,750	47,271	90.4

Table 14. Average statewide North Carolina production by crop, 1978-81 (6).

Crop	Yearly weight totals (Tons)				Average production (Tons)
	1978	1979	1980	1981	
Snap Beans	12,850	17,670	14,510	15,200	15,058
Cabbage	48,800	58,450	47,250	46,850	50,338
Cucumbers	98,000	104,440	111,640	103,300	104,345
Peppers	13,005	12,950	13,750	14,000	13,426
Tomatoes	13,500	11,900	13,500	15,000	13,475
Sweet Potatoes*					257,099

*1982 Census.

Table 15. Estimated Eastern North Carolina system production by crop (1, 6).

Crop	System acreage as a % of state acreage	Average production (1978-81) (Tons)	System average production (Tons)
Snap Beans	39.3	15,058	5,918
Cabbage	51.6	50,338	25,974
Cucumbers	90.5	104,345	94,432
Peppers	94.1	13,426	12,634
Tomatoes	16.1	13,475	2,169
Sweet Potatoes	90.4	257,099	232,418

Table 16. Estimated monthly Eastern North Carolina harvest and storage totals by crop (tons) (1, 4, 6, 10).

Month	Snap beans	Cabbage	Cucum- bers	Peppers	Toma- toes	Sweet potatoes	Total
Jan						17,431	17,431
Feb						18,361	18,361
Mar						19,756	19,756
Apr						17,199	17,199
May		13,288	10,492			9,064	32,844
Jun	1,716	4,165	36,724	4,254	216		47,075
Jul	1,953		20,984	5,853	781		29,571
Aug	1,657			2,527	431	6,043	10,658
Sep	592		15,739		390	24,404	41,125
Oct		1,850	10,493		351	27,426	40,120
Nov		3,336				52,991	56,327
Dec		3,335				39,743	43,078

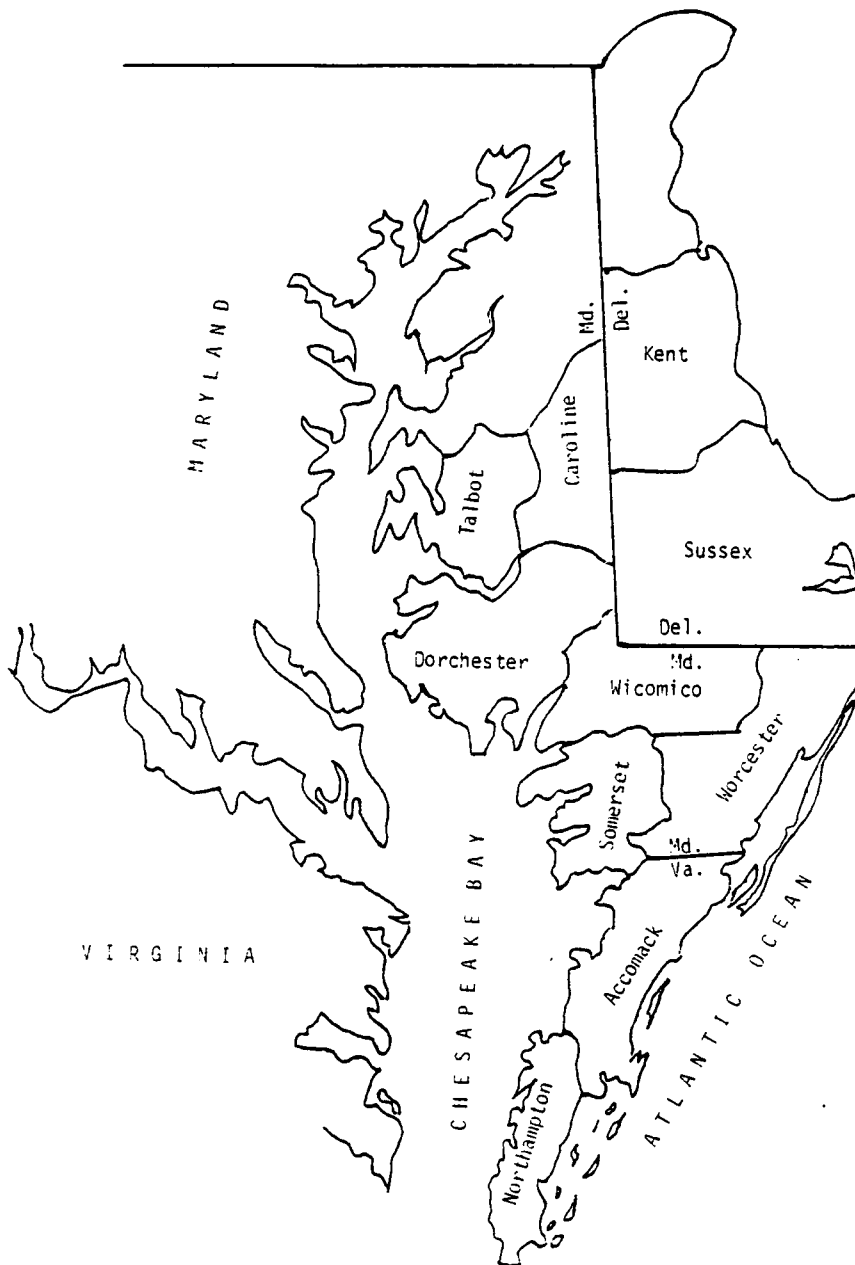


Figure 3. Potential Delmarva pallet bin leasing system location.

Table 17. Delmarva system acreage as a percent of state acreage for each crop and state (1).

Crop	Total system acreage			Total state acreage			System acreage as a % of state acreage		
	DE	MD	VA	DE	MD	VA	DE	MD	VA
Lima beans	6,374	641	0	11,436	1,578	n/a	55.7	40.6	n/a
Snap beans	3,424	1,226	3,641	3,429	4,197	4,449	99.9	29.2	81.8
Cabbage	482	57	80	508	404	1,887	94.9	14.1	4.2
Canta- loupe	291	951	28	298	1,296	708	97.7	73.4	4.0
Cucum- bers	1,342	1,989	5,929	1,755	2,367	6,130	76.5	84.0	96.7
Sweet potatoes	10	843	2,068	10	999	2,619	100.0	84.4	79.0
Tomatoes	1,053	4,367	1,846	1,096	5,605	3,398	96.1	77.9	54.3
Water- melon	1,308	2,210	100	1,311	2,317	2,512	99.8	95.4	4.0

Table 18. Average statewide production by crop and state for the Delmarva system, 1978-81 (6).

Crops								
	Lima beans	Snap beans	Cabbage	Canta- loupe	Cucum- bers	Sweet Pota- toes*	Toma- toes	Water- melon
<u>Yearly weight totals (tons)</u>								
<u>1978</u>								
DE	11,000	22,150			9,100			15,700
MD	3,250	15,050	5,850		25,650		54,200	19,800
VA		12,250	20,350		36,550		57,500	
<u>1979</u>								
DE	8,570	12,200			7,690			13,300
MD	2,550	18,200	6,250		33,730		47,150	18,900
VA		12,550	19,250		25,250		59,200	
<u>1980</u>								
DE	6,790	12,480			7,200			16,000
MD	1,690	11,920	5,600		33,000		38,500	22,500
VA		9,560	19,250		24,350		30,610	
<u>1981</u>								
DE	10,260				7,500			17,350
MD	1,810	12,860	6,250	5,600	35,330		62,900	24,050
VA		9,660	26,000		25,220		46,500	
<u>Average production (tons)</u>								
DE	9,180	15,583			7,872	69		15,588
MD	2,325	14,508	5,988	5,600	31,928	8,196	50,688	21,312
VA		11,005	21,212		27,842	16,818	48,452	

*1982 Census data.

Table 19. Estimated Delmarva system production by crop (1, 6).

Crop	System acreage as a % of state acreage			Average production (1978-81) (tons)			System average production (tons)			
	DE	MD	VA	DE	MD	VA	DE	MD	VA	Total
Lima beans	55.7	40.6	n/a	9,180	2,325	0	5,113	944	0	6,057
Snap beans	99.9	29.2	81.8	15,583	14,508	11,005	15,567	4,236	9,002	28,805
Cabbage	94.9	14.1	4.2	6,031	5,988	21,212	5,723	844	891	7,458
Canta- loupe	97.7	73.4	4.0	1,288	5,600	3,059	1,258	4,110	122	5,490
Cucum- bers	76.5	84.0	96.7	7,872	31,928	27,843	6,022	26,820	26,923	59,765
Sweet Pota- toes	100.0	84.4	79.0	69	8,196	16,818	69	6,917	13,286	20,272
Tomatoes	96.1	79.9	54.3	11,069	50,688	48,452	11,598	39,486	26,309	77,393
Water- melon	99.8	95.4	4.0	15,588	21,312	25,549	15,557	20,332	1,022	36,911

Table 20. Estimated monthly Delmarva harvest and storage totals by crop (tons) (1, 6, 10).

Month	Lima beans	Snap beans	Cab- bage	Canta- loupe	Cucum- bers	Sweet potatoes	Tomatoes	Water- melon	Total
Jan									
Feb									
Mar									
Apr			829						829
May			829						829
Jun	1,211	5,761	829	14,941	13,148		19,348	7,382	62,620
Jul	1,211	5,761	829	14,941	13,148		19,348	7,382	62,620
Aug	1,211	5,761	829	14,941	13,148	5,068	19,349	7,382	67,689
Sep	1,212	5,761	829	7,471	10,161	5,068	19,348	7,382	57,232
Oct	1,212	5,761	828	7,471	10,161	5,068		7,382	37,882
Nov			828			5,068			5,896
Dec			828						828

Table 21. Summary of potential pallet bin leasing system areas in terms of stated requirements.

Leasing system requirements	Potential bin leasing system areas				
	North Texas	South Texas	Rio Grande	Eastern North Carolina	Delmarva
Bin acceptance	Insignifi- cant	Insignifi- cant	Excellent	Excellent	Good
Production volume	Adequate	Adequate	Excellent	Very good	Very good
Single bin adaptability	N/A	N/A	Difficult	Easy	Easy
Sequentiality of harvests	Excellent	Excellent	Good	Good	Adequate
Penetrable systems of bin use	N/A	N/A	Strongly present	Strongly present	Present
Potential additional markets (300 mi.)	No	No	Unknown	Yes	Yes
Interstate firms present	No	Yes	Yes	Yes	Yes

ECONOMIC AND MARKET POTENTIAL TO ESTABLISH A WOODEN BIN LEASING SYSTEM:
A CASE STUDY

Abstract

The establishment of a wooden bin leasing system among agricultural bin users was investigated. A potential system site was identified that had two distinct harvest periods representing two groups of bin users and 21,000 and 24,000 bins in respective ownership.

An economic model was devised to analyze the system. The system used bins costing \$40 each, having seven year lives, and requiring between \$0.50 and \$2.00 worth of repairs in years one through seven. Transportation costs were \$1.70 per loaded mile for an estimated haul distance of 50 miles.

The market was penetrated at the rate of 1,500 bins per year until a steady-state representing half of the potential market was established in the seventh year. With yearly per bin revenues of \$18.92, management costs of \$30,000 per year, a 42% income tax rate, and a discount rate of 12.5%, the system net present value was calculated at \$31,056.99. System internal rate of return was 15.46%

For the purpose of comparison, a second analysis was performed for a system utilizing a bin with a four year life. All other assumptions were constant. The NPV was \$-60,430 at a 12.5% discount rate. System IRR was 7.24%.

Introduction

Pallet bins, as the name implies, are pallet mounted containers used for the bulk handling and transport of a myriad of industrial and agricultural products. The bin used for agricultural purposes is typically built of hardwood lumber. The bin used by many processors has a 40" fork entering face, a 48" length or depth, and stands approximately 34" high. Such a bin would contain about 60 to 75 board feet of lumber and weigh close to 200 pounds.

Wooden pallet bins are extensively used in the fruit and vegetable growing and processing industries (9). From Maine to Florida and west to California bins are used to transport and store over two dozen varieties of fruits and vegetables (9). At a cost of perhaps \$35 each and a lumber content of 60 to 75 board feet, the large numbers of pallet bins in agricultural use across the country represent a significant market for hardwood lumber.

Pallet bins are a high-cost component of the fruit and vegetable processors' operations. A survey of east coast processors reported an average investment in bins of over \$500,000 (6). However, due to the seasonality of these operations the bins are idle for a significant fraction of the year. If a leasing system could be designed and implemented, then the same inventory of bins could be leased to different growers and processors who operate at different times of the year. The capital required of each grower or processor to secure the needed bins would be reduced and bin use costs would be lower.

Objectives

The objectives of this study were to develop a set of criteria to judge a successful leasing system site, to develop a strategy by which a successful system can be initiated and operated, to accumulate pertinent cost and bin use information, and to financially analyze the leasing system.

Leasing site criteria

Leasing systems have been organized for goods similar to pallet bins, such as pallets, but little effort has been made to develop a pallet bin leasing system (4, 7, 11, 12). It appears likely that several factors may have contributed to the absence of any successful effort to organize a bin leasing system. In many areas tradition, geography, weather conditions, or markets dictate only one major crop. With only one crop there is typically only one harvest season and limited opportunities for bin use beyond the single harvest season. Even when more than one crop is produced in an area, the crops may have common harvest seasons which limit the possibilities for bin use extension. In addition, many agricultural areas use bulk handling or have well established and complex systems of bin ownership. Any of these conditions could denote a market area difficult to penetrate with leased bins.

The characteristics that are required for successful pallet exchange include binding legal contracts defining the responsibilities and services required of each party, well designed systems of replenishment which insure that pallets will be available to clients when and where pallets are required, pallets built to rigid specifications, and reliable and rapid pallet repair and replacement (12). Any pallet bin lessor would need to operate under similar guidelines.

In order for bin leasing to be viable, certain additional requirements would have to be met:

1. There must be widespread acceptance of bin use in the area.
2. The area must have significant crop production volumes.
3. One bin design must be usable by to a significant identifiable fraction of the potential lessees, if not all of them.
4. The major crops in the area preferably should be harvested at different periods during the year.
5. Established bin use in the area should have decipherable systems of ownership and control.

System area choice

Fresh Fruit and Vegetable Shipments shows what crops are shipped from each state during each month of the year (10). The occurrence of many bin-handled crops being harvested in one state at different times of the year is conducive to the establishment of a bin leasing system.

The Census of Agriculture, County Summary Data (3) reports the total acreage of each crop that is grown in each county of each state. The concentrated production areas can be identified by mapping the major producing counties.

Once an area with satisfactory production and alternating harvest seasons has been identified, Crop Reporting Board statistics can be used to establish weight total estimates for the production of any system being considered (2).

Market penetration strategy

Assuming that any market area deemed worthy of a leasing system is already experiencing substantial bin use, and that the stocks of bins in the area during any one year are adequate for that year's harvest, then the penetration or establishment of a leasing market can be accomplished in several ways. One alternative involves buying the entire bin stocks of one or more of the prominent local bin using firms and contracting with the participating firm(s) to lease back the required number of bins per harvest. This strategy would require significant capital outlays and could result in the purchase of poor quality bins for leasing purposes.

Another perhaps more promising strategy is a replacement strategy. A conservative estimate is that typical bin using firms replace at least 10% of their bins annually (6).

Initiating a leasing system through bin replacement contracts offers the lessor control over many important start-up parameters. First, the lessor can exercise control over the size of the original bin inventory and the size of the investment required by contracting to provide specific quantities of replacement bins. Later, by supplying additional yearly replacement needs, the bin inventory and leasing operation would grow. The increasing bin inventory would be advantageously linked to increasing levels of lessor experience. The lessor investment, and related overall risk, would also build in small increments rather than being required entirely at the outset. The lessor could also contract with companies whose major workloads are at different times of the year and use the same bin inventory to satisfy both customer segments.

An example wooden bin leasing system

The system is designed to cater to the mid-Atlantic pickling companies, which handle cucumbers and peppers from the last week in May until September, and the sweet potato growers and packers, who begin their harvest in September and store the crop in the bins through the winter until April or May. Although the possibility of additional users has not been ruled out, these two groups are permanently established and provide a foundation for the establishment of a leasing system.

Along with the obvious advantage of having complementary use schedules, the picklers and sweet potato handlers also compare advantageously in other aspects. First, the bin designs required by both groups are close enough in size and shape that one bin design could be used by any participating firm. Secondly, the numbers of bins used in the area by the two groups, while not exactly equal, are comparable enough that at a reasonably chosen system size no bins will necessarily stand idle during either season. Third, the major picklers in the region and the predominant sweet potato handlers are located within a 100 mile area. Finally, the two groups are both dominated by large firms, making it possible to establish a good sized leasing system without having to deal with a prohibitive number of firms.

System area characteristics and planning assumptions

The accumulation of necessary economic information was accomplished by telephone surveying and personal interviews of potential participants and other parties located in the system area. The results of this surveying and a previous mail survey (6) have been used to perform the initial economic analyses of pallet bin leasing.

Seven costs were identified that should be considered before initiating any leasing system. The seven are original bin purchase price, bin repair costs, bin transportation costs, yearly management costs, property and income taxes, and insurance.

Bin purchase price & average service life

Telephone surveying of potential users revealed an overall average bin price of \$35.00. The pickle companies use a bin that costs \$32.75 on the average. The sweet potato handlers use a slightly more expensive bin, averaging \$36.00 each. The leasing bin purchase price was estimated at \$40.00 per bin. Based on visits to bin manufacturers, telephone surveying, and other research, it is believed that \$40 will purchase a sturdy, reliable bin.

The sweet potato handlers' average reported bin life was 9.67 years. The picklers' average bin life was only 3.25 years. The explanation for the differing bin lives is probably not in new bin quality, but instead has to do with bin use intensity. The sweet potato bins are seldom used for more than one load per year. The crop is placed in bins, the bins are placed in storage, and until the packer needs the produce, the bins aren't touched. On the other hand, the cucumber/pepper bins are used many times per year. These bins are used up to three months per year and rarely hold an individual load longer than one week. Single bins may be loaded in the field, transported to the processing facility, unloaded, and returned to the field up to a dozen times per year. It is most likely due to the variance in numbers of uses per year that the sweet potato bin lasts longer than the cucumber bin. One additional factor that could contribute to the greater life expectancies of sweet potato bins is that the sweet potato bins are stored indoors during storage and when not in use. On the

other hand, the cucumber bins are stored through their idle season, the winter, on unprotected lots. Bin deterioration due to the weather is common among these users (13).

For the purposes of this investigation an estimated bin life of seven years was used. Although bin life reports for the area chosen make a seven year life seem unlikely, it is believed that a higher quality new bin and conscientious repair will increase the chances of receiving seven years of use. Research has, in fact, revealed that 55% of all bin using companies get seven or more useful years service from each bin (6).

Bin repair costs

Bin repair costs are significant for most bin users. Unfortunately, the task of establishing reliable bin repair costs is extremely difficult. Many bin using companies have no real data on repair costs. Bins are repaired as needed and few records are kept. Accurate repair cost estimates were available from only a few firms.

Repair costs for sweet potato handlers appear relatively low. One company reportedly owns 18,000 bins that are used almost solely for sweet potatoes. The company reports an annual repair cost of \$.50 per bin for the 15 year life of their bins (8). In comparison, a major pickle company, whose bins last three to four years, spends \$10,000 - 12,000 per year to repair their 4,000 bin inventory (5). The repair

costs for a rental bin would likely be more comparable to those for cucumber bins due to the additional yearly use.

The lessor's repair costs are estimated to start at \$.50 per bin in the first year and increase to \$2.00 per bin in the fifth through seventh years, reflecting the effects of age (Table 1).

Transportation costs

The haul distances for the system for which the lessor will be responsible will average under 100 miles and probably under 50. A local trucking company reports that their highest rate, which would be applied at a 100 mile minimum for any single haul below 100 miles, is \$2.24 per loaded mile (1). A bin using firm reported a cost of \$.84 per one-way mile (13). A flatbed trailer holds 96 empty 48 x 40 inch bins when completely loaded. Since a lessor would almost always be moving multiple loads, a long-term contract could be negotiated with the trucker, resulting in a lower rate. A freight rate of \$1.70 per loaded mile is assumed for the system plan with a 50 mile minimum.

Property taxes & insurance

Bins are insured at replacement value with premiums of 1% of replacement value. Property tax rates of 1% apply to book-value from year one to year five and to a \$4 per bin value thereafter.

Management costs & income taxes

Management costs have been estimated at \$30,000 annually. It is believed that this system could be best initiated by an existing bin manufacturer or bin user. The applicable income tax rate in our example was set at 42%.

Revenues

The bin ownership costs for the cucumber/pepper handlers were derived in the following way:

Yearly bin cost:

$$\frac{\text{Average cost of new bin}}{\text{Average bin life}} = \frac{\$32.75}{3.25} = \$10.08/\text{Year}$$

Plus yearly repair cost (estimate): \$ 2.50/Year

Plus opportunity cost of capital (@ 10%): \$ 3.28/Year

\$15.86

The ownership costs corresponding to the sweet potato handlers were similarly calculated:

Yearly bin cost:

$$\frac{\text{Average cost of new bin}}{\text{Average bin life}} = \frac{\$36.00}{9.67} = \$ 3.72/\text{Year}$$

Plus yearly repair cost (estimate): \$.50/Year

Plus opportunity cost of capital (@ 10%): \$ 3.60/Year

\$ 7.82

System revenues are based on 80% of bin user ownership costs. Rates to the two user groups are different because the yearly bin ownership costs of the user groups are different. The total yearly revenue per bin is \$18.92.

System size

In the heart of the system area there are a dozen major handlers of cucumbers, peppers, and/or sweet potatoes. The 12 companies currently own and use more than 95,000 pallet bins. However, many of the area companies handle both crops being considered, and thus would not be in the group of potential participants. In the same area, cucumber/pepper handlers that don't handle sweet potatoes own over 21,000 bins. Firms dealing exclusively in sweet potatoes own 24,000.

For the purposes of this initial system the annual bin replacement quantity has been set at 1500. The number was chosen based on bin use volumes and realistic replacement needs in the area. At a yearly replacement size of 1500 bins, the leasing system could be adopted in the area without problems.

Cash flow calculations and tax aspects

Bin depreciation is based on the five year Accelerated Cost Recovery System (ACRS). An investment tax credit (ITC) is taken in the first year of operation. Although the first year's taxes are less than

the ITC, the entire credit is still applied to cash flow in that year. The whole ITC is taken and considered a positive cash flow in the first year assuming that it is applied against other tax liabilities of the lessor. Any negative taxable income values are handled similar to the ITC, that is, the tax savings due to negative flows are considered positive after-tax flows.

Discount rate

The discount rate used for net present value (NPV) calculations is based on a prime rate of 10.5% plus 2%, for a total of 12.5%.

System profitability

A financial analysis of the proposed leasing system was conducted using the values in Table 1. Seven years were necessary to capture a level of half the potential market, at which point a steady-state was established and allowed to continue until the fifteenth year. In year 15 the bins were sold at book value. A tax credit recovery of \$12,000 was deducted from revenues in the last year, per IRS regulations. Table 2 gives costs and revenues on a year by year basis for the leasing system.

A NPV of \$31,056.99 was calculated at a 12.5% discount rate. The IRR was 15.46%

The sensitivity of the NPV of the 15 year system to changes in revenues and key costs is illustrated in Figures 1 through 5. While keeping all of the variable values at the values shown Table 2, or varying those values accordingly, repair costs, freight costs, yearly purchase costs, management costs, and revenues were varied from 25% below to 25% above the values shown. A 10% change in the original repair cost values caused a 9.5% change in final NPV. The corresponding changes were 12.7% for freight costs, 74.3% for purchase costs, 37.2% for management costs, and 143.7% for revenues. All calculations used a 12.5% discount rate.

In order to gauge the impact of changes in useful bin life, a system was analyzed which used bins having four year useful lives. All other system assumptions remained the same. The NPV, at a discount rate of 12.5%, of the system was \$-60,430. The IRR was 7.24%.

Summary

For the system identified there is potential to establish a successful pallet bin leasing system. The system is assumed to capture one-half of a market that includes cucumber/pepper handlers owning 21,000 bins and sweet potato packers owning 24,000 bins.

A replacement strategy is used which adds 1,500 bins per year to the system for seven years. After seven years a steady-state is achieved and maintained at 50% market penetration. Annual per bin revenues are \$18.92. For a 15 year operation the system has an NPV of

\$31,056.99 at a 12.5% discount rate, and an IRR of 15.46%. The changes in system NPV that result from changes in revenues and freight, repair, management, and purchase costs are shown. A system using bins with useful lives of four years is also analyzed.

The system could be implemented by a pallet or pallet bin manufacturer, as well as an area processor or grower. Any operator that already possessed some system requirement, such as repair facilities, a storage yard, or trucks suitable for hauling, would have a distinct advantage in system initiation.

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Table 1. Summary of bin leasing system assumptions.

Purchase Price (delivered)	\$40.00/bin
Bin Life	7 years
System Size	1500 bins
Annual Repair Cost	
Year 1	\$.50
Year 2	\$.75
Year 3	\$1.25
Year 4	\$1.75
Year 5	\$2.00
Year 6	\$2.00
Year 7	\$2.00
Transportation Cost	\$1.70/loaded mile
Average Haul Distance	50 miles
Insurance Cost	1% of replacement cost
Property Tax	1% of assessed value
Yearly Management Costs	\$30,000
Income Tax Rate	42%
Revenues from Cucumber Processors	4 months @ \$3.17/bin/month
Revenues from Sweet Potato Processors	8 months @ \$.78/bin/month

Table 2. Costs and revenues by year for multi-year system start-up (all values in dollars).

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Years 8-14	Year 15
Investment:	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	0
Revenues:	4,680	33,060	61,440	89,820	118,200	146,580	174,960	198,660	198,660
Bin Use Costs:									
Repair Cost:		750	1,875	3,750	6,375	9,375	12,375	15,375	15,375
Freight Cost:		2,720	5,440	7,990	10,710	13,430	15,980	17,340	18,700
Insurance Cost:	600	1,200	1,800	2,400	3,000	3,600	4,200	4,200	4,200
Property Taxes:	600	1,114	1,504	1,773	1,923	1,983	2,043	2,043	2,043
Management Cost:	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Total Bin Use Costs:	31,200	35,784	40,618	45,913	52,008	58,388	64,598	68,958	70,318
Before Tax Cash Flow:	-26,520	-2,724	20,821	43,907	66,192	88,192	110,362	129,702	128,342
Depreciation:	8,550	21,090	33,060	45,030	57,000	57,000	57,000	57,000	0
Salvage Value:									132,270
Taxable Income:	-35,070	-23,814	-12,239	-1,123	9,192	31,192	53,362	72,702	128,342
Taxes:	0	0	0	0	3,861	13,101	22,412	30,535	53,904
Investment Tax Credit:	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	-12,000
After Tax Cash Flow:	-65,791	-46,722	-28,038	-9,621	8,332	21,092	33,950	45,167	194,709

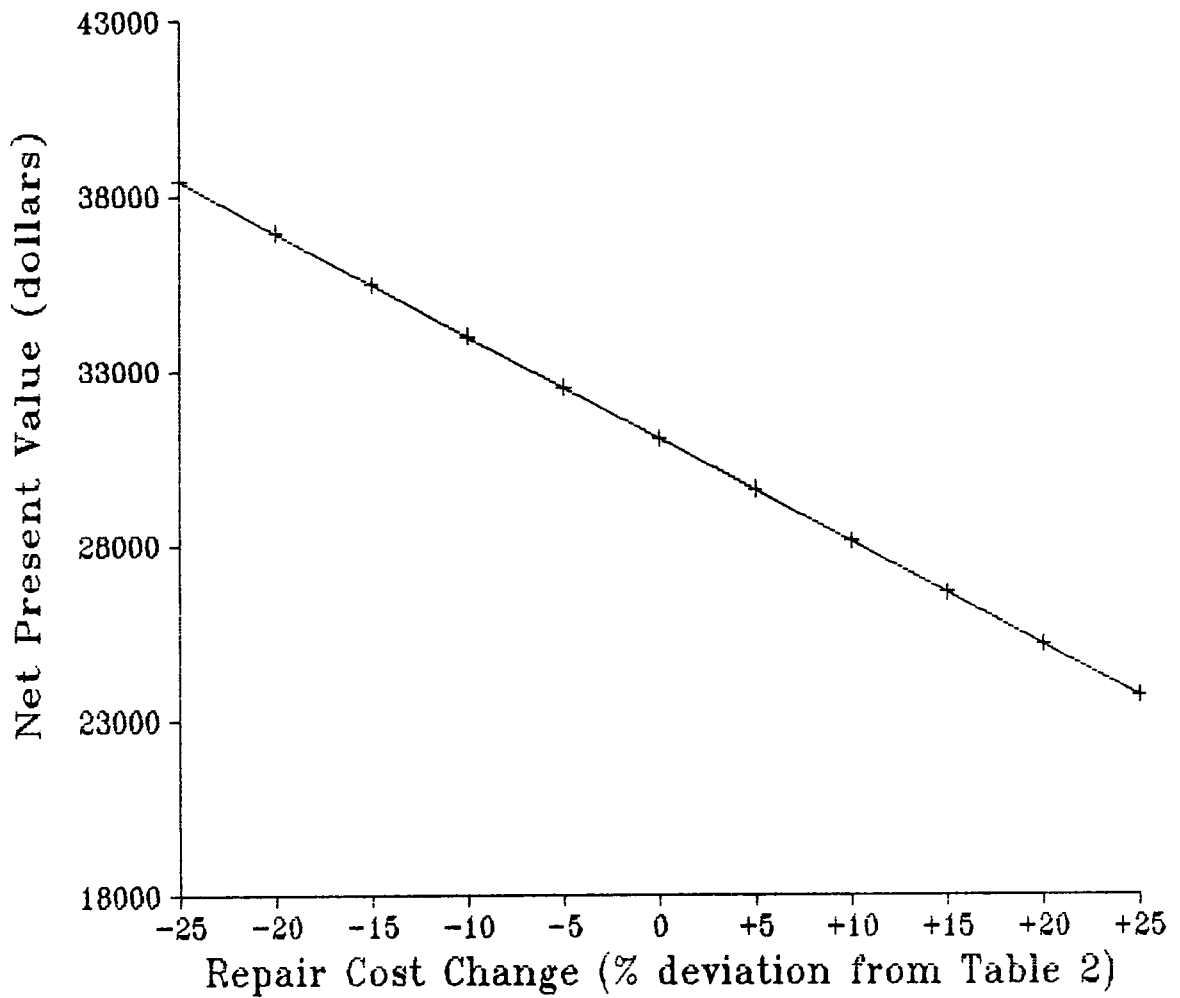


Figure 1. The effect of repair cost changes on NPV for a 15 year pallet bin leasing system, all other variables are constant at values shown in Table 2, discount rate is 12.5%.

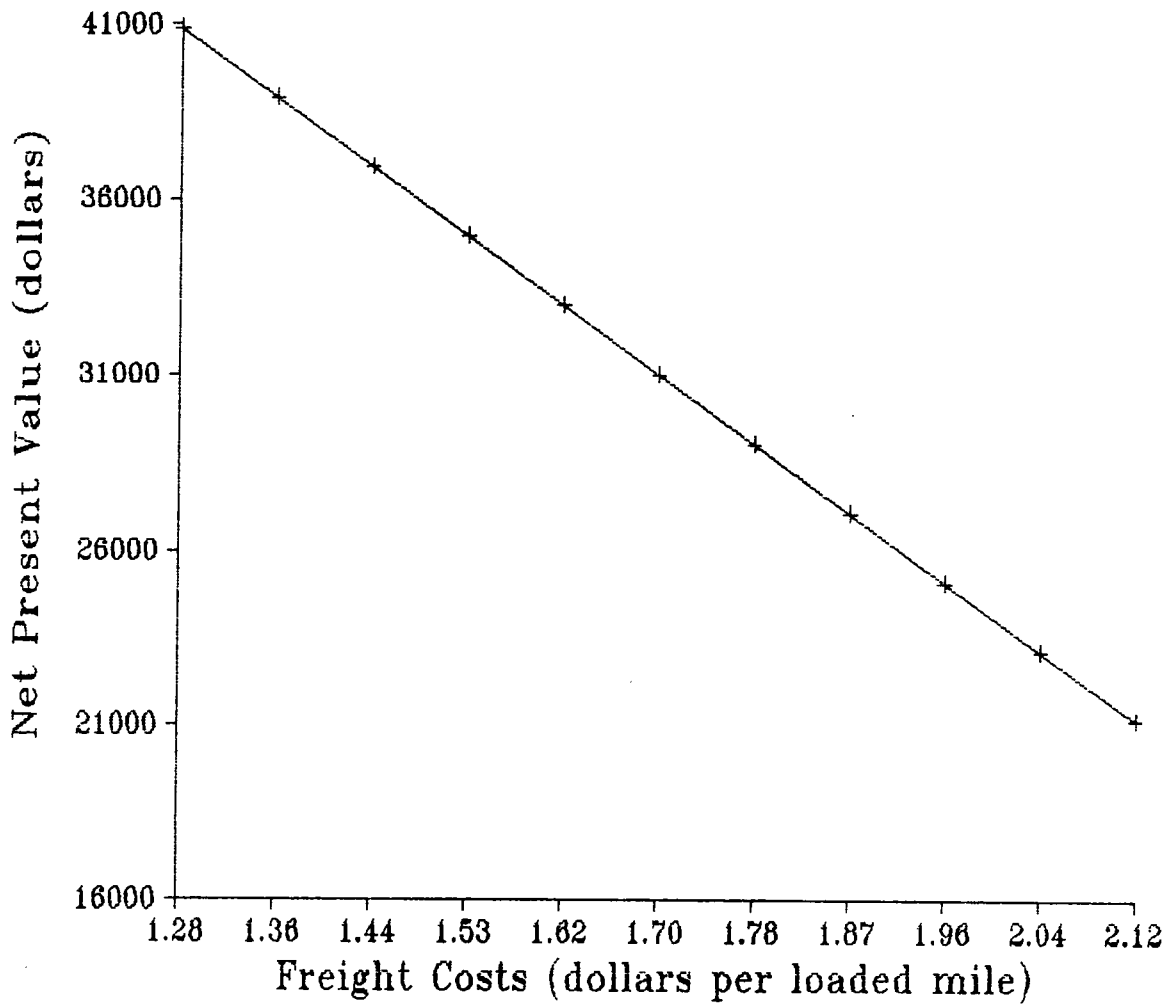


Figure 2. The effect of freight cost changes on NPV for a 15 year pallet bin leasing system, all other variables are constant at values shown in Table 2, discount rate is 12.5%.

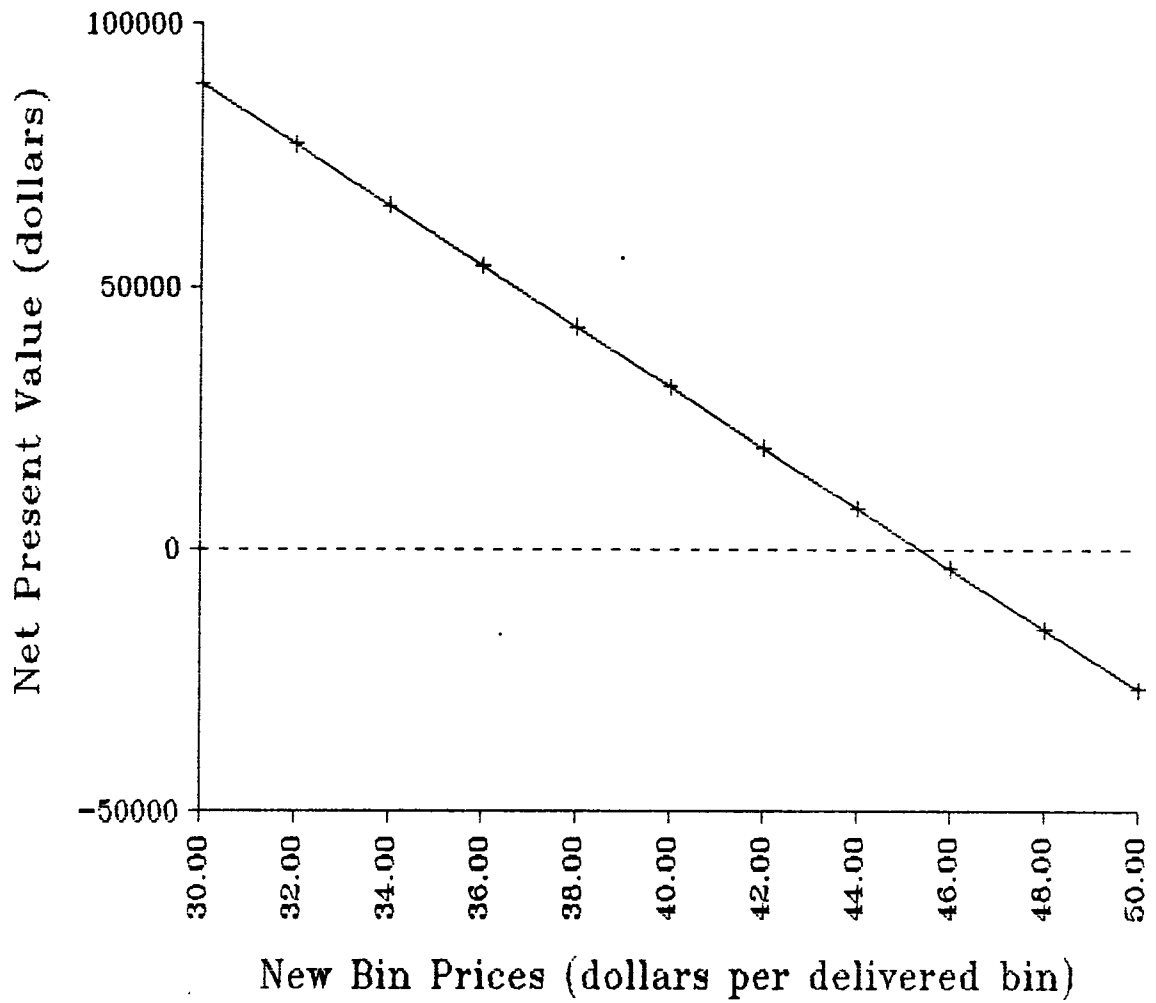


Figure 3. The effect of new bin purchase price changes on NPV for a 15 year pallet bin leasing system, all other variables are constant at values shown in Table 2, discount rate is 12.5%.

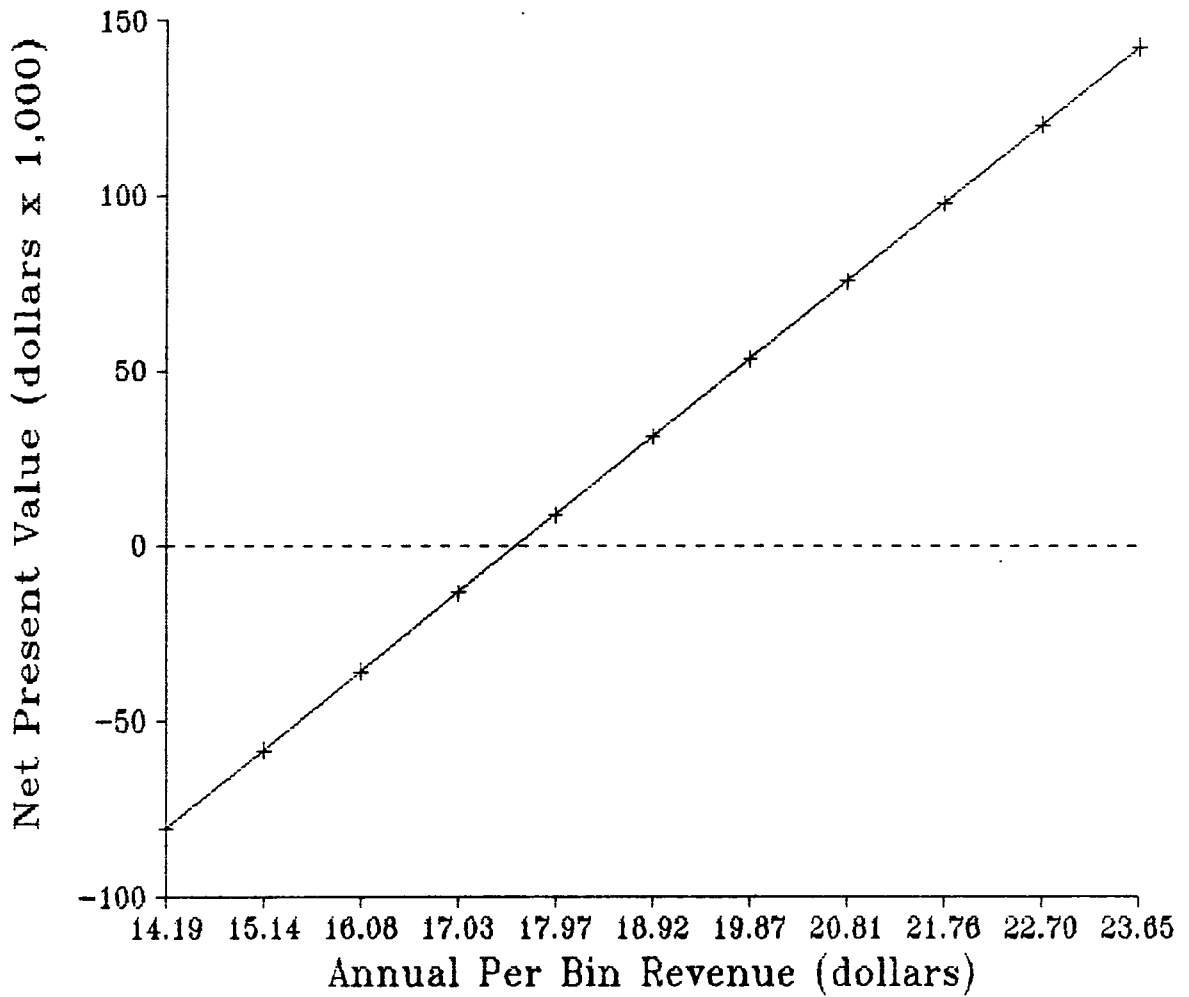


Figure 4. The effect of revenue changes on NPV for a 15 year pallet bin leasing system, all other variables are constant at values shown in Table 2, discount rate is 12.5%

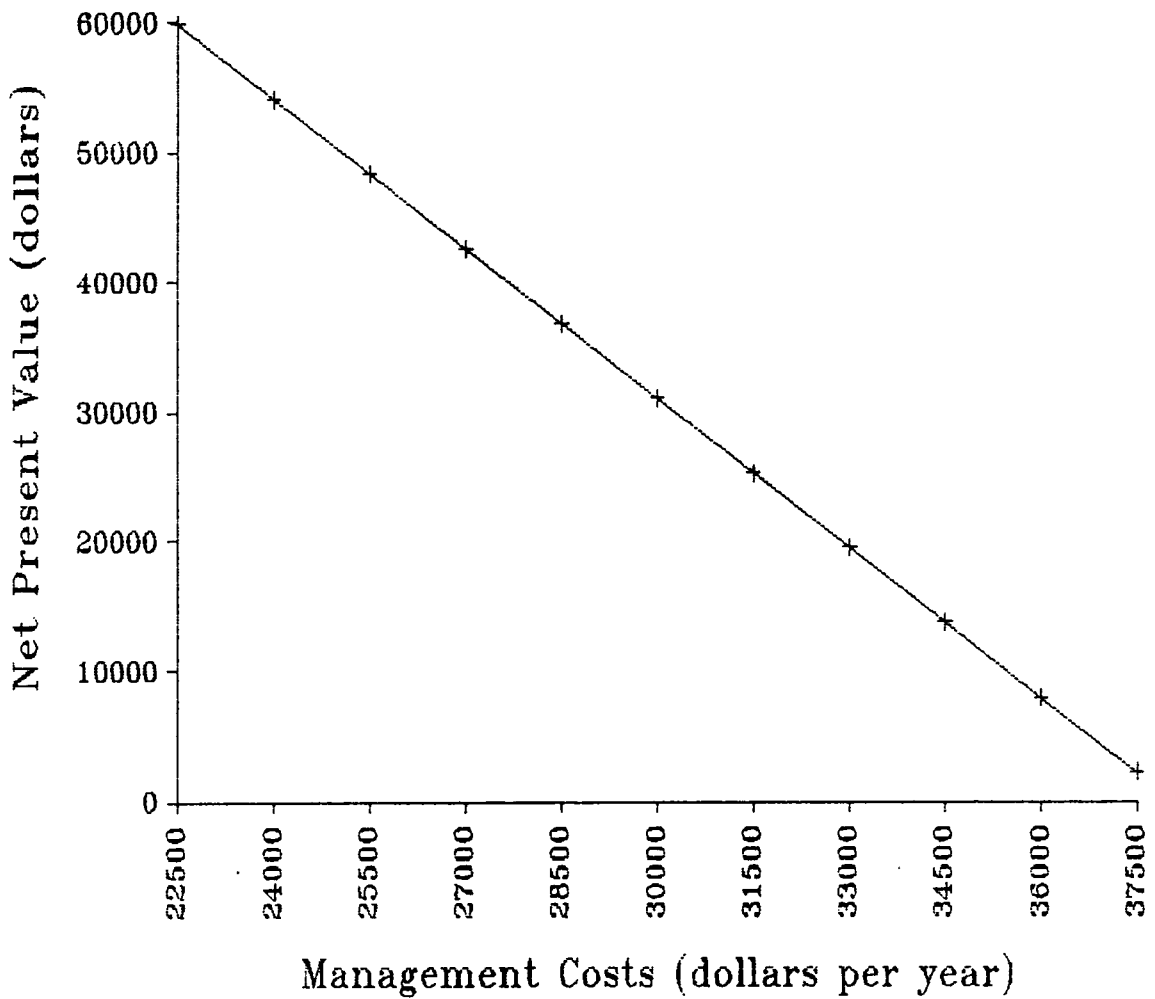


Figure 5. The effect of management cost changes on NPV for a 15 year pallet bin leasing system, all other variables are constant at values shown in Table 2, discount rate is 12.5%.

SUMMARY AND CONCLUSIONS

The feasibility of establishing a successful wooden pallet bin leasing system among agricultural bin users in the eastern U.S was explored. In hopes of coming to a decision on the overall objective, the research sought to fulfill three sub-objectives:

1. To develop a current comprehensive data base of pallet bin use statistics, methods, and costs through review of available literature, surveys, and personal visits.
2. To identify locations possessing potential as leasing system sites and to select the best such site and a penetration strategy by which to develop the market.
3. To determine the potential for profitable operation of a leasing system in the specified area.

The review of secondary information sources provided a solid background in the methods of, and justifications for, wooden pallet bin use. The literature revealed which crop varieties were handled in bins, what bin designs were used, and what the recognized advantages and disadvantages of bin use were.

Unfortunately, the bulk of the literature sources were slightly dated, originated on the west coast, or dealt with potential bin use rather than current use. In an attempt to develop a more current pool of information concerning actual bin use, it was decided that a mailed survey of pallet bin users would be conducted.

Questionnaires (Appendix 1) were sent to 333 fruit and vegetable processors in 18 states. One hundred fifty processors responded to the survey, for an overall response rate of 45%. Sixty of the respondents were bin users.

The survey succeeded in providing the current data base required. The respondents listed 20 crop varieties that were transported and/or stored in pallet bins. Most of the bins were made of hardwood lumber, designed to hold about 1,100 pounds, and had an average price of \$36.53.

The average bin was idle 6.8 months per year. Uses per year, derived from reported months of use per year and the reported length of time that the corresponding crop remained in the bins, were found to have a stronger effect on bin life than any related characteristics such as price or storage environment. Bin lives of over seven years were reported by 55% of the firms.

The total number of bins owned by responding companies was 883,901. The total bin ownership in the survey area was estimated to be at least 1,962,260 bins.

The survey also revealed that while bin use is widespread and the market is fairly large, bin owners consider several aspects of bin use to be troublesome. The majority of owners agreed that bin repair, empty transport costs, initial purchase price, and monitoring time required were all problem areas of bin use.

The identification of potential system areas was based upon information provided by the users survey, the Census of Agriculture, and other state and federal sources. Based on the judgement criteria outlined in the report, the Eastern North Carolina system was selected as the site having the greatest potential for successful bin leasing.

Of the penetration techniques discussed, straight rental, buy-in and rental, replacement and rental, and large firm buy-in, the replacement and rental strategy was selected as the most appropriate for the area chosen. The use characteristics and market structure in the Eastern North Carolina area are well matched to the replacement and rental method's advantages.

The Eastern North Carolina system caters to cucumber/pepper processors and sweet potato packers. Cucumber/pepper firms contacted that would be able to participate owned a total of 21,000 bins. Sweet potato companies owned 24,000. The total ownership of bins in the area, for firms able or not able to lease in the system, is approximately 95,000.

Important costs were estimated based on telephone and personal interviews of resident bin users. A \$40 bin price is estimated, as are a seven year life, increasing repair costs, a \$1.70/mile freight rate, and \$18.92 per bin yearly revenues.

A 15 year system that established a steady-state operation at a 50% share of the available market after seven years of 1,500 bins-per-year growth was analyzed. Calculated NPV was \$31,056.99 at a discount rate of 12.5%.

A 10% change in bin repair costs resulted in a 9.5% change in final system NPV. A similar change of 10% of the original values caused changes in final NPV of 12.7% for freight costs, 74.3% for new bin prices, 37.2% for management costs, and 143.7% for revenues. A

system using bins with four year lives rather than seven year lives had an NPV of \$-60,430 at the 12.5% discount rate.

The economic analysis provided in this report represents an academic analysis of a theoretically designed system. It must be understood that despite conscientious research effort, there may be estimates in this analysis that are less than accurate or represent a single value of a highly variable characteristic. The conclusions which could be drawn from the information in this document should therefore be considered carefully, and any actions based on the information should be undertaken with caution.

RECOMMENDATIONS FOR ADDITIONAL RESEARCH

1. Conduct studies to investigate the durability, in terms of actual life span, of wooden pallet bins currently in use.
2. Investigate the relationships between bin design and actual bin life.
3. Research the use of and potential uses for pallet bins made of materials other than wood.
4. Analyze the problem of establishing realistic values for pallet bin repair costs.
5. Investigate uses for pallet bins other than agriculture, and determine the potential for including those users in a leasing system.

APPENDIX 1

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
DEPARTMENT OF FOREST PRODUCTS
PALLET BIN SURVEY

1. Please indicate your position in the company.

2. Do you use pallet bins?

☐ yes 60 positive responses

☐ no 90 negative responses

→ If no, please stop here and return the survey in the postpaid envelope.

3. Please rank the crops processed in your last fiscal year which were transported in pallet bins. Rank from largest physical volume to smallest physical volume.

1. 20 varieties, listed in text (largest volume)

2. _____

3. _____

4. _____ (smallest volume)

Answer the following questions in terms of your largest volume crop listed in number 1 above.

4. What month(s) does harvesting occur?

☐ January

☐ February

☐ March

☐ April

☐ May

☐ June

☐ July Some crop harvested
☐ August during each month of
☐ September the year somewhere in
the research area.

☐ October

☐ November

☐ December

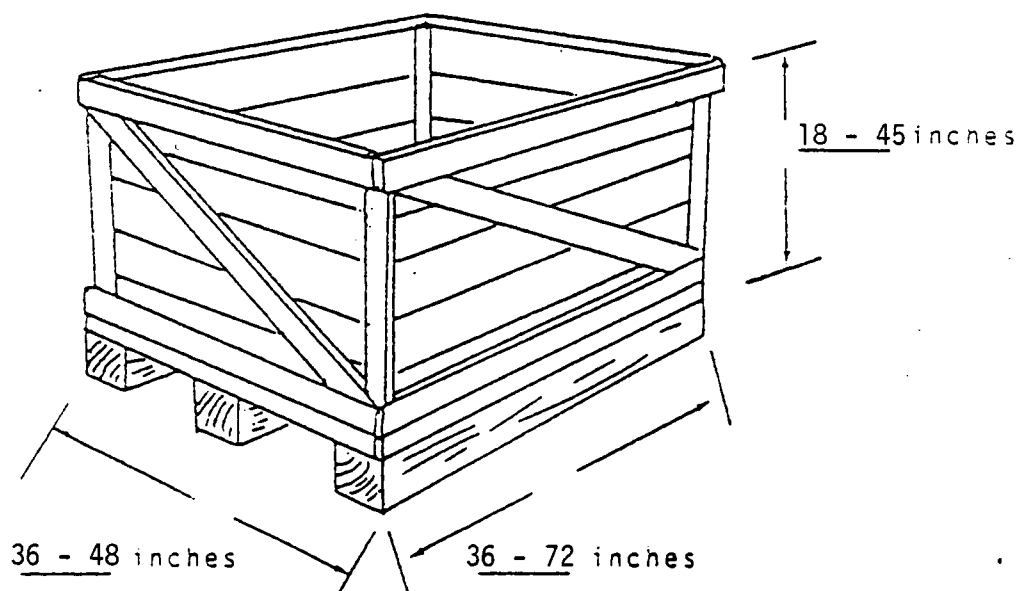
5. How long does the crop remain in bins? 59 responses

- ☐ Up to 1 week 40.68%
- ☐ 1 week to 1 month 11.86%
- ☐ 1 month to 4 months 22.03%
- ☐ 4 months to 1 year 25.42%
- ☐ don't know

6. Approximately how many months of the year are your bins empty and idle? Average = 6.8, Range is 0 - 11, Standard Deviation = 2.4

7. How many pounds of crop will a fully loaded bin hold? Average = 1104.3,

8. Please fill in the dimensions of the bin you currently use. Standard Deviation = 502



9. What is the wall material of the bins you use? 59 responses

- ☐ plywood 22.03%
- ☐ boards 92.53%
- ☐ other (please specify) 5.08%, plastic, cardboard

Note: Continue to answer the following questions (10-21) in terms of the bins you use for your largest volume crop.

10. Please indicate if the bins you use are chemically treated. 58 responses

- ☐ no treatment 47 responses
- ☐ fungicide 2 responses
- ☐ wood preservative 8 responses
- ☐ insecticide or pesticide
- ☐ disinfectant
- ☐ other (please specify) One respondent used painted bins

11. Do the bins you use collapse for shipping empty?

- ☐ yes 4 responses
- ☐ no 56 responses

12. Are the bins used more than once before disposal?

- ☐ yes 58 responses
- ☐ no 0 responses
- ☐ don't know 0 responses

13. Which of the following handling methods do you use for bins? 60 responses
(Check all that apply.)

- ☐ fork lift devices 98.33%
- ☐ bin wall grasping devices 11.67%
- ☐ water emersion unloading 6.67%
- ☐ other (please specify) Hydraulic Dumpers

14. For which of the following functions do you use pallet bins? 45 responses

- ☐ Transporting the crop from harvest in field to a repacking facility. 35.56%
- ☐ Transporting the crop from a repacking facility to the processor. 35.56%
- ☐ Transporting the crop from field to processor. 84.44%

(Storage only, 6.67%)

15. What is the total number of full bins you received for processing in your last fiscal year? Average = 44,803, Median = 12,200, 49 responses

16. Do you own all of the bins you currently use? 60 responses

☐ yes 31 responses

☐ no 29 responses

→ If no, please indicate your sources for bins (i.e., growers, rentals, leasing).

Growers were by far the greatest outside source of bins.

17. Are you involved in any bin exchange system, where bins are exchanged, empty or full, without provision for the return of the identical bin?

☐ No No real exchanges were revealed.

☐ Yes

→ If yes, who is involved in the system?
(Check all applicable)

☐ Growers

☐ Transporters

☐ Processors

☐ Other (please specify) _____

If you do not own any bins, please stop here and return the survey in the postpaid envelope. If you own any bins, please continue to answer questions 18-21 in terms of the bins you use for your largest volume crop.

18. How many bins do you own? Average = 16,369, Median = 2,000, 54 responses

19. In your last bin purchase, what was the purchase price per bin?

\$_____per bin Average = \$36.53, Median = \$34.00, 48 responses

20. What is the useful life of a bin in your operation? 44 responses

- ☐ 1 month to 1 year 0
- ☐ 1 to 2 years 5.26%
- ☐ 2 to 3 years 7.89%
- ☐ 3 to 4 years 15.79%
- ☐ 4 to 5 years 10.53%
- ☐ 5 to 6 years 5.26%
- ☐ 7 years or longer 55.26%

21. How do you store your bins, when not in use? 54 responses

- ☐ indoors 42.59%
- ☐ covered outdoors 18.52%
- ☐ outdoors uncovered 64.91%

The following questions pertain to your operation and bin use in general. Please answer in terms of your total operation.

22. Do you use bins for anything other than transporting or storing crops? 56 responses

- ☐ no 51 responses
- ☐ yes; please explain 5 responses, used for trash and cans and lids

23. What were your total sales in your last fiscal year? 36 responses

- ☐ under \$2,000,000 11.11%
- ☐ \$2,001,000 to \$5,000,000 16.67%
- ☐ \$5,001,000 to \$10,000,000 19.44%
- ☐ \$10,001,000 to \$20,000,000 11.11%
- ☐ above \$20,000,000 41.67%

Please indicate the extent to which you agree or disagree with the following statements by placing a check mark in the appropriate column.

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree	Total Responses
24. Bin repairs are a problem	<u>44.44%</u>	<u>33.33%</u>	<u>11.11%</u>	<u>11.11%</u>	<u> </u>	54
25. Transporting empty bins is expensive	<u>49.05%</u>	<u>35.85%</u>	<u>11.32%</u>	<u>3.77%</u>	<u> </u>	53
26. Purchasing of bins represents a significant investment	<u>58.93%</u>	<u>37.50%</u>	<u>1.79%</u>	<u>1.79%</u>	<u> </u>	56
27. Significant amounts of management time are required to monitor bins	<u>24.56%</u>	<u>35.09%</u>	<u>12.28%</u>	<u>24.56%</u>	<u>3.5%</u>	57
28. If leasing or renting bins would reduce the investment of money and/or management time in bins, it would be a strong alternative to bin ownership	<u>25.93%</u>	<u>40.74%</u>	<u>14.81%</u>	<u>18.52%</u>	<u> </u>	54

Thank you for your cooperation. Please return the survey in the postpaid envelope. If you would like a copy of the results, please fill in your name and address below or send a post-card with your name and address to Mr. Tom Garrahan at the address shown on the enclosed return envelope.

(Name)

Company

(Mailing Address)

(City and State and Zip Code)

APPENDIX 2

North Texas System packers and processors

1. Barrett-Fisher Company
P. O. Box 750
Hereford, Texas 79045

(potatoes, onions)
2. Blue Ribbon Produce Co. of Texas, Inc.
P. O. Box 1099
Dimmitt, Texas 79027

(broccoli, cabbage, carrots, cantaloupe, honeydew, cucumbers, onions)
3. Dimco Industries, Inc.
P. O. Box 799
Dimmitt, Texas 79027

(onions, potatoes)
4. Ken Gray Produce
P. O. Drawer A
Lorenzo, Texas 79343

(onions, peppers)
5. R. B. Todd Produce Company, Inc.
P. O. Box 6163
Lubbock, Texas 79493-6163

(onions, peppers, cantaloupe, dry beans and peas)
6. Tri-Frye Brand
P. O. Box 2172
Hereford, Texas 79045

(cabbage, onions, carrots, lettuce)
7. Griffin and Brandt Company
Hereford, Texas 79045

(potatoes, onions, carrots, cantaloupe)

APPENDIX 3

South Texas System packers and processors

1. Henry J. Berry Co.
P. O. Box 1687
Uvalde, Texas 78801

(cabbage, carrots, watermelon, onions, cantaloupe)
2. Joe Byrd Produce
P. O. Box 662
Crystal City, Texas 78839

(cabbage, peppers, spinach, kale, greens, onions)
3. Cargil Produce Co.
P. O. Box 1146
Uvalde, Texas 78801

(lettuce, cabbage, carrots, onions, cantaloupe, cucumbers, peppers)
4. Del Monte
Crystal City, Texas 78839

(green beans, beets, carrots, onions, potatoes, spinach)
5. Frio Foods
Uvalde, Texas 78801

(broccoli, carrots, squash)
6. W. C. Jacob
P. O. Box 269
Uvalde, Texas 78801

(spinach, kale, collards, parsley)
7. T. J. Power & Co.
P. O. Box 126
Carrizo Springs, Texas 78834

(carrots, onions, cabbage, lettuce, potatoes)

8. Otto Strube Farms
P. O. Box 1417
Uvalde, Texas 78801

(cabbage, onions)

9. Van de Walle Farms, Inc.
5342 Highway 90 West
San Antonio, Texas 78227

(carrots, cabbage, onions, potatoes, cucumbers, peppers)

10. Winter Garden Growers, Inc.
P. O. Box 1418
Uvalde, Texas 78801

(carrots, cantaloupe, onions, cabbage)

APPENDIX 4

Rio Grande System packers and processors

1. A-W Produce Company
P. O. Box 685
Mercedes, Texas 78570

(avocados, greens)
2. Black & White Vegetable Co., Inc.
1220 W. Hiway 83
Alamo, Texas 78516

(cucumbers, peppers, squash, limes)
3. Crest Fruit Co.
100 N. Tower Rd.
Alamo, Texas 78516

(citrus)
4. Donna Fruit Co., Inc.
P. O. Box 487
Edinburg, Texas 78539

(citrus)
5. Edinburg Fruit & Vegetable Co., Inc.
P. O. Box 929
1009 N. Closner
Edinburg, Texas 78539

(cucumbers)
6. Elmore and Stahl, Inc.
P. O. Drawer 730
Pharr, Texas 78577

(broccoli)
7. Griffin & Brand of McAllen, Inc.
P. O. Box 1840
McAllen, Texas 78501

(carrots)

8. Lake Delta Citrus Association
P. O. Box 1
Weslaco, Texas 78596

(citrus)

9. J. S. McManus Produce Co., Inc.
P. O. Box 568
Weslaco, Texas 78596

(broccoli, peppers, turnips, beets, greens, carrots)

10. Marvin Schwarz Produce
P. O. Box 152
Mercedes, Texas 78570

(citrus)

11. Mission Shippers, Inc.
P. O. Drawer 471
Mission, Texas 78572

(citrus)

12. Plantation Produce Co.
P. O. Box 1043
Mission, Texas 78572

(broccoli, peppers, cauliflower, celery, cabbage)

13. Pride of the Citrus of Texas
P. O. Box 99
Mission, Texas 78572

(citrus)

14. Rio Fresh, Inc.
P. O. Box 968
San Juan, Texas 78589

(broccoli)

15. Rogers & Sons, Inc.
P. O. Box 1088
Donna, Texas 78537

(citrus)

16. South Texas Citrus Association
2302 North Closner
Edinburg, Texas 78539

(citrus)

17. Teddy Bertuca Co.
P. O. Box 217
McAllen, Texas 78501

(broccoli)

18. Top Tex, Inc.
Rt. 1, Box 371 B
Mission, Texas 78572

(citrus)

APPENDIX 5

Eastern North Carolina System packers and processors

1. Bardin Brothers Produce Company
Route 5
Wilson, North Carolina 27894

(sweet potatoes, cucumbers)
2. Bruce Foods Corporation
P. O. Box 2043
Wilson, North Carolina 27893

(sweet potatoes, white potatoes)
3. Campbell Soup Co.
Rt. 2, Box 98
Maxton, North Carolina 28364

(carrots, white potatoes)
4. H. P. Cannon & Sons, Inc.
P. O. Box 1507
Dunn, North Carolina 28334

(peppers)
5. Charles F. Cates & Sons, Inc.
P. O. Box 158
Faison, North Carolina 28341

(cabbage, cucumbers, peppers, tomatoes)
6. Godwin Product Company, Inc.
P. O. Box 163
Dunn, North Carolina 28334

(sweet potatoes)
7. Goodson Farms
P. O. Box 106
Turkey, North Carolina 28393

(grapes, sweet potatoes)

8. Gray Cucumber Co.
P. O. Box 1136
Robersonville, North Carolina 27871

(cucumbers)
9. Harnett Produce Company, Inc.
P. O. Box 1171
Dunn, North Carolina 28334

(cucumbers, sweet potatoes)
10. Odell Jackson Produce Company
Rt. 5
Dunn, North Carolina 28334

(sweet potatoes)
11. James Brothers, Inc.
Route 4
Elizabeth City, North Carolina 27909

(cabbage, white potatoes)
12. Frank Jennings, Jr.
Route 4
Elizabeth City, North Carolina 27909

(sweet potatoes)
13. Joan of Arc Co.
Turkey, North Carolina 28393

(asparagus, sweet potatoes)
14. Nash Produce Company
Rt. 3, Box 231
Nashville, North Carolina 27856

(cucumbers, sweet potatoes)
15. Sampson Produce Company, Inc.
Route 2, Box 352-A
Clinton, North Carolina 28328

(cucumbers, peppers, sweet potatoes)

16. G. E. Small & Sons, Inc.
Route 1, Box 360
Elizabeth City, North Carolina 27909

(cabbage, white potatoes)

APPENDIX 6

Delmarva System growers, packers, and processors

1. Ashby Produce Co.
Exmore, Virginia 23350

(sweet potatoes)
2. Byrd Foods, Inc.
Box 318
Parksley, Virginia 23421

(cucumbers, sweet potatoes, tomatoes)
3. Clifton Canning Co.
R. D. #1, Box 149
Milton, Delaware 19968

(beans, potatoes, tomatoes)
4. D. Parke Custis & Son
P. O. Box 237
Nassawadox, Virginia 23413

(cucumbers, white potatoes)
5. Draper Foods, Inc.
Box 299
Milford, Delaware 19963

(beans, carrots, peas)
6. Draper-King Cole, Inc.
Box 218
Milton, Delaware 19968

(beans, carrots, potatoes, squash)
7. Duer Produce Farms, Inc.
Painter, Virginia 23420

(cucumbers, peppers, potatoes)

8. Fred Hall & Sons
Hallwood, Virginia 23359

(sweet potatoes, white potatoes)
9. Curtis Jones, Jr.
Franktown, VA 23354

(cucumbers)
10. P. C. Kellam & Sons
P. O. Box 366
Exmore, Virginia 23350

(cucumbers, white potatoes)
11. Kings Creed Canning Co., Inc.
P. O. Box 206
Princess Anne, Maryland 21853

(tomatoes)
12. Laban
Box 266
Atlantic, Virginia 23303

(beans, white potatoes)
13. Thomas B. Long & Sons, Inc.
Cape Charles, Virginia 23310

(cucumbers, sweet potatoes)
14. Northampton Growers, Inc.
Box 248
Cheriton, Virginia 23316

(white potatoes, spinach)
15. Nottingham Bros., Inc.
Nassawadox, Virginia 23413

(cucumbers, sweet potatoes)
16. C. J. Prettyman, Jr., Inc.
Exmore, Virginia 23350

(cucumbers, peppers)

17. San Del Packing Co., Inc.
R. D. 1, Box 238
Camden-Wyoming, Delaware 19934

(cucumbers, peppers)

18. J. G. Townsend, Jr. & Co.
Box 430
Georgetown, Delaware 19947

(beans, peas)

19. Whiteford Packing Co., Inc.
2419 Whiteford Road
Whiteford, Maryland 21160

(carrots, sweet potatoes)

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