THESIS

A Comparison of Two Methods of Selecting and Packing Cut Carnations - A Cost Analysis

Submitted by

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WE HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER OUR SUPERVISION BY John Logan Heinzelman

ENTITLED A COMPARISON OF TWO METHODS OF SELECTING AND PACKING CUT CARNATIONS - A COST ANALYSIS

BE ACCEPTED AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE.

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Chapter I

INTRODUCTION

> "There is much to be said for research of the pinpointing type, for each research result that is sound helps to improve the strength of the marketing structure. Many research studies provide answers to problems which, in turn, open up new problems. Research in every field is cumulative. The more we find out about any subject through research the larger is our stockpile of knowledge to solve new problems as they arise." (Joseph G. Knapp). (9:393)

The accelerated rate of technological progress of the last 50 years is evidence of the opportunities available to any industry to perform work more efficiently. Innumerable innovations are available today for industrial use. With such opportunity one would expect the methods of any industry to be characterized by change. Yet in many segments of industry, operations are being performed much the same today as they were 20 or 30 years ago. This seems to be the situation with the carnation industry and possibly the entire cut flower industry. If this is true improved efficiency is possible with the application of existing ideas.

Background

The cut flower industry is a sizeable enterprise and carnations are responsible for a major share of the gross sales. The wholesale value of carnations, chrysanthemums, gladiolus, and roses sold in 1957 by ten selected states[1] amounted to $58 million. Carnations accounted for $15.5 million of the sales. Colorado sold $5.8 million or 10 percent of the wholesale value of the four cut flowers. Five million dollars of the sales in Colorado (Approximately 86 percent) were cut-carnations.

The three largest wholesale firms in the Denver area accounted for more than 90 percent of the total sales of cut carnations in Colorado. The data for this study were obtained from two of the above firms. Their sales accounted for approximately 45 percent of the total carnations sold in Colorado.

While carnations account for the largest share of their sales, the Denver wholesalers supply a complete line of cut flowers, potted plants, and floral supplies. Carnations are supplied to the wholesalers largely by

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[1] California, Colorado, Florida, Illinois, Iowa, Michigan, New York, Ohio, Oregon and Texas.

growers under a contractual agreement. The wholesaler agrees to take the entire production of the grower and get the best possible returns for the products, and in turn the grower agrees to supply his entire crop to the wholesaler. The grower receives payment for the amount of his product marketed, less the commission charged by the wholesale house.

The carnations when received by the wholesaler, have been graded, tagged, and bunched by the grower. Upon receipt the carnations are checked to insure that grading standards have been met. The carnations are then credited to the grower and put into either short or long term storage.

Orders are received daily by the wholesalers through their sales force or directly from the retailer or jobber by mail, teletype, telephone or personal visit. The orders are booked, acknowledged, and posted to the daily order sheet.

The order sheet is forwarded to the packing room of the wholesale house. The selectors select carnations from short term storage for shipment in accordance with the daily order sheet as modified by current circumstances. As the order is assembled the shipment

is invoiced. The customer's copy of the invoice is placed within the container and the wholesaler's copy becomes a record of shipment and a receivable account.

When the orders are packed they are delivered to the airline, bus company, truck company or picked up by the railway express for shipment to their ultimate destination. The individual house schedules the shipments in accordance with transportation timetables and the customers' requirements.

Problematic Framework

The problematic framework of this study is to be found within the objectives of the Colorado contributing project to Federal project WM-24 which is entitled, "Increasing the Efficiency in the Methods of Marketing Cut Flowers and Other Specialty Crops."

The objectives of the Colorado project are as follows:

1. To develop more reliable and effective methods of packing cut flowers for shipment.
2. To develop efficiency in the packing operations.

3. To discover conditioning treatments and handling techniques which will maintain quality and prolong flower life in marketing.

4. To develop an efficient wholesale marketing plant model.

This study is primarily concerned with contributing to objectives 1 and 2 and establishing a starting point for the evolution of objective 4.

Scope of the Study

The combined objectives of this study and the objectives of the Colorado contributing project to Federal project WM-24 could all be included within a broader objective; the development of an efficient marketing operation. The development of an efficient marketing operation would necessitate the analysis of all of the following operations and procedures:

1. Receiving
2. Grading
3. Storage
4. Selection
5. Packing
6. Shipping

7. Office Procedure

While familiarization with and cursory analysis of all of the above phases is necessary due to their interrelationships, the construction of the entire efficient marketing operation is beyond the scope of this thesis.

Preliminary analysis of the entire wholesale operation led the author to the opinion that a detailed study of the selection and packing procedures would lead to fruitful results. Having thus chosen a more specific and manageable area for analysis, the scope of this study has been limited to the selection and packing of cut carnations as performed by a typical Denver area wholesaler.

Objectives

The objectives of this study are:

1. To determine the material and transportation costs of the ice-pack and moist-pack shipping containers.
2. To determine the time requirements and labor costs of the original method of selecting and packing cut carnations for both the ice-pack and the moist-pack.

3. To develop a more efficient method of selecting and packing cut carnations.

4. To analyze the costs and determine the efficiencies of the above methods and packs.

Definition of Terms

Ice-pack: A floral shipping container that uses wooden cleats to hold the flowers in place and ice as a refrigerant to preserve the flowers.

Moist-pack: A floral shipping container that uses specially designed inserts to hold the flowers in place and polyethylene as a moisture barrier to preserve the flowers.

Moist-storage: A method of storing carnations, not in water or other liquid, in a low temperature, high humidity cooler.

Original method: A composite of procedures that exists or has existed within a typical wholesale house for the purpose of performing the various operations necessary to select and pack cut carnations. In this study two distinct original methods are examined. One method uses the ice-pack, the other uses the moist-pack.

Improved method: A proposed method of selecting and packing that is a composite of the moist-pack, moist storage, packing without tissue, and a revised selecting-packing procedure.

Operation: A broad term that designates an entire operation that is composed of more than one sub-operation or phase, e.g., packing operation or selection and packing operation.

Phase: This term designates a specific sub-operation that is one part of an entire operation. For example, the packing operation of the original method using the ice-pack is composed of the phases of packing, icing, and wrapping.

Miscellaneous: This term refers to all cut flowers other than carnations, potted plants, and floral supplies commonly sold by a carnation wholesale house.

Observed time requirements: The time requirements of the specific tasks that are measured in this study.

Unobserved time requirements: The time requirements of the various tasks of clean-up, supply, error correction, etc., that are not measured in this study.

Delay time: The time that the selecting and packing crews spend not working. Delay time does not include time out for long breaks for lunch or rest periods.

Total time requirements: The total of observed, unobserved, and delay time requirements.

300-pack: This term designates a floral shipping container with a mean capacity of 300 cut carnations. The term is used with both types of containers, e.g., 300 carnation capacity moist-pack shipping container.

Container: A receptacle for shipping flowers, composed of box and lid.

Typical carnation wholesale house: For the purpose of this study a wholesale house that markets 15,000,000 blooms per year divided one-third fancys, one-third standards, and one-third shorts is typical. On the basis of 300 working days per year this is a mean daily volume of 50,000.

Typical shipment: A container of 100 fancys, 100 standards, and 100 shorts for a total of 300 carnations per container.

Review of Literature

In the search for ideas applicable to the development of "An Improved Method" much literature on the efficiency of handling many commodities is available for review. Various reports have been issued on the handling of potatoes (4), milk (5), pears (6, 7), frozen food (12, 13) etc. Some of the findings of these reports have limited application to the handling of cut flowers. However, the selection and packing of cut carnations is a unique process with its own special problems and limitations. Consequently, while a review of the above literature is of value in establishing rapport with the general subject of efficient methods, the literature is of little assistance with the specific problems encountered in this study.

Information pertaining to the moist-pack shipping container was obtained from the bulletin by Hudek (8). The procedures of packing the ice-pack and moist-pack and the advantages and limitations of the moist-pack are to be found within this bulletin. Certain suggestions for further study of the bulletin have been followed in this thesis.

Reference material of a general nature has

been most useful in the analysis of this problem. Texts on efficiency and work simplification (1, 10, 14, 15), reports on the application of improved methods (2, 11, 19), studies on the physical limitations of carnations (16, 17, 21), and similar works constitute the nature of the previous work applicable to this study.

Chapter II

METHODS AND PROCEDURE

The problem has been limited in scope to the investigation of the efficiency of the selection and packing operations for carnations in a typical wholesale house.[1] During the course of this investigation two different shipping containers have been examined for efficiency and a revised method of selecting and packing was tested. The procedures of this study are those of an efficiency study modified to serve the specific requirements and limitations of the problem situation.

Hypotheses

Two hypotheses have been tested which embody the four objectives of the study. The fulfillment of the objectives provides the data necessary to examine the hypotheses. The two hypotheses are as follows:

1. The incorporation of the moist-pack

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[1] See page 12

shipping container, as compared with the ice-pack container, into the packing and shipping operations of a typical carnation wholesale house will result in improved efficiency in terms of lowered packing and transportation costs.

2. The incorporation of the improved method, as compared with the original method, into the selection and packing operations of a typical carnation wholesale house will result in improved efficiency in terms of lowered selection and packing costs.

Assumptions

Implicit in virtually every efficiency study is the assumption that no man, machine, or method has attained maximum efficiency.

The explicit assumptions of this study are as follows:

1. The efficiency of workers remains constant from worker to worker and between compared methods.

2. Presented costs are sufficiently realistic so that deviations from the actual costs would not alter the conclusions of this thesis.
3. Carnations do not require water while in short term storage at the wholesale house.
4. Any differences that may exist within the costs of equipment and/or overhead between methods are insufficient to nullify the findings of this study.

The Criterion of Efficiency

The criterion of efficiency employed in the examination of the hypotheses is cost. The costs incurred within the selecting and packing operations of a typical wholesale house can be classified into the costs of labor, materials, equipment, and overhead. Since there is little difference in the costs of equipment and overhead between methods these costs have been omitted from the analysis.

The cost of transportation has been included in the analysis of shipping container efficiency. This cost is not borne by the wholesaler and is therefore

not a true cost of selecting and packing cut carnations. However, transportation costs are of primary importance to the efficiency of a shipping container and could therefore not be omitted from the analysis.

Within the limits of this study, the efficiency of shipping containers is dependent upon the relative costs of transportation, labor, and materials of the two types of packs while the efficiency of methods is dependent upon the relative costs of labor of the methods.

Procedure

The first part of this study is an evaluation of the efficiency of the moist-pack as compared with the ice-pack shipping container. The second part is an evaluation of the improved method as compared with the original method of selecting and packing cut carnations. The study was divided into these two parts in order to separate the efficiencies of packs from the efficiencies of methods. In the comparison of the original with the improved method the efficiency attributable to packs will be included separately.

Comparison of the Moist-Pack and the Ice-Pack

The moist-pack shipping container brought about the first major changes in the methods used to pack Colorado flowers for shipment in 20 years. (8:1). Of the two wholesale houses studies, one has used the moist-pack exclusively for two years, the other uses the moist-pack and various forms of the ice-pack. Data were acquired from both houses on the two shipping containers.

The relative efficiency of the moist-pack had not been determined. Since the improved method tested in this study incorporates the use of the moist-pack it was necessary to determine its relative efficiency.

An efficient shipping container should require a minimum of labor, low material costs, and moderate transportation charges. The efficiency of the two packs has been determined on this basis. These costs (labor, material, and transportation) have been determined as follows:

1. Labor costs. Labor's share of the cost of packing a typical shipment has been determined by sub-dividing the entire process and timing each individual sub-operation. The time requirements

presented in this study are a composite of the individual time requirements of the sub-operations of the two houses studied. Once the time requirements were determined, typical wage rates were applied to determine the cost of labor per shipment.

2. Material costs. The costs of the materials used in packing both the ice-pack and the moist-pack have been obtained from the wholesale houses studied. These costs are presented as the unit costs of both a typical ice-pack and a typical moist-pack shipment.

3. Transportation costs. The shipping weight of typical railway express, air express, and air freight shipments of three sizes each of the ice-pack and the moist-pack have been determined. A common destination has been selected as representative, in terms of distance and locality, of a typical shipment. The appropriate shipping charges were

applied to the shipments to determine costs.

Comparison of the Original and Improved Methods

The efficiency of methods is dependent upon the efficient use of labor and the resultant costs of labor per shipment. The costs of materials and transportation and certain of the labor costs are directly associated with the shipping container used. As explained above they have been treated separately from the analysis of methods.

The time required to perform the operations essential to selecting and packing was determined for each method. From these observed time requirements the total time requirements were estimated. Wage rates were applied and the cost per container for typical shipments was determined. The conclusions were based upon these cost differences.

Chapter III

PRESENTATION OF DATA

The data necessary to examine the hypotheses of the study are presented within this chapter. Throughout the entire thesis measurements of distance are in feet, time measurements are in hundredths of a minute, and weight measurements are in pounds and/or ounces unless otherwise specified.

Material Costs

The cost of each item of material presented in this study is based upon the quantity of that material used to pack a 300 carnation capacity moist-pack or ice-pack shipping container. Certain materials such as insulation and ice vary in usage depending upon the season and distance of shipment. Since insulation is thought necessary against both heat and cold, and ice is used both as a refrigerant and a source of moisture the variation is not excessive. An estimated mean annual usage of materials has been used to determine the following costs.

Shipping Container: There are presently four sizes of the moist-pack container and eight sizes of the ice-pack container in use. A direct comparison of a specific size moist-pack and a specific size ice-pack was not made for no two existing containers are comparable in every respect. It was felt that their differences would be diminished somewhat by taking the arithmetic mean of the capacities and costs of the three most frequently used containers of each type. The result is a hypothetical container of each type capable of holding a maximum of 450 carnations with an average "in use" capacity of 300.

The details of the above determinations are presented in the following table:

Table 1.--Determination of the Average Capacities and Costs of Containers for the Ice-pack and Moist-pack.

Capacity		Ice-Pack		Moist-Pack	
Mean	Maximum	No.	Cost	No.	Cost
150	250	5F	.365	4C	.510
250	400	6F	.440	6C	.625
500	700	10F	.585	BAC	.785
900	1350	Total	1.390	Total	1.920
300	450	Mean	.463	Mean	.640

Accurate data of the total number of shipping containers and carnations shipped for a specified period were not available from either house studied. Estimates were made for these quantities by both houses for the moist-pack for one year. From these estimates it was possible to approximate both the mean number of carnations shipped per container and the mean cost of the containers for the moist-pack for a house shipping 15,000,000 blooms per year. The following was determined. The house would use 48,705 containers at a total cost of $31,587. This results in a mean of 308 carnations per container at a mean cost of $.649 per container. These results are nearly identical to the results obtained for the moist-pack shown in Table 1.

Polyethylene. A sheet of 1-1/2 mil polyethylene 6 feet wide and nine feet long is used as a moisture barrier in the 300 capacity moist-pack. One roll of polyethylene 6 feet wide is 960 yards long, weighs 104 pounds and costs $55.20. This is a cost of $.53 per pound or $.057 per yard. Three running yards weight 5.2 ounces and cost $.171.

Newspaper. Newspaper, used for insulation and moisture absorption, is available for three cents per pound.

Eighteen full sized sheets (23" X 33") make up a pound. The mean annual usage is as follows; two rolls of five sheets each are placed at the ends of the container to cushion the blooms, three sheets per pound of ice are used for moisture absorption and insulation, and six pads of five sheets each are included in the outer wrapping for insulation. This is a total of 64 sheets per container or 3.6 lbs. At three cents per pound the typical cost of newspaper used in a 300 capacity ice-pack is $.108 per container.

Waxed Tissue. White waxed floral tissue is used between the heads of each bunch of 25 carnations and is used to cover the stem ends. Fifteen (9 X 12) sheets are used per container of 300 carnations. At $.60 per ream this is a cost of $.018 per container.

Kim-pac. Two 16 inch strips of Kim-pac are used per container to pad the stems from the cleats in the ice-pack. A box of 1,430 lineal feet costs $16.06 or $.011 per foot. This is a cost of $.029 for the 32 inches necessary for the 300 capacity ice-pack.

Cleats. Wooden cleats are nailed to the center section of the ice-pack to hold the flowers in place, add strength, and form an ice chamber. The 300 pack uses

two 4 X 16 cleats at a cost of $5.34 per 100. This is a cost of $.107 per container.

Nails. A large head, roofing type nail is used to secure the cleats to the sides of the box in the ice-pack. An average of ten per 300 pack is used. The cost is $12.11 per 100 lbs. and there are 100 nails to the pound. This is a cost of $.012 per container.

Ice. Block ice is used at a cost of $.60 per 100 lbs.; the mean annual usage is approximately 8 pounds for the 300 capacity ice-pack. Loss of ice due to melting prior to use is an added cost of material estimated at 25 percent. The cost per unit is $.048 plus 25 percent or $.060.

Invoice and Label. Invoices cost $.70 per 100 and labels cost $.80 per 100. This is a cost of $.007 and $.008 respectively per box or a total of $.015 per container.

Twine. Two-ply twine is used to secure the container. A fifty-pound coil costs $14.50. This is a cost of $.29 per pound. Approximately three ounces of twine are used per 300 pack for the moist-pack. The cost is $.054 per container. Two and one-half ounces are used for the ice-pack at a cost of $.045 per container.

Glue. The typical wholesale house will use 125 gallons of glue per year at a cost of $2.00 per gallon for a total cost of $250. If the house ships 50,000 containers per year the cost per container is $.005.

Kraft. Kraft wrapping paper used in the ice-pack costs $.10 per pound. Nine ounces are used in the typical 300 pack at a cost of $.056 per container.

Transportation Costs

The shipping rates of railway express, air express and air freight from Denver, Colorado to Birmingham, Alabama have been applied to the appropriate weights of three ice-pack and three moist-pack shipping containers. The containers used for the comparison are presented in Table 3. The Denver to Birmingham shipment was selected as representative, in terms of distance and locality, of a typical shipment.

The express charges cover the entire cost of transportation from wholesaler to jobber or retailer. The air freight rates do not include delivery to and from terminals. The cost of delivery to the Denver terminal will be excluded from the analysis and the Birmingham delivery will be included at an estimated common carrier rate of $.75 per 100 pounds and a

Table 2.--Summary of the Material Costs for the Ice-Pack and the Moist-Pack Shipping Containers.

Materials	Description	Ice-Pack Costs	Moist-Pack Costs
Container	300 Capacity	.463	.640
Polyethylene	1-1/4 m (6' X 9')	None	.171
Newspaper	64 sheets	.108	None
Waxed Tissue	15 sheets	.018	.018
Kim-pac	32 inches	.029	None
Cleats	2 (4 X 16)	.107	None
Nails	10	.012	None
Ice	8 pounds	.060	None
Label and Invoice	1 each	.015	.015
Twine	2.5 and 3.0 ounces	.045	.054
Glue	For labels	.005	.005
Kraft paper	9 ounces	.056	None
Totals		$ .918	$ .903

$1.00 minimum.

Air freight rates have a 50 pound minimum, are graduated from 50 to 100 pounds, and are constant per 100 over 100 pounds. Because of the rate scale, air freight is seldom used for lots of less than 100 pounds. In order to make an effective comparison the 100 pound rate was used. The actual charge per pound would be greater for the given shipping weights.

The shipping weights of the packed containers were determined by weighing the component parts of each. These weights are presented in Table 3 in summary form. The specific quantity of any material may be found by referring to the text of the material costs presentation.

It was determined that one bunch of 25 standard grade carnations weighs one pound on the average. Thus the carnation weight was found by dividing the carnation content by 25.

The Original Method

The original method of selecting and packing cut carnations is divided into two sub-methods to permit a more direct comparison of methods. The most meaningful original method for the Denver wholesalers is

Table 3.--Weights of Materials Used in Packing Six Specified Shipping Containers.

Container	4C		6C		BAC		5F		6F		10F	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
Box*	1	- 10	2	- 0	2	- 7	1	- 9	1	- 15	2	- 9
Lid	1	- 11	2	- 1	2	- 8	0	- 13	1	- 1	1	- 5
Two Inserts	0	- 14	1	- 2	1	- 6	---		---		---	
Polyethylene	0	- 6	0	- 6	0	- 6	---		---		---	
Two cleats	---		---		---		1	- 10	2	- 2	2	- 10
Kraft paper	---		---		---		0	- 6	0	- 8	0	- 10
Newspaper	---		---		---		2	- 8	3	- 6	3	- 12
Ice	---		---		---		5	- 0	7	- 0	9	- 0
Total	4	- 9	5	- 9	6	- 11	11	- 14	14	- 15	18	- 9
Rounded Total**	5 lbs.		6 lbs.		7 lbs.		12 lbs.		15 lbs.		19 lbs.	

* The Term "Box" designates the bottom half of a shipping container.

** Additional weight of tissue, invoice, label, nails, Kim-pac, glue and staples included.

Table 4.--Transportation Charges - Denver, Colorado to Birmingham, Alabama

Container Size	Mean Capacity (Standard Grade)	Displacement (Cubic Inches)	Dimensional Weight*	Carnation Weight	Material Weight	Total Weight (Carnations & Mat'l.)	Railway Express Charge **	Air Express Charge	Air Freight (100 lb. rate)
4C	150	4,688	17.6	6 lbs.	5 lbs.	11 lbs.	$3.28	$5.72	$3.07
5F	150	5,031	18.9	6 lbs.	12 lbs.	18 lbs.	3.91	8.08	3.30
6C	250	6,846	25.7	10 lbs.	6 lbs.	16 lbs.	3.91	7.41	4.49
6F	250	7,310	27.5	10 lbs.	15 lbs.	25 lbs.	4.67	10.45	4.80
BAC	500	9,210	34.6	20 lbs.	7 lbs.	27 lbs.	5.30	11.13	6.04
10F	500	11,319	42.6	20 lbs.	19 lbs.	39 lbs.	6.31	15.18	7.44

* Displacement Divided by 266

** Less 10 percent for ice

one that uses the moist-pack shipping container, since it has been in use in Denver for two years. However, some form of an ice-pack shipping container is used by the remainder of the industry and is therefore a part of their original method. Consequently the original method is presented using both the ice-pack and the moist-pack.

The selection procedure is the same for both the ice-pack and the moist-pack when used with the original method. The carnations are selected from buckets of water in the cooler and carried in the arms of the selector to the packing room where they are placed on a table or bench near the packer. Tissue is used between bunches when packing with the original method using either pack. From this point on the sub-operations required to pack the two shipping containers are dissimilar as can be observed by comparing their sub-operations presented in tables 5, 6 and 7.

Labor Requirements and Costs of the Original Method

The time requirements of the original method using the ice-pack and the moist-pack are presented in this section. The time requirements of the improved method are presented in the next section.

The time requirements presented in Tables 5, 6, 7, 8 and 9 were determined by timing the individual operations and sub-operations associated with selecting and packing cut carnations until a pattern was established for the observations. The time requirements of the two houses studied were compared for consistency. Whenever a large time difference was observed between houses for the same operation, the reason for the difference was determined, the operation was retimed, and the data were adjusted accordingly. As a result of this procedure the data represents the "standard time" required to perform the various tasks associated with selecting and packing for a typical carnation wholesale house.

Two methods of timing were used. The workers were notified that they were being timed and cautioned to proceed at a "normal" rate. The results of this method were found to correspond closely to results obtained by timing the various operations while the workers were unaware of their being timed.

The time requirements presented in this study do not include delay time nor allowance for delay time. The techniques of "work-sampling" or "ratio-delay" were applied to both houses and from the results it is

estimated that on a yearly basis the entire packing crews spend 30 percent of their time not working. This estimate does not include long breaks for lunch or rest periods.

The percentage of "working" or "non-working" time is determined by observing each worker at repeated intervals and obtaining a series of instantaneous observations which are then classified as "working" or "not working" observations. The percentage of "working" time is given by the ratio (working observations/total observations) times 100. (11:4).

The time requirement data presented in Tables 5 through 13 do not represent total labor requirements. Of the 70 percent "working" time presented above the time of the selection and packing crews is utilized in maintaining supplies, answering telephones, correcting errors, taking inventory, selecting and packing miscellaneous, and other activities as well as selecting and packing carnations.

In order to determine the cost of labor per unit of output, the total labor requirements must be known or estimated. The last section of this chapter and tables 14 and 15 contain estimates of the total time

requirements.

The time requirements of the original method using both the ice-pack and the moist-pack are presented in Tables 5 through 9. The operations necessary to select and pack 300 carnations, with all materials at hand and with no interruptions, are presented in Tables 5 and 6. The time required to assemble the moist-pack and ice-pack containers is presented in Table 15.

The time required to perform the various operations necessary to store carnations in buckets of water was determined experimentally with 12 buckets at a time. The results are presented in Table 8. The data were adjusted to allow for the fact that the buckets are typically scrubbed every other day. The average capacity of a bucket is 250 carnations. On a 50,000 carnations per day basis the daily time requirement is 1 hour and 37 minutes. The time required to handle buckets is .58 minutes per 300 carnations on a typical shipment basis.

Table 9 is a summary of Tables 5, 6, 7 and 8 and as such it represents the total observed time requirements of the original method using both the ice-pack and the moist-pack.

The hourly wage rate for the packing crew of a

Table 5.--Time Requirements of the Original Method Using the Ice-Pack.

	Operation	Distance	Comments	Lapsed Time	Running Time
S	Walk into Cooler	20'	Read Order on Way	.08	.08
E	Select 300 Carnations	25'	12 Bunches	.48	.56
L	Take Carnations to Packer	45'	Carry in Arms	.12	.68
E	Lay Carnations Down	-	Stems Toward Packer	.26	.94
C T			Time to Select	.94	
	Get Box	4'	Begin Packing Phase	.05	.99
P	Make and Place Rolls	-	One at each end of Box	.21	1.20
A	Place Tissue	-	On Ends of Box	.09	1.29
C	Pack 300 Carnations	-	With Tissue	.52	1.81
K	Get and Place Kim-pac	-	Protect Stems from Cleats	.10	1.91
	Move Box	12'	To Icer	.04	1.95
			Time to Pack	1.01	
	Get Box	4'	Begin Icing Phase	.04	1.99
	Get and Place Cleats	-	Two (4 X 16)	.12	2.11
I	Nail	-	4 Nails per Cleat	.55	2.66
C	Place Newspaper	-	Under Ice	.09	2.75
E	Cut and Place Ice	-	One Chunk	.15	2.90
	Place Newspaper	-	Around Ice	.11	3.01
	Put Invoice in Box	-	If Ready	.05	3.06
	Get and Place Lid	-	3 Inch Lid	.16	3.22
	Move Container	12'	To Wrapper	.04	3.26
			Time to Ice	1.31	
	Get Container	4'	Begin Wrapping Phase	.04	3.30
W	Prepare Wrap	-	6 Pads	.40	3.70
R	Wrap	-	Secure with Staples	.40	4.10
A	Tie	-	Two Loops	.40	4.50
P	Glue Label	-	And Exp.Sticker if needed	.20	4.70
	Stack	8'	Awaiting Shipment	.09	4.79
			Time to Wrap	1.53	

Table 6.--Time Requirements of the Original Method Using the Moist-Pack.

	Operation	Distance	Comments	Lapsed Time	Running Time
S	Walk into Cooler	20'	Read Order on Way	.08	.08
E	Select 300 Carnations	25'	12 Bunches	.48	.56
L	Take Carnations to Packer	45'	Carry in Arms	.12	.68
E	Lay Carnations Down	-	Stems Toward Packer	.26	.94
C			Time to Select	.94	
T					
	Get Box	4'	Begin Packing Phase	.05	.99
P	Unfold Polyethylene	-	6' X 9'	.12	1.11
A	Place Tissue	-	On Ends of Box	.09	1.20
C	Pack 300 Carnations	-	With Tissue	.52	1.72
K	Move Box	12'	To Lid Phase	.04	1.76
			Time to Pack	.82	
	Get Box	4'	Begin Lid Phase	.04	1.80
L	Fold Polyethylene	-	Side then Ends	.15	1.95
I	Put Invoice in Box	-	If Ready	.05	2.00
D	Get and Place Lid	-	Full Telescope	.20	2.20
	Move Container	12'	To Tyer	.04	2.24
			Time to Place Lid, etc.	.48	
	Get Container	4'	Begin Tying Phase	.04	2.28
T	Glue Label	-	Exp.Sticker if needed	.20	2.48
I	Tie	-	Three Loops	.45	2.93
E	Stack	8'	Awaiting Shipment	.09	3.02
			Time to Label and Tie	.78	

Table 7.--Time Requirements for Container Assembly.

	Operation	Comments	Lapsed Time	Running Time
I	Get Box	6F	.05	.05
C	Staple Box	12 Staples	.25	.30
E	Stack	With Boxes	.06	.36
	Get Lid	3" Lid	.05	.41
P	Staple Lid	8 Staples	.20	.61
A	Stack	With Lids	.06	.67
C		Time to Assemble		
K		Ice-Pack Shipping Container	.67	
	Get Box	6C	.05	.05
	Staple Box	12 Staples	.25	.30
M	Get, Fold, and			
O	Place Insert	Place in Box	.18	.48
I	Cut and Place			
S	Polyethylene	On Top of Box	.12	.60
T	Fold Polyethylene			
	into Box	6' X 9'	.08	.68
P	Stack	With Boxes	.06	.74
A	Get Lid	Full Telescope	.05	.79
C	Staple Lid	12 Staples	.25	1.04
K	Get, Fold, and			
	Place Insert	Place in Lid	.18	1.22
	Stack	With Lids	.06	1.28
		Time to Assemble Moist-Pack Shipping Container	1.28	

Table 8.--Time Requirements for Bucket Handling

Operation	Comments	Time Required (Min.) Per Bucket	Per 12	Per 200
Set up	Carry 6 at a time	.07	.86	14.33
Fill	8 Gal/Min.Rate of Flow	.27	3.32	55.33
Empty	Kick Buckets Over	.03	.30	5.00
Scrub	and Stack	.09	1.13	18.83
Put Back	6 at a Time	.02	.20	3.33
	Totals	.48	5.81	96.82

Table 9.--Comparison of Time Requirements for Ice-Pack and Moist-Pack (Summary of Tables, 5, 6, 7 and 8.)

Ice Pack		Moist-Pack	
Operation	Time Min.	Time Min.	Operation
Handle Buckets	.58	.58	Handle Buckets
Assemble Container	.67	1.28	Assemble Container
Select	.94	.94	Select
Pack	1.01	.82	Pack
Ice	1.31	.48	Lid
Wrap	1.53	.78	Tie
Total	6.04	4.88	Total

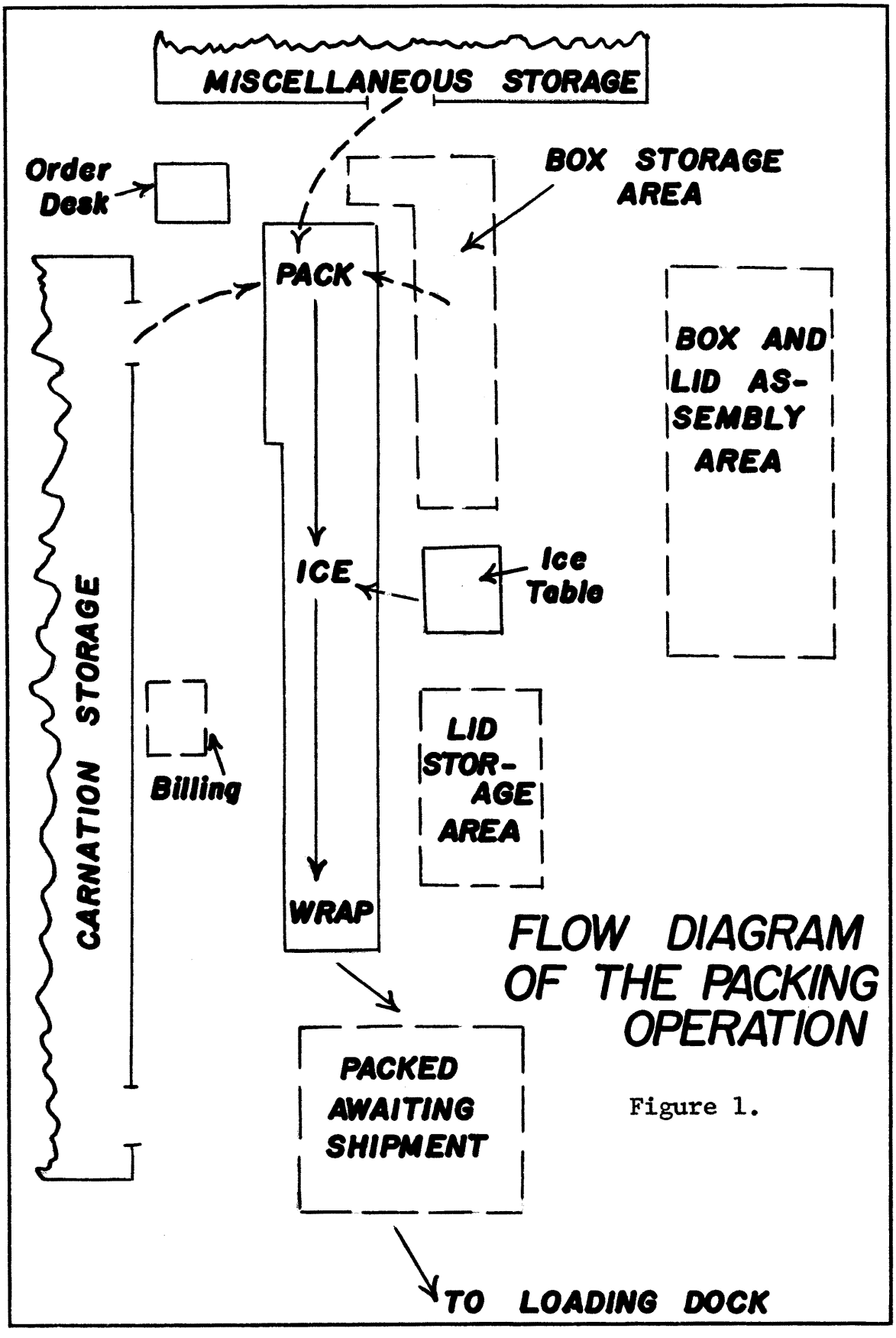
MISCELLANEOUS STORAGE
Order Desk
BOX STORAGE AREA
PACK
BOX AND LID ASSEMBLY AREA
ICE
Ice Table
CARNATION STORAGE
Billing
LID STORAGE AREA
WRAP
FLOW DIAGRAM OF THE PACKING OPERATION
PACKED AWAITING SHIPMENT
TO LOADING DOCK

Figure 1.

typical house ranges from $1.30 per hour to $1.90 per hour. The typical work week is 45 hours, five of which are overtime at time and one-half. The mean wage rate of $1.60 per hour has been used in the analysis of this study.

The Improved Method

The improved method is a method of selecting and packing cut carnations that incorporate the advantages of the moist-pack, moist selection, packing without tissue, and taking the pack-to-the-flowers. The time requirements of the moist-pack have been presented. The method of taking the pack-to-the-flowers and additional data necessary for a comparative analysis are presented in this section.

Taking the pack-to-the-flowers: The procedure of taking the pack-to-the-flowers, as opposed to the original procedure of taking the flowers-to-the-pack, has been tested in one of the wholesale houses. The operations performed by the selector and the packer are combined. The carnations are packed in the cooler as they are selected. This is made possible by using a packing cart[1] which the packer-selector takes through the cooler

[1] See Appendix B. page 78.

as he selects. The selection is facilitated by storing the carnations by grade and frequency of use in such a manner that the highest number of carnations may be selected with a minimum of distance traveled.

It has been assumed that carnations may be kept in short-term storage without the benefit of water or a solution.[2] The relative efficiency is dependent, in part, upon the ease of selection made possible by moist-storage.[3] For the purpose of comparison the time required to store carnations in buckets of water has been determined.[4] The space requirements of each method must also be compared.

The space requirements for both wet and moist storage were calculated on the basis of 1/3 fancys, 1/3 standards, and 1/3 shorts. Carnations require from eight to ten square feet of floor space per 1,000, depending upon the size of the blooms, when stored in buckets. The requirement varies from six to nine square feet per 1,000, depending upon stem length, when stored moist upon the surface of a table with no racks.

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2 Assumption 3 page 21.

3 See definition of terms, page 14.

4 Page 43.

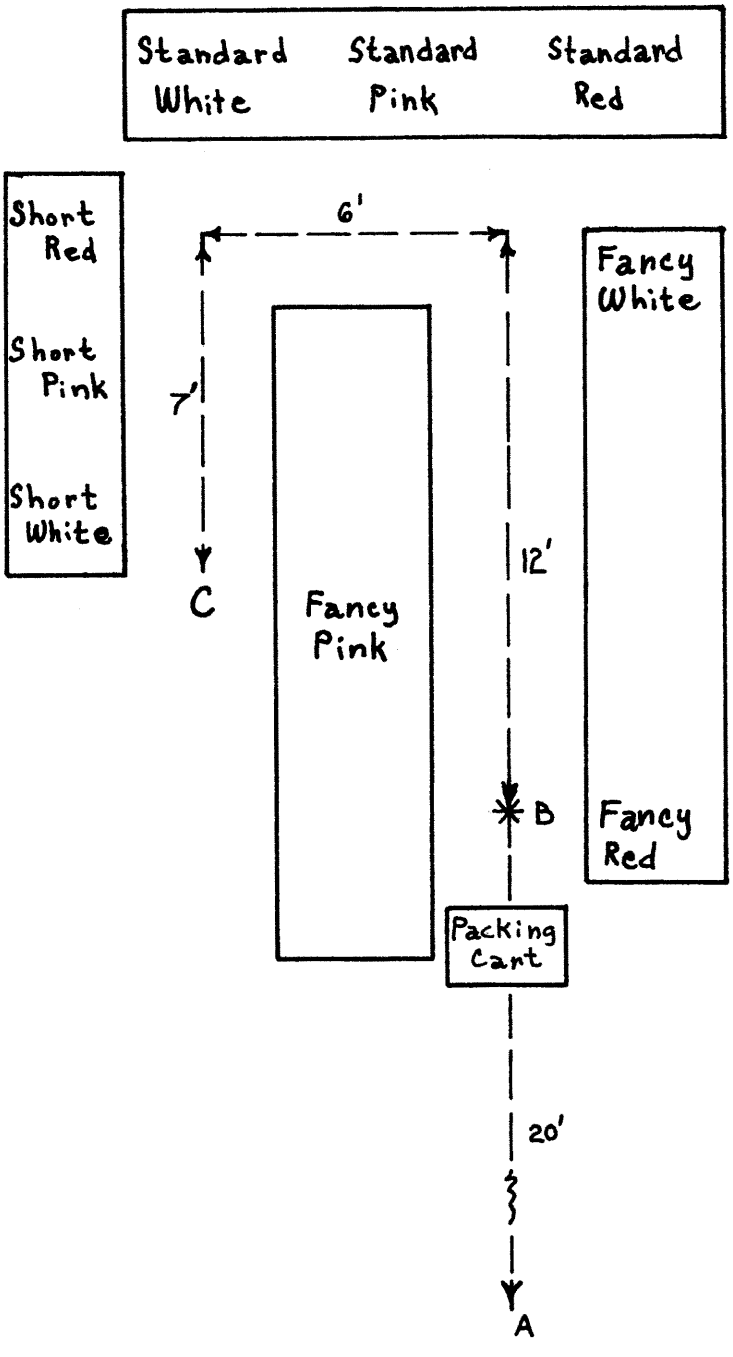
The capacity of a cooler 40 X 50 feet, when carnations are stored dry and aisle space is sufficient for a 37 inch packing cart, is 135,000 carnations. The capacity of the same cooler when carnations are stored in buckets is 131,000 when 1.5 feet of aisle space is allowed for every two rows of carnations across and three aisles are allowed in the other dimension.

Labor Requirements of the Selecting and Packing Phase of the Improved Method

The selection room was set up as shown in Figure 2 to test the selection and packing phase of the improved method. Seven mock invoices were made up to simulate actual orders for various combinations of 300 carnations to be selected from the three grades and three varieties used in the test. As the packer-selector was handed one of the orders at point A the timing began. The cart was pushed from A to B where the actual packing began. The packing continued to point C where the cart was turned around and then returned over the same path to B and on to A. This same procedure was continued until a trend was established for two packer-selectors. The results of this test are presented in Table 11.

The same layout and invoices were utilized by

Figure 2. Selection Room Layout Used To Test The Improved Method



two selectors selecting in the original manner with the exception that the carnations were stored dry in the same order as used to test the improved method. The results of this check are presented in Table 12.

The packers and selectors utilized in the above two tests were checked for rate of work. Their "normal" rate was found to be 75 percent of their "fast as possible" rate.

Cart Adjustment

The cart used for the test was not of satisfactory design. It was nearly twice as long as necessary. The height and width were satisfactory and the castors of good design. A second cart was tried which was of the approximate correct length and width but much too high. Of the two carts, the longer was used for the packing tests since proper packing height was deemed the most important specification.

In use the excessive length was found to limit maneuverability and resulted in an avoidable addition to the time required to select and pack 300 carnations. To adjust for this condition, the following experiment was performed. Both carts were walked through the same route a number of time with the following results:

Table 10.--Cart Adjustment

Station	Distance	Cart		Difference
		Short	Long	
A-B	20'	.06	.06	-
B-C	25'	.10	.13	.03
C-B	25'	.10	.14	.04
B-A	20'	.06	.06	-
Totals	90'	.32	.39	.07

The difference found above was applied to the time requirements presented in Table 11.

Time Adjustments

A summary of the time requirements for the original and improved methods are presented in Table 13. The unadjusted totals represent the original method as it presently exists using the ice-pack or the moist-pack, and the improved as it was designed to be used, using the moist-pack. If tissue is to be used with the improved method the adjustment of +.19 should be added for the comparison. If tissue is not used with the original method the adjustment of -.19 should be applied. Adjustments of -.19 and -.58 should be applied to the original method if moist storage and selection are used.

Table 11.--Time Requirements of the Selection-Packing Phase of the Improved Method

	Operation	Distance	Comments	Lapsed Time	Running Time
S E L E C T	Get Box	-	Polyethylene is in Box	.05	.05
	Unfold Poly-ethylene	-	6' X 9'	.12	.17
A N D	Push cart in-to cooler	20'	Read order on way	.11	.28
	Select and Pack 300	25'	12 Bunches	.59	.87
P A C K	Take cart to tyer	45'	Over same route	.19	1.06
			Time Not Using Tissue	1.06	
			Added Time due to Tissue	.19	
			Time with Tissue	1.25	

Table 12.--Time Requirements of the Selection Phase and the Packing Phase of the Original Method Using the Moist-Pack and Moist-Storage

	Operation	Distance	Comments	Lapsed Time	Running Time
S	Walk into Cooler	20'	Read order on way	.08	.08
E L E C T	Select 300 Carnations	25'	From Moist-Storage	.29	.37
	Take Carnations to Packer	45'	Carry in Arms	.12	.49
	Lay Carnations Down	-	Stems toward packer	.26	.75
P A C K	Get Box	4'	Begin Packing Phase	.05	.80
	Unfold Polyethylene	-	6' X 9'	.12	.92
	Place Tissue	-	On Ends of Box	.09	1.01
	Pack 300 Carnations	-	With Tissue	.52	1.53
	Move Box	12'	To Icer	.04	1.57
			Time with Tissue		1.57

Total Time Requirements

The time requirements that have been observed and recorded for the original method using the ice-pack account for 35 percent of the total demands upon the time of the selection and packing crews. Thirty percent of the crew's time is spent not working.[5] Thus 65 percent of the total time requirements have been observed or accounted for and 35 percent of the total time has not been observed.

To estimate the total time requirements for the original method using the moist-pack and the improved method using the moist-pack Tables 14 and 15 were constructed. It was assumed for both estimations that delay time is 30 percent of total time. The observed time requirements were obtained from Table 13.

The unobserved time requirements presented in Table 14 were assumed to be 35 percent of the total as were the observed time requirements. From this the delay time and totals were derived. The unobserved time requirements presented in Table 15 were assumed to be

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[5] See page 38.

Table 13.--Observed Time Requirements Summary and Time Adjustments

Operation	ORIGINAL METHOD* Ice-Pack Time	ORIGINAL METHOD* Moist-Pack Time	IMPROVED METHOD** Moist-Pack Time
Handle Buckets	.58	.58	-
Assemble Container	.67	1.28	1.28
Select	.94	.94	-
Pack	1.01	.82	-
Select/Pack	-	-	1.06
Ice	1.31	-	-
Wrap	1.53	-	-
Lid	-	.48	.48
Tie	-	.78	.78
Totals	6.04	4.88	3.60

* Selecting wet, using the unimproved selection room layout, packing with tissue.

** Selecting moist, using the improved selection room layout, no tissue.

ADJUSTMENTS

Original Method		Improved Method	
Select Moist	-.19	Pack with Tissues	+.19
No Tissue	-.19		
No Buckets	-.58		

the same (6.04) between packs and between methods.

Table 14.--Total Time Requirements (Assuming Unobserved Time Proportionate).

Time Requirement	Original Method (A) Ice-Pack	(B) Moist-Pack	Improved Method (C) Moist-Pack
Observed time	6.04	4.88	3.60
Unobserved Time	6.04	4.88	3.60
Delay Time	5.18	4.18	3.09
Total Time Per Pack	17.26	13.94	10.29
Daily Man-Hours	48.04	38.80	28.63
Percent of (a)	100.00%	80.77%	59.60%
Required Workers	6.00	4.85	3.58
Daily Labor Bill	$76.86	$62.08	$45.80
Labor Cost Per Pack	$ .46	$ .37	$ .27
Estimated Maximum Savings Per Pack	-	$ .09	$ .19

Table 15.--Total Time Requirements
(Assuming Unobserved Time Constant.)

Time Requirement	Original Method (A) Ice-Pack	(B) Moist-Pack	Improved Method (C) Moist-Pack
Observed Time	6.04	4.88	3.60
Unobserved Time	6.04	6.04	6.04
Delay Time	5.18	4.68	4.13
Total Time Per Pack	17.26	15.60	13.77
Daily Man-Hours	48.04	43.42	38.33
Percent of (A)	100.00%	90.38%	79.79%
Required Workers	6.00	5.43	4.79
Daily Labor Bill	$76.86	$69.47	$61.33
Labor Cost Per Pack	$ .46	$ .42	$ .37
Estimated Minimum Savings Per Pack	-	$ .04	$ .09

Chapter IV

ANALYSIS AND DISCUSSION

The purpose of this chapter is to determine the relative efficiencies of the shipping containers and methods in order to test the validity of the hypotheses.[1] The first hypothesis was that the moist-pack will result in lower packing and transportation costs as compared with the ice-pack. The second hypothesis was that the improved method is relatively more efficient than the original method in terms of lower selection and packing costs. The two hypotheses will be examined in the order presented above.

Moist-pack vs. Ice-pack

The costs of transportation and packing for both packs have been determined. Packing costs, for the purpose of this study, are composed of the costs of material and labor. These costs (transportation, labor and

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[1] The hypotheses are formally stated on page 19.

material) are compared for the two packs in this section.

Material costs: The summary of material costs presented in Table 2 indicates a difference of $.015 between the total material costs of the two packs. While materials associated with the use of ice are not found in the moist-pack, the savings in cost due to this reduction in material is largely offset by the additional costs of inserts, polyethylene and a full-telescoped lid with a reflective outer liner.

The quality of the two types of containers is comparable in the sense that both will perform the jobs for which they were designed. However, the design of the moist-pack reduces the quantities of materials to be inventoried and handled. It also gives superior stacking strength, and is of improved appearance. No attempt has been made to assess the value of these differences.

On the basis of the data presented in Table 2 the difference in total material costs of the two packs is insufficient to conclude that one costs less than the other.

Transportation costs: The cost of shipping three sizes each of the moist-pack and ice-pack to Birmingham has been determined. From these data the

cost of shipping a 300 capacity moist-pack and ice-pack via railway express, air express, and air freight has been estimated.

The mean railway express charge for the moist-pack (4C + 6C + BAC ÷ 3) is $4.16 and for the ice-pack (5F + 6F + 10F ÷ 3) the charge is $4.96. This is a difference of $.80 and 16 percent less cost for the moist-pack as compared with the ice-pack. The mean air express charge for the moist-pack is $8.02 and for the ice-pack the charge is $11.24. This amounts to $3.22 or 29 percent less cost for the moist-pack as compared with the ice-pack.

For the above express rates the charge covers the entire door-to-door delivery cost incurred by the express company. For railway express iced shipments a 10 percent deduction is allowed to compensate for the melting ice. This deduction has been accounted for in the above analysis.

Air freight charges are calculated on the basis of actual weight or dimensional weight, whichever is the greater. For the six shipments presented in Table 4 the dimensional weight is the greater weight in every case. The mean air freight charge, on this basis, for the

moist-pack is $4.53 and for the ice-pack it is $5.18. This is a 12 percent less cost for the moist-pack as compared with the ice-pack. When the appropriate common carrier rate from the Birmingham terminal is included (moist-pack + $.14, ice-pack + $.21) for both packs the percentage difference becomes 13 percent in favor of the moist-pack.

The differences in transportation costs of the ice-pack and moist-pack is, of course, due to the lower shipping weight of the moist-pack. The difference was found to average 34 percent less weight for the moist-pack as compared with the ice-pack. The cost differences were less than this (34 percent) due to the discount for ice and the fact that shipping rates increase at a decreasing rate.

The two containers do not perform the job of preserving carnations in transit equally well. Unpublished results of tests by one of the wholesale houses studied and by Colorado State University indicate that carnations are received with less breakage and spoilage when shipped in the moist-pack. Credits for breakage and spoilage that must be allowed the receiver add to the cost of transportation since a greater quantity of

carnations must be shipped in order to have a given quantity accepted. The credit cost for breakage and spoilage has not been included in the above analysis.

Labor costs: From the time requirements presented in Tables 5, 6, and 7 it can be observed that the selection operations are identical for the two packs. (.94 minutes). The time required to pack the moist-pack is .19 minutes less than that required for the ice-pack. If the time required to handle Kim-pac (.10 minutes) and polyethylene (.12 minutes) are taken to be the same, the difference in total time seems largely accounted for by the time required to make and place newspaper rolls. (.21 minutes).

The icing and lidding phases are comparable in the sense that both packs are readied for the next phase of wrapping and/or tying. There is a difference in total time between packs for this phase of .83 minutes. The use and provision for ice (1.02) accounts for the difference between the ice-pack (1.31) and the moist-pack (.48) if folding polyethylene (.15) and handling a more difficult lid (+.04) for the moist-pack are discounted.

The wrapping and tying phases are comparable between packs with two exceptions; the moist-pack uses three

loops of twine (+.05) where the ice-pack uses two and the ice-pack is wrapped with kraft and newspaper (+.80) where the moist-pack requires no wrapping. The ice-pack requirement for this phase is 1.53 minutes and the moist-pack requirement is .78 minutes. The difference is .75 minutes.

The time requirements of both packs to select, pack, ice and/or lid, and to wrap and/or tie have been accounted for. The time required to prepare the boxes for the packing operation must be included in the analysis at this point since there is a considerable difference for this operation between packs. The time requirements for container assembly for both packs are presented in Table 7. The greater time required by the moist-pack (.61) is due to additional staples in the lid (+.05), handling polyethylene (.20), and handling the two inserts (.36).

When the time required to handle buckets (.58) is added to the above time requirements the total observed time (35 percent of the total time) becomes 6.04 minutes for the ice-pack and 4.88 minutes for the moist pack.[2]

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[2] See Table 13, page 54.

From the data presented in Tables 14 and 15 it can be observed that the estimated labor cost for the ice-pack is $.46 per pack while the cost for the moist-pack falls within the estimated range of $.37 to $.42 per pack. The estimated difference in total labor costs between the two packs is $.04 to $.09 less per pack for the moist-pack as compared with the ice-pack.

Improved Method vs.
Original Method

The relative efficiency of methods can best be observed by comparing the sub-operations necessary to select and pack cut carnations. The sub-operations of the two methods are compared in terms of labor requirements in this section. A comparison of total time requirements and costs will follow.

The time required to select with the original method is .94 minutes as may be observed from the time requirement summary presented in Table 13. The data of Table 12 are the results of a check that was made to determine the time required to select carnations from moist storage. The result is a time requirement of .75 minutes to select 300 carnations which is .19 minutes less than that required to select from buckets. Since

the selection and packing phases are combined in the improved method it is not possible to make a direct comparison of selection time requirements between methods.

The time requirements of the packing phase of the original method using the ice-pack is 1.01 minutes and using the moist-pack is .82 minutes. Included in this time is a requirement of .19 minutes to place tissue over the ends of the box and between bunches of carnations. It is not possible to make a direct comparison of packing time requirements between methods.

By combining the time required to select and pack using the original method, a comparison may be made with the select-pack phase of the improved method. The time requirement for this phase for the improved method is 1.06 minutes as compared with 1.95 minutes using the ice-pack and 1.76 minutes using the moist-pack for the original method. If the two methods are compared using only the moist-pack and if the original method is adjusted to moist-selection (-.19) and packing without tissue (-.19), then the difference becomes .32 minutes, (1.76 - .19 - .19 - 1.06 = .32). The .32 minutes represents the saving in time attributable to the procedure of taking the pack-to-the-flowers of the improved method.

The difference in the observed time requirements between the original method using the ice-pack (6.04 minutes) and the improved method (3.60 minutes) has been accounted for as follows: of the total difference (2.44 minutes) a saving of 1.16 minutes can be directly attributed to the moist-pack. Of the remaining difference (1.28 minutes) .58 minutes are required to handle buckets, .19 minutes are saved by moist-selection, .19 minutes is the added time required to pack with tissue, and a saving of .32 minutes can be attributed to the advantage of taking the pack-to-the-flowers. Expressed in percentages of the original method using the ice-pack (6.04) the total difference (2.44) is 40 percent, 19 percent of which is due to the moist-pack. Of the remaining 21 percent, 10 percent is due to not using buckets, 3 percent is due to moist-selection, 3 percent is due to packing without tissue, and 5 percent is due to taking the pack-to-the-flowers.

Total Time Requirements

The original method using both the ice-pack and the moist-pack have been compared with the improved method using the moist-pack in Table 13. The adjustments

at the bottom of Table 13 may be applied to the totals of the table to allow for modifications of procedure, however the unadjusted totals represent typical methods as they stand. The analysis will deal with the unadjusted totals only.

The total observed time requirements of Table 13 have been transferred to Tables 14 and 15. Tables 14 and 15 present two methods of estimating total time requirements.

The observed time is known to represent approximately 35 percent of the total time for the original method using the ice-pack. In addition, delay time has been estimated to be 30 percent of the total time.[3] The remaining 35 percent of total time has not been observed. From the above, the total time requirements for the original method using the ice-pack have been determined and presented in Tables 14 and 15.

To estimate total time requirements for the original method using the moist-pack and the improved method using the moist-pack presented in Table 14 it was assumed that the observed and unobserved times for the

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[3] See page 38.

above each account for 35 percent of the total time. For the estimate presented in Table 15 it was assumed that the unobserved time requirements would remain the same for each method and equal the unobserved time requirements of the original method using the ice-pack.

The estimates of Tables 14 and 15 are therefore a result of the assumption that the unobserved time requirements are no greater than constant and equal to the unobserved time requirements of the original method and no smaller than proportionate and equal to the observed time requirements of each method.

From the data of Tables 14 and 15 it can be observed that the improved method results in an estimated saving in the cost of labor per box of from $.09 to $.19 as compared with the original method using the ice-pack. Compared with the original method using the moist-pack an estimated saving of $.05 to $.10 is possible using the improved method.

Recommendations for Further Study

This thesis has been primarily concerned with the selection and packing operations of the wholesale plant. The study, in its entirety, is only a starting

point for the construction of an efficient wholesale marketing operation. In order to develop an efficient marketing operation the receiving, grading and storage operations and the office procedure must also be studied. Inventory control and the prediction of the quantity of incoming cut flowers by grade and variety is an area of study where improvement must be considered a prerequisite to the development of an efficient marketing operation. The "unobserved" time requirements of this study, such as the storage and maintenance of supplies, handling of miscellaneous, billing procedure, etc., require analysis in order to construct an entire efficient marketing operation.

Moist-storage requires further examination and testing. A method of storing carnations should be developed that utilizes the dimension of height to full advantage. A system that permits the selection of a maximum number of carnations with a minimum distance traveled should be worked out.

The time required to assemble the moist-pack is excessive. The desirability of using a pre-assembled container should be investigated. Such a container could save .50 of a minute per container in assembly time

by eliminating the need for stapling.[4]

The present method of handling polyethylene is not satisfactory. Double handling and the need for cutting could be eliminated if polyethylene were purchased in pre-cut pads and incorporated into the packing line.

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[4] See Table 7, page 42.

Chapter V

SUMMARY AND CONCLUSIONS

The primary objectives of this study were to determine the efficiency of the selection and packing operations for carnations in a typical Colorado wholesale house and to develop an improved method. An improved method was developed which incorporates the moist-pack shipping container. The moist-pack was compared to the original ice-pack container for relative efficiency in terms of material, transportation and labor costs.

The material cost of the moist-pack was found to be $.015 less than the material cost of the ice-pack. The difference is insufficient to conclude that one pack costs less than the other.

Transportation costs are lower for the moist-pack than for the ice-pack due to a lower gross shipping weight. Moist-pack shipments from Denver to Birmingham by air freight results in a savings of $1.28, railway express $.80 and air express a savings of $3.22 relative to the ice-pack. The percentage difference is 13 percent

16 percent, and 29 percent, respectively.

The time required to select and pack the moist-pack was found to be 19 percent less than that required with the ice-pack. This results in an estimated savings in the cost of labor of from $.04 to $.09 per pack shipped for the moist-pack as compared with the ice-pack shipping container.

The improved method that was developed employs the moist-pack, moist-storage and the procedure of taking the pack-to-the-flowers. The improved method resulted in a 40 percent savings in observed time requirements as compared with the original method using the ice-pack. Of this 40 percent, 19 percent was attributed to the moist-pack, 10 percent to not using buckets, 5 percent to the procedure of taking the pack-to-the-flowers, 3 percent to moist selection, and 3 percent to packing without tissue. The estimated savings per pack for the improved method compared with the original method using the ice-pack was from $.09 to $.19 and compared with the original method using the moist-pack was from $.05 to $.10.

APPENDIX

APPENDIX TABLE OF CONTENTS

APPENDIX A

Economic Justification

The researcher employed by a public institution is morally, if not legally, bound to strive for the enhancement of the public welfare. Frequently, however, the research work must be done in cooperation with one or a few firms in the hope that the findings may be extended in application. Such is the case with this study.

The primary objective of this study is the development of a method of increasing relative efficiency in the selection and packing operations of a typical wholesale house. If it is assumed that the improved method is applicable to all carnation wholesale houses or even extended to the entire cut flower industry what may be said of the effect of this upon the general welfare? Is the result a gain in economic efficiency?

A gain in economic efficiency may be defined as the result of a recombination of productive resources in such a manner as to enhance the position of a greater number of individuals to a given degree than it

diminishes the position of a lesser number of individuals to the same degree. Conversely the degree may vary while the number of affected individuals remains constant.

If an increase in efficiency within one or many firms results in lowered inputs of labor or materials per unit of output, these factors of production are released to alternative employment. Providing that alternative employment is available this will result in a more efficient allocation of resources and consequently a gain in economic efficiency.

Further possibilities that may offset the gain derived from a more efficient allocation of resources must be considered. Over the short run it is apparent that a reduction of cost per unit of output within a single firm will result in a larger margin of profit for that firm. Thus the position of at least one or more persons is enhanced by the successful construction of an improved method.

The effect upon the general welfare is dependent upon the action of the firm as a result of the increased margin of profit. The firm has four basic alternatives (1) to reinvest the increase, (2) lower price, (3) improve quality, or (4) to retain the profit

as payment to the risk of ownership.

It is evident that lowered price or improved quality will result in a gain of position for a large number of individuals; the consumers of cut flowers. Also it would be difficult to assign a negative value to the addition of risk capital as an investment in an expanding economy.

It is with the final alternative that fault may be found, especially if entry into the industry is not possible. If the rate of return to ownership exceeds alternative investment returns sufficiently, the prospects will attract new firms into the industry. Such added competition will result in concessions to the consumers until the margin of profit returns to normalcy for the industry. Providing that freedom of entry exists the result is a gain in economic efficiency. Without freedom of entry a loss of economic efficiency is possible.

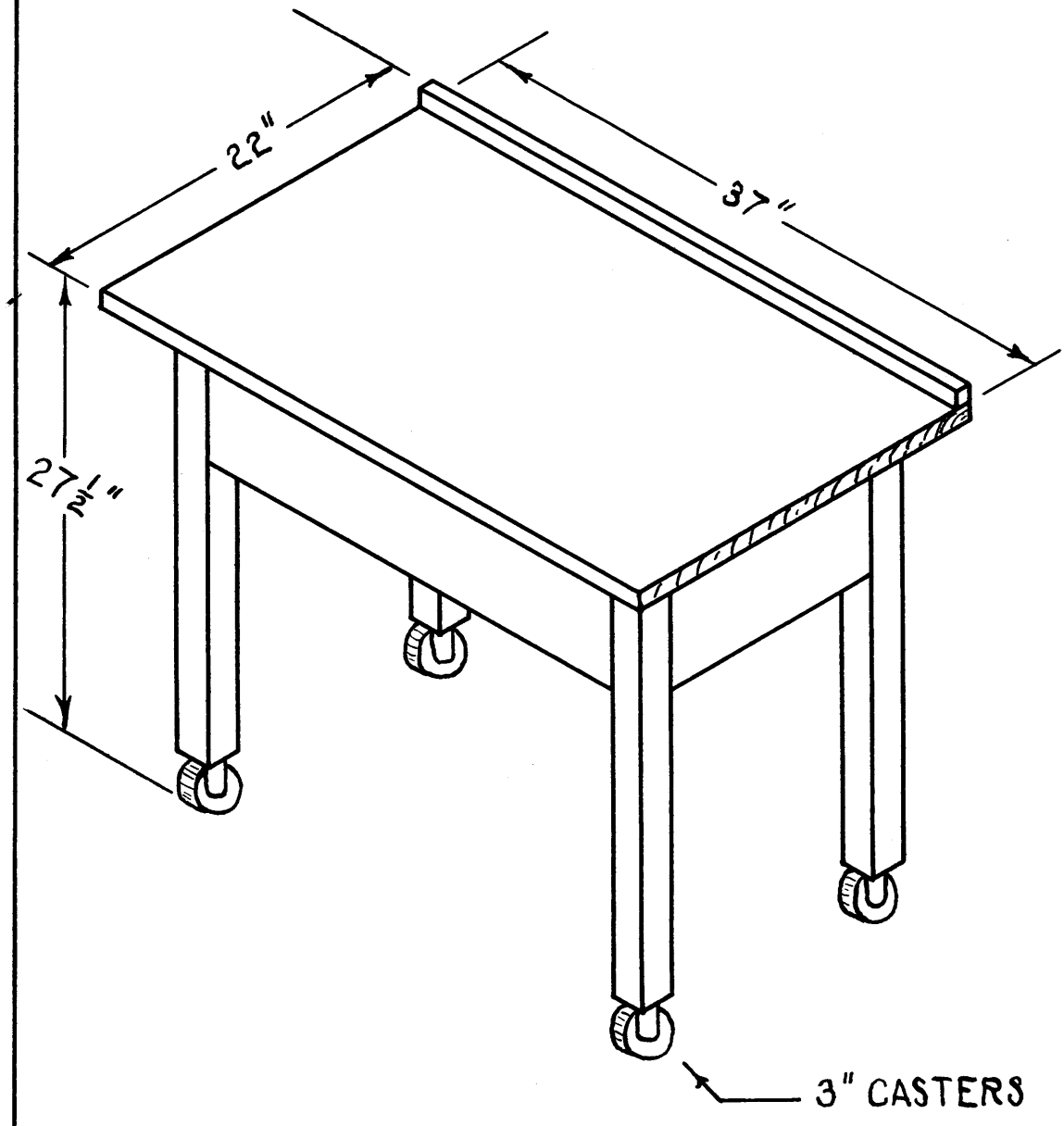
In summary it has been shown that the creation of an improved method is justified and will result in a gain in economic efficiency with the possible exception of a situation where freedom of entry into the industry is restricted. Within the industry under consideration,

it is submitted after cursory analysis, that price and/or quality competition exists to a sufficient degree to demand a share of any additional margin of profit. Furthermore there does not appear to be excessive restriction to entry into the industry.

If the findings of this study are sound they will contribute to the stockpile of knowledge, and if they are successful in application the result will be an enhancement of the public welfare.

APPENDIX B

PACKING CART



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