



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

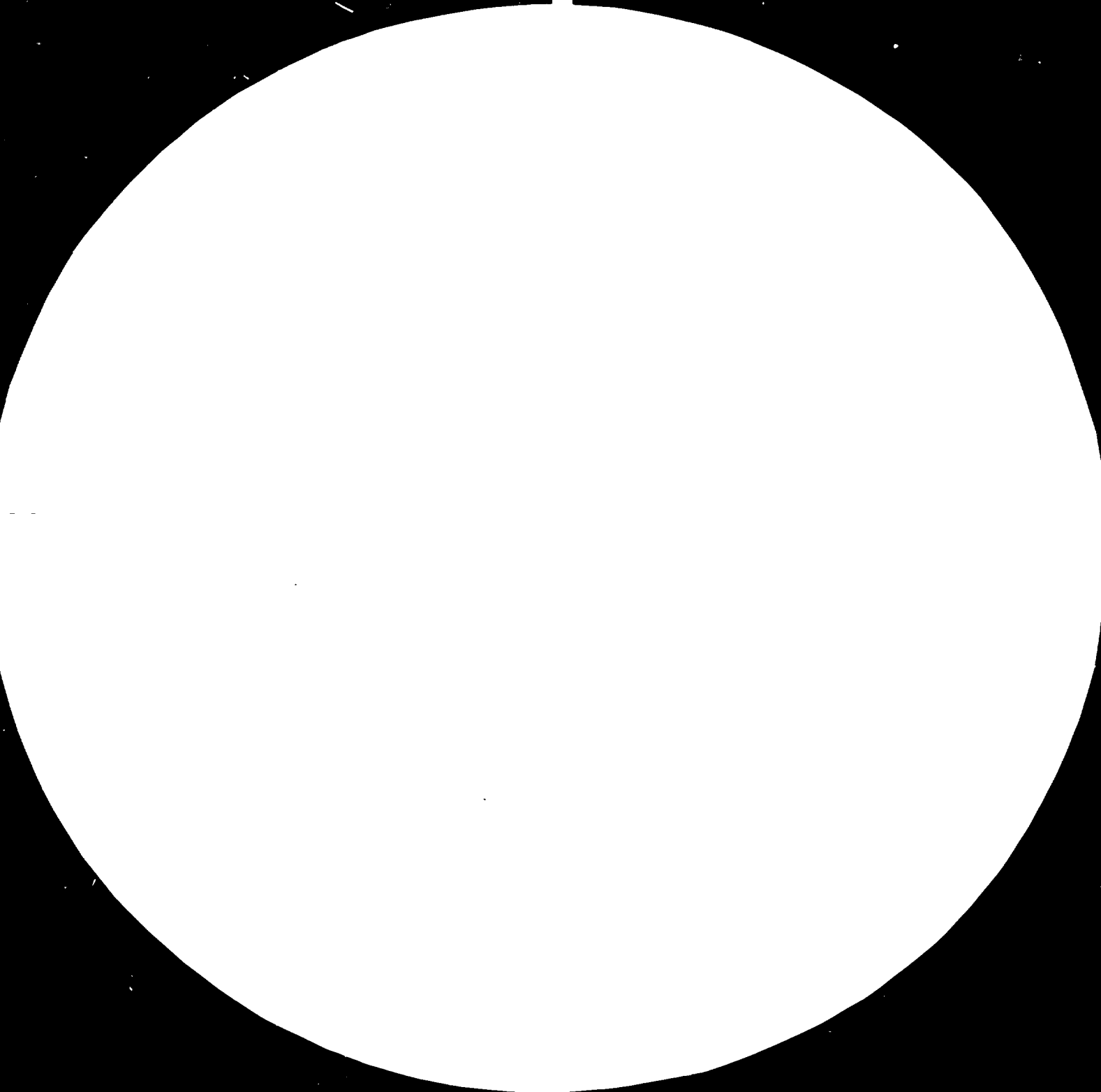
FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org





McRae, J. P. (1981). *Visual acuity*. In J. M. Martens & J. M. Martens (Eds.), *Handbook of visual perception* (Vol. 1, pp. 1-40). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

SPARE-COPY-HOLD

09539

RESTRICTED

April 1975

APPLICATION OF RESEARCH RESULTS TO THE POST-HARVEST
HANDLING OF FRUIT AND VEGETABLES IN ISRAEL

I S R A E L

(D.P./I.S.R./73/014/11 - 2/06 rev. 1)

PROJECT FINDINGS AND RECOMMENDATIONS

TERMINAL REPORT PREPARED FOR THE GOVERNMENT OF ISRAEL

by

B.L. Tugwell (Post Harvest Physiologist)

Expert of the United Nations Industrial Development Organization
Acting as Executing agency for the United Nations Development Programme

00017

This report has not been cleared with the United Nations Industrial Development Organization which therefore does not share the views presented.

RESTRICTED

April 1975

APPLICATION OF RESEARCH RESULTS TO THE POST-HARVEST
HANDLING OF FRUIT AND VEGETABLES IN ISRAEL

I S R A E L

(D.P./I.S.R./73/014/11 - 2/06 rev. 1)

PROJECT FINDINGS AND RECOMMENDATIONS

TERMINAL REPORT PREPARED FOR THE GOVERNMENT OF ISRAEL

by

B.L. Tugwell (Post Harvest Physiologist)

Expert of the United Nations Industrial Development Organization
Acting as Executing agency for the United Nations Development Programme

This report has not been cleared with the United Nations Industrial Development Organization which therefore does not share the views presented.

TABLE OF CONTENTS

	Page
SUMMARY	1
INTRODUCTION	
Background.....	4
Objectives.....	5
FINDINGS	
ISRAEL FRUIT GROWER ASSOCIATION.....	6
CITRUS MARKETING BOARD.....	7
Automatic packaging.....	8
Post Harvest Fungicide Treatment.....	9
Storage of Citrus.....	9
Reducing Weight Loss of Citrus.....	9
Precooling facilities.....	10
Oleocellosis injuries.....	10
Other Fruit Treatments.....	10
AGREXCO	
Broad Industry Problems.....	12
Overseas Laboratory.....	12
Extension of Marketing Periods	12
Cooling Methods.....	12
Quality Control.....	13
VULCANI CENTER	
Division of Fruit and Vegetable Storage.....	14
'Institute of Agriculture' Engineering.....	14
RECOMMENDATIONS	
Post Harvest Extension Specialists.....	15
Travel and Training.....	15
Communication between Post Harvest Specialists in Israel,	15
Research Equipment and Facilities.....	16
Overseas Quality Control	16

Local Quality Control.....	17
Courses for Packing Shed Managers.....	17
Newsletters.....	17
Extension Specialists for Agrexco.....	17
Research Priorities.....	18
Project for Research Extension and Application.....	19
APPENDIX	
Project Counterparts.....	21
Fellowships.....	21
Reference to Related Reports.....	21
Seminar Conducted.....	22
Acknowledgements.....	22

Summary

Israel produces a range of fruit and vegetables of high quality which are marketed as fresh produce in overseas markets.

Fruit and vegetables are highly perishables and must be harvested at the optimum maturity, cooled as soon as possible after harvest and then transported to the consumers under the conditions most suitable for maintaining quality of the produce.

Vast resources of technical information are available from the leading post-harvest research institutions in America, Canada, Europe, Australia, South Africa and Israel.

The quality of fruit and vegetables exported from Israel can be improved, and the marketing season extended by adaptation of existing technology with applied research to develop handling procedures specific for each product.

The two leading Israeli export companies engaged in exporting fruit and vegetable have modern centralized cooling facilities which are used for precooling produce before export. Suggestions for improving cooling rates, improving the design of future facilities and the research approach required, have been made in a report by a U.N.I.D.O. expert agricultural engineer. These recommendations are now being applied to the commercial cooling operation.

The Citrus Marketing Board, Israel Fruit Growers Association, and the Agricultural Research Organizations Division of Fruit and Vegetable Storage and Institute of Agricultural Engineering have teams of highly qualified scientists working on basic and applied post-harvest handling research. It is essential that selected technical officers such as engineers and physiologist from these institute travel together to overseas research institutions to establish contacts with other research workers and to enable prompt application of overseas research findings to the local industry.

A list of projects considered suitable for applied and adaptive research in Israel is included in this report.

Because of its complexity and the involvement of many research disciplines the extension of post harvest technology is best carried out by either the research workers themselves or by extension marketing technologists working with the teams of post harvest research workers and group involved in handling fruit from harvest until eventual consumption. Promotion for such extension specialists must be based on success in application and adaption of research results by problem solving research, consultation, and the production of extension publications and newsletters, rather than the publication of scientific papers in recognized journals.

Communication between all research extension personnel involved in post harvest research is required to ensure that uniform recommendations are made and problems are solved within the shortest possible time without wasting research resources and time. Small informal groups of research-extension personnel working in common fields, such as packaging, citrus handling, controlled atmosphere storage, on the storage of vegetables should be formed to meet annually and also wherever technical problems arise during the export season.

Managers of fruit packing sheds vary considerably in level of education and technical skills. Appointment of technically trained officers responsible for the handling and quality control of claim products should be encouraged. Short courses and training of existing management will encourage the understanding and adaption of new technology recommended by research-extension personnel.

Overseas evaluation of trial shipments and quality control of fruit from commercial consignment by specialists familiar with post harvest technology is recommended for all products exported. Potential loss of quality and sales can be avoided by marketing the produce overseas according to its conditions on arrival and by providing "feedback" of specific local market requirements, for

packaging and maturity.

Cooperation of local machinery and coolroom manufacturers with engineers from the Institute of Agricultural Engineering and Universities is recommended to ensure that most up to date research results are incorporated into new designs and proper evaluation occurs before commercial equipment is built.

Effective extension of new post harvest technology to fruit and vegetable retailers , chain store managers, transport companies and fruit and vegetable growers can be encouraged by distribution of "post harvest handling newsletters" similar to "Perishable Handling" produced by the University of California and by demonstration of technology during annual "open days" at research institutions.

The methods suggested in this report for improving the application of research results can be achieved within the existing framework of research institutions and commercial concerns by shifting research priorities to applied research, providing incentives in terms of promotion for adoption, application , and adoption of new technology and by employing more research-extension orientated personel in cooperative packing sheds, post harvest research research institutions and the vegetable marketing organizations.

INTRODUCTION

BACKGROUND

The limiting factors to extending the export of perishable products from Israel are the distance from European markets and the limited storage life which can result in loss of quality during marketing.

By combining temperature management , harvesting maturity , packaging technique and modified atmospheres, a specific handling system can be engineered for each fruit or vegetable to ensure that quality will be maintained for the largest possible time. The aim is to transport the commodity to the consumer in the best possible conditions by the most practical methods, at the lowest possible cost.

In recent years the amount of technology available for application to the handling of fruit and vegetables has increased so rapidly that the limitation for "improvement" is the rate at which the new technology can be extended or applied to the marketing system.

This project was initiated to suggest the most effective method for gaining access to local and overseas post harvest technology, and applying it to the local export industries in the minimum possible time by utilizing local personnel and measures.

Overseas visits by physiologists and engineers have revealed techniques which are suitable for application to the handling conditions and climate of Israel. More recently a U.N.I.D.C. specialist agricultural engineer suggested improvements and research directions necessary to improve the performance of pre-cooling installations in Israel. This current project is intended to follow on by suggesting suitable technology for application in Israel and possible method for research extension and application of the best of local and overseas research results.

OBJECTIVES

- 1.) To make recommendations on methods for adaption and application of research findings to the commercial handling of fruit and vegetables for export from Israel.
- 2.) Discuss with industry groups the existing systems for post harvest handling of fruit and vegetables and advise on new developments in applied research in overseas countries, especially Australia.
- 3.) Advise industry groups of methods and equipment developed for handling specific fruits that may be easily applied to the handling of other fruits and vegetables.
- 4.) Lecture to research staff and discuss the post harvest handling of fruit and vegetables in Australia and suggest possible directions for applied research in cooperation with export companies, industry groups and co-operatives in Israel.

FINDINGS

The procedures used for the post harvest handling of fruit and vegetables for export and local marketing by the Citrus Marketing Board, Agrexco, and the Israeli Fruit Growers Association were examined and discussed to determine their requirements and sources of technical information. Discussions with officers of the Division of Fruit and Vegetable Storage and the Institute of Agricultural Engineering were held to exchange research information, and determine the most suitable way to communicate research results to the industry, adapt overseas research to the local situation, and work with industry researchers to ensure that the most suitable technology is applied to the handling system recommended for each fruit and vegetable exported.

ISRAEL FRUIT GROWERS ASSOCIATION (Kiryat Shemona)

The Israel Fruit Growers Association employs a research officer and two assistants at its well equipped laboratory situated near Kiryat Shemona. The success of the group in researching overseas information, adaption by local research, and application to the field situation is revealed in the handling, controlled atmosphere storage and marketing of apples in Israel.

Initial contacts for research information were made by overseas visits to applied research institutions in California, New York State, Europe and England and a regular exchange of informations in the form of extension newsletters, field observations and first hand research results has been continued by mail.

The need for on the spot information , analysis services for chemicals used , and quick results have all been recognized by this laboratory. Research covers all aspects of post harvest handling from predicting and assessing the correct harvest maturity, fungicide treatment, coolstore construction, design, construction and operation of controlled atmosphere equipment, temperature measurement and the final marketing of the fruit to the consumer.

The research extension information is applied by the officers of the laboratory working with well informed cool store managers who understand the technology and maintain and build their own equipment. They are encouraged to contact the laboratory if problems occur and some have visited cool stores overseas to investigate new techniques themselves.

A seasonal newsletter is published about four times a year to inform managers of new technical developments, additional services provided by the laboratory and potential problems to watch. Annual recommendations are made to fruitgrowers on maturity requirements and post harvest treatments before they deliver fruit to the cold store. Field days are held when it is necessary to demonstrate a new piece of equipment or demonstrate the results of storage trials.

The similarity between techniques for storage and handling apples in South Australia was discussed and information was exchanged on generator design and construction, polyurethane foam and aluminium for cool room construction,

calcium for improving storage life, thiabendazole analysis, ethylene removal from storage room , apple maturity prediction, and experimented techniques used for obtaining practical recommendations quickly.

The practical knowledge gained by the workers in this laboratory could be readily applied and adapted to the storage and marketing of the other fruit and vegetables. The applied nature of the research and the extension adaptation systems used have ensured that the association is storing fruit under the best possible conditions available. The delay between development of new technology and its application is minimal.

CITRUS MARKETING BOARD

The Agrotechnical Division of the Citrus Marketing board employs a group of technical qualified personnel responsible for the application of post harvest handling technology to the marketing of citrus. Each officer is responsible for researching a key section of post harvest handling procedures as well as being responsible for technical advice , problem solving and application of new handling procedures to a group of citrus packing sheds. These officers provide technical services for citrus packing sheds and are encouraged to provide advice , and solve technical problems for packing sheds managers rather than to "police" their operating procedures.

Officers of the Agrotechnical Division have accumulated considerable practical experience in the technical problems of citrus handling in local sheds. It is important that these officers should have access to all possible sources of information relative to their assigned field of research. They also provide the contacts necessary for rapid application of new ideas to the citrus industry .

A quality control section has recently been set up to examine samples of fruit packed by different packing sheds. It is intended to provide incentives for packing a uniform line of high quality of fruit by introducing a system

of fines and bonuses for the packing-houses according to fruit quality.

Fruit quality is assessed on arrival abroad by a recently appointed resident technical officer. This enables export trials initiated by the local technical officers here, to be assessed on arrival overseas and also enable fruit to be marketed according to its condition and market requirements.

Liaison between specialists in the citrus marketing board and research workers with similar interest occurs, but should be further encouraged and developed in the form of joint projects for the application of research results. The combination of theory and practical application will provide the best possible technology for select managers to adapt.

Post harvest handling procedures used in Israel were discussed at length with officers from the Division of Fruit and Vegetable Storage Research, Institute of Agricultural Engineering, and the Citrus Marketing board.

In the fields of automatic fruit packaging, and the cooling of fruit after harvest excellent cooperation at the applied research level was observed. A physiologist, engineer, machinery manufacturer and a scientist from the Technion University were all working with a citrus marketing board specialist in a packing shed to demonstrate and apply a new system for the automatic packing of citrus. This type of coordinated application of research results to the field situation should be encouraged by providing equal opportunities for promotion for research-extension officers successful in applying research results to the commercial situation.

Automatic packaging

Local research workers have developed a system for automatic filling of boxes and bulk bins with citrus fruit. This system will considerably reduce the labour input and cost involved in the packing of citrus for export. The research approaches used and participation in field application will ensure rapid adoption by the citrus industry.

Post Harvest Fungicide Treatment

The citrus industry is at present applying several fungicide treatments for the control of citrus wastage during marketing . The industry is rapidly developing automatic packing , export in bulk bins, and considering new techniques for storage of citrus. In order to develop this technology fully new and more efficient techniques for fungicide application must be considered. Prompt application of fungicides immediately after harvest using dipping equipment and a single protective fungicide applied to the fruit prior to washing is recommended to ensure complete control of wastage and allow fruit to be automatically filled into boxes without individual wraps.

Storage of citrus

The ethylene free controlled atmosphere storage system currently under development in Australia may provide an alternative to the current practice of ventilated cool storage. Although the current practice of checking samples of stored fruit to determine wastage allows selective marketing according to fruit condition, an alternative system of handling may give better results. If the fruit is fungicide treated and stored in bulk, any wastage can be eliminated prior to packing, and the distorsion of cartons and fungal growth on wooden boxes would no longer be a problem .

Reducing Weight Loss of Citrus

The precooling of citrus prior to export in non refrigerated ships has considerably reduced this problem. However, often fruit loses water by evaporation during delays between harvesting and packing. A system of evaporative cooling is at present being investigated by officers from the Institute of Agricultural Engineering and Division of Fruit and Vegetable Storage Research. By combining prompt fungicide treatment with the wetting of bins of fruit after harvest and their storage in an evaporatively cooled area, weight loss will be kept to a minimum.

Precooling facilities

A U.N.I.D.O. expert engineer has suggested improvements in package design, stacking patterns, and coolroom design which should improve the performance of these facilities. A conventional coolroom with the same amount of air movement and refrigeration capacity would provide more uniform precooling than the present system.

Oleocellosis injuries

A handling procedure for harvesting turgid fruit susceptible to oleocellosis is required. The techniques recommended by the University of California, Riverside for predicting and avoiding oleocellosis during harvesting should be adopted. Fungicides used for fruit treatment during this susceptible season should be applied promptly and phytotoxic materials should be avoided.

Other Fruit Treatments

The effects of G.A., and 2 - 4D on 1 showing color development and maintaining citrus rind quality are well known. Combinations of these treatments can be effectively applied to improve the quality of oranges and lemons for export.

AGREXCO

The Agrexco organization is responsible for the marketing of a wide range of perishable horticultural produce including vegetables, stonefruit and flowers. This organization has been established for a shorter period of time than the Citrus Marketing Board but because of the highly perishable nature of the produce handled its needs for a quality control system, well trained technical officers and overseas assessment of export are greater. Agrexco requires practical information on the best systems for handling fruit and vegetables from the time of the harvest through to eventual marketing overseas. This information is best supplied by specialist post harvest extension officers working within the established research institutions and carrying out joint demonstration trials with equivalent technical people employed by the Agrexco organization. The specialist post harvest extension officers, by working with applied research specialists and with the industry can apply the technology developed for other fruits to the produce exported by Agrexco.

The system developed for precooling and export of strawberries is a good example of the sort of cooperation between Agrexco and Research Institutions that should be encouraged. Although there are still problems with package design and stacking methods, the fruit has arrived overseas in good conditions even when exported in refrigerated containers aboard ships instead of by air freight.

Production orientated extension officers working for the Ministry of Agriculture cannot effectively extend post harvest technology because of their existing commitments and the complexity of the technology involved with the post harvest handling of fruit and vegetables. The production of a high yielding crop is often not in the interests of the high quality and critical maturity required for export markets. Specialist post harvest extension technologists are better qualified to liaise between production extension officers growers and industry requirements.

Broad Industry Problems

The broad industry problems on which research-extension efforts should be concentrated are:

- 1) Harvesting at the correct maturity and handling to avoid injury and damage to produce and containers.
- 2) Sanitation - all packing equipment should be kept clean and sterilized and appropriate materials for control of bacterial and fungal wastage should be utilized when required.
- 3) Rapid precooling followed by temperature maintenance during transport and marketing.

Overseas Laboratory

Establishment overseas of a technical team and laboratory will enable the condition of perishable to be checked on arrival and sales arranged accordingly. Some produce travel better in a green condition but initiation of ripening is required prior to sale in cooler European climates. Such a laboratory can supervise the controlled ripening of produce prior to sale.

Extension of Marketing Period

Many flowers can be harvested at the bud stage, stored for several weeks at 0°C and then opened prior to marketing without reducing quality or shelf life.

The extension of marketing periods by manipulating maturity, controlling temperature, and initiating the ripening process should be examined for many of the products marketed by Agrexco.

Cooling Methods

Agrexco has the basic equipment suitable for precooling fruit and vegetables. Forced air cooling, vacuum cooling, room cooling and hydrocooling all have a place in the cooling of fruit and vegetables prior to marketing. Research to improve cooling rates by modifying package design has been suggested and is

being carried out by the Institute of Agricultural Engineering.

The problem of pilfering , security checking and costs in relation to return are important aspects of research application.

Quality Control

The introduction of a system of quality control is essential to provide a fair system of incentive payments for packing quality produce. The importance of quality control is emphasized by the highly perishable nature of the produce and its critical maturity for marketing.

VULCANI CENTER

Division of Fruit and Vegetable Storage

Institute of Agricultural Engineering

This research organization employ groups of highly qualified people experienced in researching problems associated with the post harvest handling of fruit and vegetables. Despite isolation of the two groups from each other, cooperation in joint research projects is developing. The Institute of Agricultural Engineering can provide valuable basic information on cooler design, air flow systems, and packing machinery design. The production engineering division contributes valuable information on systems design and possible weaknesses during commercial application of research results. Since post harvest research involves the use and development of complicated machinery it is essential that officers from these divisions work together and contribute jointly to research projects and application of technology.

Research workers in these organizations are orientated towards applied research for the local industries but the application of their findings is limited by the system of assessment for promotion currently operating. Promotion is based on the production of research papers which especially in the field of post harvest physiology must be of a high standard for acceptance by recognized journals. This system of promotion does not encourage researchers to become involved in the application of local and overseas findings to the local industry. With the establishment of incentive for the application of research results, the development of a research extension outlook cooperation with industry will develop, and research results will be simultaneously applied to suit industry needs.

Provision of money by industry for research would be encouraged by assurance that the research carried out will be followed through to the practical application of results. It is desirable for the research-extension team to apply results in the field rather than leave it to another group not familiar with both the theoretical and practical problems involved.

Research approaches by these groups are in the right direction but more emphasis is needed on the practical approach to problem solving by using the existing resources of research information available. This often means adapting knowledge post harvest physiology and engineering techniques to modify existing procedures for marketing perishable produce.

RECOMMENDATIONS

1. Post Harvest Extension Specialists

Extension officers specialising in the post harvest handling of fruit and vegetables should be appointed to work with research staff in the Division of Fruit and Vegetables Storage and the Institute of Agricultural Engineering. These officers must be highly qualified, have a practical outlook, and capable of making precise recommendations based on scientific information available from local and overseas sources. To obtain effective extension of research results the specialists must be actively involved in applied research, demonstration of new technology and the preparation of information sheets and newsletters. Promotion of existing staff should be based on both the production and application of research results.

2. Travel and Training

Research personnel selected for their ability to recognize and adapt technology to local conditions should travel to key overseas research institutions carrying out applied post harvest research. Since post harvest technology is involved with engineering, marketing and physiological problems it is desirable for specialists from these fields to travel together to assess overseas research results.

3. Communication between Post Harvest Specialists in Israel

Post harvest handling principles are basically the same for most fruit and vegetables. Systems of handling developed for some fruits can be applied with minor modifications to vegetables.

Post Harvest Researchers working for government, and private organizations should be encouraged to meet informally in small groups to ensure the maximum utilization of research information and experience. Small committees of this type in Australia have encouraged the rapid distribution of research information, provided uniform recommendations on post harvest techniques, and increased the relevance of research by preventing duplication of research.

4. Research Equipment and Facilities

Modern laboratory and office facilities are required for officers of the Division of Fruit and Vegetables Storage Research. Coolrooms and controlled temperature rooms are required for the demonstration and research of post harvest techniques. A small citrus packing line is required for the demonstration of practical research results to the citrus industry. Emphasis should be placed on simple modular design which will allow the equipment to be easily modified to demonstrate alternative handling and storage techniques.

5. Overseas Quality Control

Marketing organizations exporting fruit and vegetables overseas require technologists resident in major importing countries to examine the quality of fruit and vegetables on arrival and make decision on their suitability for either storage or immediate sale. These officers will also assess the results of export trials and provide expert assessment of the causes of wastage and possible changes in technology to suit overseas requirements.

The citrus marketing board has already based a technical office overseas for this purpose but more experienced and qualified personnel are required for quality checking of the wide range of highly perishable produce exported by Agrexco. A small laboratory similar to the U.S.D.A. facilities at Rotterdam is required for the storage, and examination, of produce from trial shipments.

6. Local Quality Control

A quality control system as recently established by the Citrus Marketing Board is required for the Agrexco organization. It is necessary to provide incentives to growers and cooperative packers to pack only quality produce. Information from the quality control section can be used to paralyze those packing poor quality produce and increase returns to those packing to a high standard.

7. Courses for Packing Shed Managers

Shed managers vary in their technical training and experience. Post harvest technology is increasing in complexity and rapidly changing. A program of short courses conducted by experienced physiologists and agricultural engineers will assist managers in decision making and encourage adaption of new technology.

8. Newsletters

A post harvest handling newsletter covering all aspects of the post harvest handling of fruit and vegetables similar to the Perishables Handling Newsletter produced at Davis California is ideal for the extension of post harvest technology to growers, packers, and marketing organizations. This newsletter should be jointly prepared by post harvest extension specialists working within the Divisions of Fruit and Vegetable Storage and Agricultural Engineering.

9. Extension Specialists for Agrexco

Attention should be directed to the research and extension requirements of the Agrexco organization. Because of the wide range of produce exported and the large numbers of growers involved every effort must be made to adapt existing technology to the handling of this produce. Additional qualified research-extension specialists are required to work with the Agrexco organization and liaise with post harvest research specialists and engineers.

10. Research Priorities

It is desirable to carry out some basic research within existing research institutions together with the immediate application of research results from local and overseas sources. Industry organizations require immediate answers to problems and cannot afford to wait for the results of long term trials. Existing personnel must familiarize themselves with all practical technology available and provide definite answers to industry based on their "resource" of information.

The broad objective for research is to improve the quality and extend the marketing period for the export of fruit and vegetables from Israel.

Research should be directed to providing significant increases in fruit quality which can be easily demonstrated, reduce costs or increase returns to the grower and be compatible with other necessary post harvest techniques. A list of techniques suitable for adoption to the local industry is included.

Projects suitable for research and application to the improvement of quality and extension of the marketing season of fruit and vegetables exported from Israel

- 1) Investigate a system of fungicide application to citrus fruits aimed at prevention of wastage by prompt treatment within 24 hours of harvest, followed by an effective application of a protective fungicide treatment to ensure no wastage develops during marketing.
- 2) By adopting the most effective program for controlling fruit wastage, efforts can be directed to exporting fruit without wraps and in bulk containers.
- 3) Without individual wraps around each fruit precooling in ventilated boxes can be investigated.
- 4) Develop the system of ethylene free atmospheres for the storage and transport of citrus fruits, flowers, bananas and tropical fruits.
- 5) Continue investigations into forced air cooling for tomatoes strawberries, stone fruits, and flowers especially in relation to container design and stacking arrangements of parcels.
- 6) Develop in the field quality and maturity checking to ensure that only the best quality produce harvested at the optimum maturity is exported.
- 7) Provide information to the floriculture industry on the techniques of harvesting unopened flowers, cool storage, and then preservative solutions for opening buds and improving vase life.
- 8) Investigate the use of slipsheets instead of pallets for the handling of bulk export bins.
- 9) Apply the technique of automatic packing to other exported products.
- 10) Investigate the effects of preharvest and post harvest applications of high concentrations of calcium for improving the quality of locally grown apples.

- 11) Investigate the potential for building lightweight low cost coolrooms for controlled atmosphere storage using urethane foam insulation and an external metal vapour seal.
- 12) Evaluate the plastic jacketed system for connecting existing coolrooms to controlled atmosphere storage especially in relation to the storage of vegetables under high humidity conditions.
- 13) Investigate the value and potential for adoption of a container system using "clip on" refrigeration units, and a refrigeration bank at the port for exporting fruit and vegetables in containers.
- 14) Develop system using cold night air, evaporative cooling, and coating of harvested fruit to reduce weight loss and precooling time required for apples, citrus, and potatoes.
- 15) Demonstrate the importance of storage temperatures for processing potatoes and the value of combining the use of C.I.P.C. as a sprout inhibitor and insulated, ventilated and refrigerated potatoes store.
- 16) Continue to develop an automatic system for sorting of blemished citrus fruit.
- 17) Evaluate the "air agitation" system for preventing odours and maintaining suspension of wettable powder fungicide in bulk dipping tanks and flood applications for citrus.

A P P E N D I X

I. Job Description

DP/ISR/73/014/11-02/06 rev. 1**

Post Title : Post-Harvest Physiologist

Duration : Three weeks

Date required : April 1975

Duty Station : Agricultural Research Organization. The Volcani Center -
Bet Dagan

Purpose of Project : To assist in improving refrigerated storage and transport of perishable products through applied research and introduction of modern equipment and methods.

Duties : The expert, working within the Division of Fruit and Vegetable Storage of the Institute and in co-operation with the Division of Environmental Engineering of the Agricultural Research Organization will be expected to:

1. suggest research approaches aimed at extending post-harvest life of perishables;
2. lead local research staff in establishing improved techniques for evaluating the quality of agricultural products during refrigerated storage and shipment;
3. evaluate commercial practices of refrigerated storage and shipment, and recommend improvements for the industry.

Qualifications : Highly qualified plant physiologist-biochemist with experience in physiology and biochemistry of perishables, post-harvest handling and storage, and laboratory evaluation of quality and applied research.

** This revision of this Job Description is being issued due to a change in the Date Required.

II. Project Counterparts

Mr. G. Felsenstein

Deputy Director, Institute of Agricultural Engineering

Dr. Edo Chalutz

Senior Scientist, Division of Fruit and Vegetable Storage

Mr. Arie Sive

Research-Extension Post Harvest physiologist, Israel Fruit-growers Association.

Mr. N. Kaplan

Advisory Section on packing houses, Agrotechnical Division, Citrus Marketing Board of Israel

Mr. D. Shalit

Quality control section. Citrus Marketing board of Israel

Mr. Z. Keshet

Sharnoia Ltd. Manufacturer of fruit and vegetable packing house equipment.

Dr. Kalman Peleg

Faculty of Agricultural Engineering, Technion Haifa

III. Fellowships

Mr. G. Felsenstein and Dr. Edo Chalutz visited Australia and Japan to study post harvest handling and refrigerated transport of fruit and vegetables from April 25th to June 1st, 1974

IV. Reference to Related Reports

1. Precooling, refrigerated storage and transport of perishable produce for the export market by A.H. Bennett (agricultural engineer).
2. Overseas report by G.Felsenstein and D. Edo Chalutz , Australia and Japan April to June 1974.
3. The Post Harvest Handling of Fruit and Vegetables . A review of research-extension needs, research projects and overseas research on the Post Harvest

Handling of fruit and vegetable by B.L. Tugwell

V. Seminars Conducted

1. A seminar on the post harvest handling of fruit and vegetables in Australia was conducted at the Division of Fruit and Vegetable Storage Research on April 21st , 1975

VI. Acknowledgments

Appreciation is expressed to the U.N.D.P. officials for providing finance and organizing the project. The cooperation of officers from the Division of Fruit and Vegetable Storage , Institute of Agricultural Engineering, Israeli Fruit-growers Association, Citrus Marketing Board, Agrexco, Packing Houses, and Cold Stores, in opening discussing their achievements and problems was also appreciated.



