AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523
BIBLIOGRAPHIC INPUT SHEET

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Batch 74

1. SUBJECT CLASSIFICATION
A. PRIMARY: Food production and nutrition — AQ10-0000-0000
B. SECONDARY: Food processing

2. TITLE AND SUBTITLE
Report on the Alexandria,Egypt food storage seminar

3. AUTHOR(S)
(101) Sem.in Food Storage and Handling Practices,Alexandria,Egypt,1977

4. DOCUMENT DATE	5. NUMBER OF PAGES	6. ARC NUMBER
1978	~~88p.~~ 90p.	ARC AFR631.56.A265a

7. REFERENCE ORGANIZATION NAME AND ADDRESS

AID/FFP

8. SUPPLEMENTARY NOTES *(Sponsoring Organization, Publishers, Availability)*

9. ABSTRACT

Proceedings of the Seminar in Food Storage and Handling Practices held in Alexandria, Egypt, January 17-21, 1977. In-country training of those individuals responsible for the handling of food is a prime means of creating an awareness of the problems and of presenting effective ways to prevent food losses. This is the third seminar of its kind, the first two being held in Dakar, Senegal, and Manila, Philippines. Following the standards set in previous seminars the Alexandria seminar provided a review of the methods and procedures for reducing food losses through the protection, proper handling and preservation of stored food, including those foods produced domestically and imported foods. One hundred and sixteen representatives from 26 African and East Asian countries were registered. Lectures outlined in this document include: (1) How to Extend the World's Available Food Supply Through Improved Packaging, Storage and Handling; (2) Quality Assurance Programs in the United States; (3) Fumigation Procedures; (4) Rodent Control; (5) Insect Pests of Processed Cereals and Bagged Grain; (6) Application of Insecticide Sprays and Fogs; (7) Types of Damage to Packaged Food Commodities; (8) Protection of Packaged Commodities From Insects; (9) Typical Movement of Commodities in Overseas Programs; (10) Warehouse Construction As It Relates to Sanitation; and (11) Inspection of Warehouse. Annexes include a List of Seminar Participants and Mailing Addresses; Food Storage Seminar Questionnaire; Warehouse Inspection Sheet; and Seminar Organization/Pre-planning.

10. CONTROL NUMBER
PN-AAF-103

11. PRICE OF DOCUMENT

12. DESCRIPTORS
Africa
Asia
Food storage
Grain crops
Materials handling
Meetings
Pest control

13. PROJECT NUMBER

14. CONTRACT NUMBER
AID/FFP

15. TYPE OF DOCUMENT

AID 590-1 (4-74)

AID/FFP
PN-AAF-103

FOOD
FOR
PEACE

FOOD STORAGE SEMINAR

Alexandria, Egypt
January 17-21, 1977

Agency for International Development
Washington, D.C. 20523

REPORT ON THE ALEXANDRIA, EGYPT FOOD STORAGE SEMINAR

JANUARY 17-21, 1977
PALESTINE HOTEL
ALEXANDRIA, EGYPT

Sponsored by:

Office of Food for Peace
Agency for International Development
Washington, D.C. 20523

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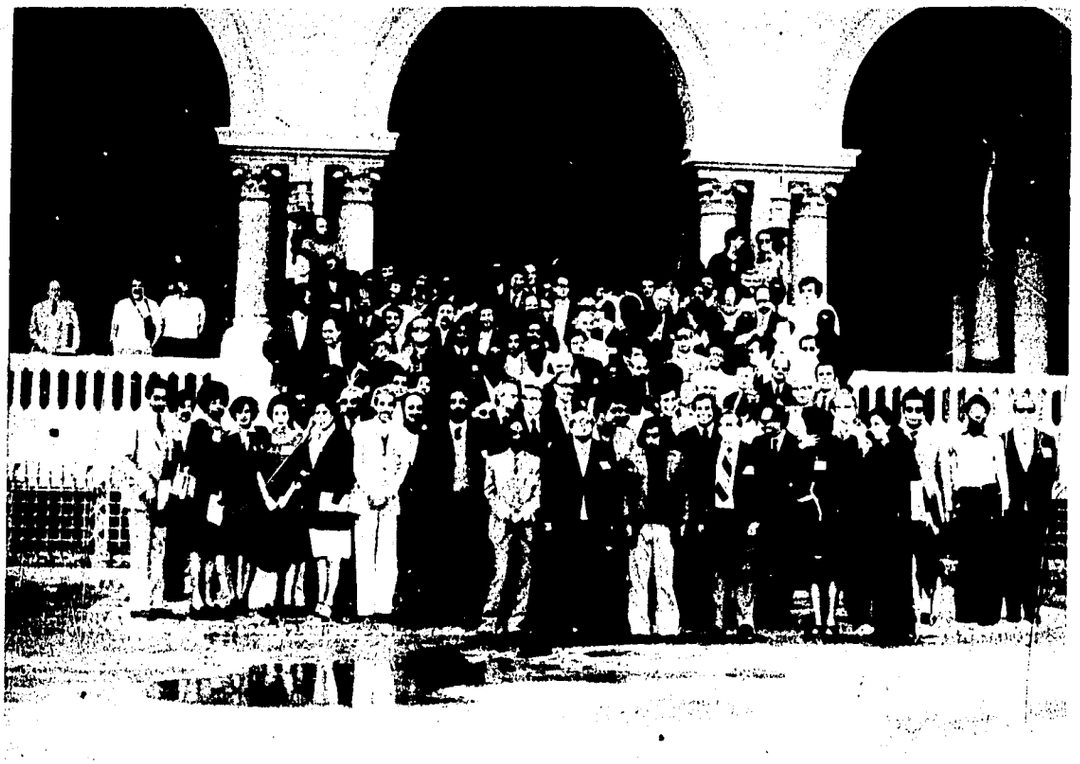


Group picture of the participants who attended the Alexandria, Egypt, Food Storage Seminar.

PREFACE AND OBJECTIVES

The Agency for International Development (AID) as the administer of the U.S. foreign aid program, is directing its efforts to those humanitarian programs which improve the daily lives of the poor in the Less Developed Countries (LDCs). Programs such as improved health care, better nutrition and viable families have been re-emphasized and expanded in scope. A.I.D. has recognized food as the primary resource in achieving these development goals. Critical to the utilization of food as a resource is the increasing of the world's available food supply. In addition to increasing food production through agricultural research, development of soil, and expanded cropping, A.I.D. has recognized another means—that of reduction of food losses in the Third World. The food storage and handling training seminars for LDC participants involved in food handling is but one of the ways of attacking food losses.

Increasing worldwide availability of food was underscored at the World Food Conference held in Rome, November 1974. This conference drew attention to the global food shortage, particularly in the Third World (LDCs). As a result of this meeting a World Food Council was formed with the primary objective of designing an international food strategy. This Council is comprised of thirty nations from the developed and developing worlds. The U.S., as a member, has proposed the focussing of attention on the issue of hunger and has requested commitments from member countries toward the problem.

As part of this attack on hunger, AID has approved continuing the training seminars through 1979 for LDC participants involved in managing and handling PL 480 food aid programs.

The PL 480 food aid program is administered jointly by AID, the U.S. Department of Agriculture (USDA), State Department and Office of Management and Budget. Within AID the Office of Food for Peace has the major responsibility for administering the PL 480 program. The Office of Food for Peace is putting forth its maximum efforts to reduce food losses which occur during the delivery, storage and distribution of Food for Peace commodities. It is estimated that the majority of the food losses now being experienced under this program could be eliminated through improved handling and storage practices. In order to achieve this goal the first step is to identify the cause of the loss and then to have the knowledge of the proper steps to take to eliminate it. To disseminate this specialized knowledge as widely as possible a series of food storage seminars have been conducted since 1974 focussing on the causes of food loss and the corrective actions necessary to prevent them.

Five objectives have been the framework for developing these seminars:

1. To create an awareness of the problems associated with the handling and storage of grains and cereals, and the magnitude of such losses.
2. To identify the conditions that contribute to the deterioration of food by insects, rodents and moisture.
3. To present methods and tools presently available to prevent or correct the problems which produce losses of food.
4. To illustrate quality control procedures that are available to ensure the safety and nutritional value of food.
5. To present current research and development of specialized packaging materials and handling procedures.

It is our belief that in-country training of those individuals responsible for the handling of food is a prime means of creating an awareness of the problems and of presenting effective ways to prevent the losses.

The effectiveness of these training seminars can be measured in terms of whether a significant reduction of food losses has occurred in countries sending participants. To date analyses of loss reports for countries who have previously attended these seminars has been encouraging and indicate a significant improvement.

The first food storage seminar sponsored by AID was held in Dakar, Senegal in November 1974 in response to the urgent need resulting from the Sahel drought emer-

gency. The second seminar took place in Manila, Philippines in April 1975, for those countries in the East Asia Region. The third seminar was held in San Pedro Sula, Honduras in January 1976 for countries of the Latin American region. Food for Peace in collaboration with the Technical Assistance Bureau (TAB) and the Regional Bureaus conducted the above series of seminars.

The most recent food storage seminar and the subject of this report was in Alexandria, Egypt, January 17-21, 1977. This is the first to be scheduled under the approved seminar series sponsored by the Office of Food for Peace.

Following the standards set in previous seminars the Alexandria seminar provided a review of the methods and procedures for reducing food losses through the protection, proper handling and preservation of stored food, including those foods produced domestically and foods imported under PL 480 as well as through commercial channels.

At the Alexandria seminar the program was broadened to include U.S. D.A. claims procedures, U.S. procurement process and ocean transport. These presentations were made by representatives from the U.S. Department of Agriculture. Another addition was the availability and distribution of training sets consisting of lectures, accompanying slides and a 16 mm film to participant countries.

One hundred and sixteen representatives from twenty-six African and East Asian countries officially registered at the Alexandria seminar. The countries represented were: Botswana, Burundi, Canada, Central African Empire, Chad, Ethiopia, Italy, Ivory Coast, Kenya, Lesotho, Madagascar, Malawi, Niger, Peoples Democratic Republic of Yemen, Rwanda, Somalia, Sudan, Swaziland, Syria, Tanzania, Turkey, United Arab Republic (Egypt), United States, Yemen Arab Republic, Zaire and Zambia.

These representatives were government officials, field officers of American Voluntary Agencies such as CARE and Catholic Relief Services, UN officials, Food for Peace Officers, AID personnel and private industry representatives.

They were selected on the basis of their experience, background and present responsibilities in the area of food storage, processing, transport and distribution.

In addition to those officially registered a number of walk-in observers attended selected lectures and demonstrations on a daily basis.

View of conference participants during opening ceremonies, Alexandria, Egypt.

AGENDA

Seminar in Food Storage and Handling Practices

Alexandria, Egypt—January 17-21, 1977

Monday—January 17

09:00-12:30 CALL TO ORDER
Ms. Ann Fitzcharles, Food for Peace Officer, USAID, Cairo

WELCOMING REMARKS
Mr. Donald S. Brown, Mission Director, USAID, Cairo

WELCOMING ADDRESS
The Honorable Robert Chase, Consul General of the United States of America, Alexandria

INTRODUCTION OF STAFF
Ms. Peggy Sheehan, Chief, Program Operations Division, Food for Peace, AID/ Washington

LECTURE 1
"How to Extend the World's Available Food Supply Through Improved Packaging, Storage and Handling" (W. H. Schoenherr)

10:30 COFFEE BREAK

LECTURE 2
Quality Assurance Programs in the United States (D. E. Lawson)

LECTURE 3
Fumigation Procedures (D. A. Wilbur, Jr.)

WELCOMING ADDRESS
His Excellency Abdel Tawab Hodeib, The Governor of Alexandria

12:30-14:00 LUNCH

14:00 BUSES DEPART FROM HOTEL

15:00-17:00 WAREHOUSE DEMONSTRATION

I. Proper Procedures Prior to Fumigation

II. Proper Fumigation with Methyl Bromide and Phosphine

17:00 BUSES RETURN TO HOTEL

Tuesday—January 18

09:00-12:30 LECTURE 4
Rodent Control (D. A. Wilbur, Jr.)

LECTURE 5
Insect Pests of Processed Cereals and Bagged Grain (H. A. Highland)

COFFEE BREAK

LECTURE 6
Application of Insecticide Sprays and Fogs (D. A. Wilbur, Jr.)

LECTURE 7
Types of Damage to Packaged Food Commodities (P. A. Sheehan and H. A. Highland)

12:30-14:00 LUNCH

14:00 BUSES DEPART FROM HOTEL

15:00-17:00 WAREHOUSE DEMONSTRATION

I. Cleaning Techniques

II. Application of Insecticides

III. Rodent Control

IV. Monitor Fumigation

17:00 BUSES RETURN TO HOTEL

Wednesday, January 19

09:00-12:30 LECTURE 8
Protection of Packaged Commodities From Insects (H. A. Highland)

LECTURE 9
Typical Movement of Commodities in Overseas Programs (W. H. Schoenherr)

COFFEE BREAK

LECTURE 10
Warehouse Construction As It Relates to Sanitation (W. H. Schoenherr)

12:30-14:00 LUNCH

14:00 LECTURE 11
INSPECTION OF A WAREHOUSE (D. A. Wilbur, Jr.)

15:00-17:00 WAREHOUSE DEMONSTRATION
At Conference Facility (By D. Lawson/H. Highland)

I. Completion of Fumigation

II. Demonstration of Proper Sampling Techniques

III. Warehouse Inspection

COFFEE BREAK

FOOD FOR PEACE OPERATIONS
(P. A. Sheehan/H. Highland)
Six month evaluation of Commodity Status/Recipient Status Reporting (J. Johnson)

Thursday—January 20

09:00-12:30 PRESENTATION BY PARTICIPANTS EXPLAINING STORAGE TECHNIQUES IN THEIR COUNTRY

COFFEE BREAK

OPEN FORUM-QUESTIONS FROM PARTICIPANTS

12:30-14:00 LUNCH

14:00-17:00 USDA Claims Procedures (Dave Bell)

USDA Booking and Transporting (J. Maxwell)

USDA Procurement Process (J. Schlick)

COFFEE BREAK

CLOSING CEREMONIES

Participants listening to Opening Ceremonies at Alexandria.

OPENING CEREMONIES

The seminar convened on schedule Monday, January 17 at 0900 with a call to order by the Chairman of the Seminar, Mrs. Ann Fitzcharles, Food for Peace Officer, USAID/EGYPT.

The sessions were officially opened with welcoming remarks by Mr. Donald S. Brown, Mission Director, USAID/Egypt. Mr. Brown underscored the importance of reducing food losses and the U.S. Government's interest in such programs.

The Honorable Robert Chase, American Consul General, Alexandria welcomed the participants to Alexandria. Mr. Chase cited past achievements of joint organizations and people in addressing the world's problems.

His Excellency Abdel Tawab Hodeib, Governor of Alexandria, welcomed the seminar participants on behalf of the Government of Egypt.

Mr. Donald S. Brown, Mission Director, USAID/Egypt during opening ceremonies.

Mr. Robert Chase, American Consul General, Alexandria, Egypt, shown addressing the participants during opening ceremonies.

Mrs. Ann Fitzcharles, Food for Peace Officer, USAID/Egypt issuing the Call to Order convening the seminar.

His Excellency Abdel Tawab Hodeib, Governor of Alexandria, welcoming participants on behalf of the Government of Egypt.

Miss Peggy Sheehan, Food for Peace, Washington, introduced the seminar staff. In her opening remarks she reviewed the objectives of the seminar, stressing its goal: to reduce significantly food losses due to poor handling and storage through this training technique.

Peggy A. Sheehan, Chief, Program Operations Division, Food for Peace, Washington, giving opening remarks on seminar objectives and introducing the seminar staff.

To: Participants
Alexandria Egypt Food Storage Seminar

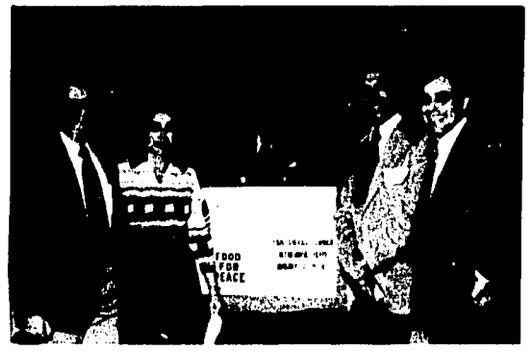
The seminar technical staff would like to thank all who attended the recent Alexandria seminar.

We hope the materials received have been helpful in your country's training programs in reducing food losses.

Sincerely

SEMINAR STAFF

The seminar staff consisted of William H. Schoenherr, Lauhoff Grain Company; Donald A. Wilbur, Jr., the Industrial Fumigant Company, Dr. Donald Lawson, Krause Milling Company and Dr. Henry A. Highland, U.S. Department of Agriculture. Together they represent many years of valuable experience in food production, protection and research. They form a well-balanced team, each one complementing the other in experience and field of expertise.



The Seminar Staff: From Left to Right: Don Lawson, Peggy Sheehan, Bill Schoenherr, Henry Highland and Don Wilbur.

TECHNICAL PROGRAM AND COURSE OUTLINE

The Alexandria seminar program combined lectures with demonstrations and field trips. These lectures were supplemented by slide presentations and films. The morning lectures were closely correlated with on-site demonstrations in the afternoon. Opportunities for question-and-answer sessions were offered to insure complete comprehension. Participants submitted questions to the seminar staff in writing at the end of the particular session.

During the first two days of the seminar, participants visited area warehouses containing actual P.L. 480 Title II commodities to observe first-hand good warehousing practices, inspection and demonstrations on fumigation. In lieu of field trips on the third and fourth days of the seminar, the lecture sessions were continued and discussed indepth at the conference facility. This permitted the conclusion of the seminar a half-day earlier than scheduled.

For the first time in the seminar series, the technical program included presentations on U.S. Government claims procedures, procurement process, and ocean transportation bookings for P.L. 480 Title II commodities. These presentations were given by U.S. Department of Agriculture representatives Mr. James Schlick, Mr. Dave Bell and Mr. John Maxwell. These presentations were accompanied by slides and hand-out materials when available.

The training manuals/handbooks distributed to the participants at the Alexandria seminar included a complete set of the seminar lecture series #1 through #11. These lectures cover the following:

ALEXANDRIA, EGYPT FOOD STORAGE AND HANDLING PRACTICES

Technical Program—Lecture Series

1. *How to Extend the World's Available Food Supply Through Improved Packaging, Storage and Handling.* A 16 mm film, showing time 29 minutes. Narration by a seminar instructor. The objectives are to illustrate the quality control requirements in the productior of foods, the methods of handling and storage of food in both the United States and other countries. Both good and poor storage practices are illustrated with emphasis on damage and spoilage.
2. *Quality Assurance Programs in the United States.* 30 slides.
3. *Fumigation Procedures.* 25 slides and a 16 mm film with sound, showing time 25 minutes.

Lectures 1, 2 and 3 are presented on the first day of the program and are followed by a demonstration of fumigation of packaged food in a warehouse.

4. *Rodent Control.* 51 slides.
5. *Insect Pests of Processed Cereals and Bagged Grain.* 45 slides.
6. *Application of Insecticide Sprays and Fogs.* 19 slides.
7. *Types of Damage to Packaged Food Commodities.* 39 slides.

Lectures 4, 5, 6 and 7 are presented on the second day of the program and are followed by a demonstration of the application of insecticide sprays and fogs and a demonstration of rodent control.

8. *Protection of Packaged Commodities from Insects.* 26 slides.
9. *Typical Movement of Commodities in Overseas Programs.* 22 slides.
10. *Warehouse Construction As It Relates to Sanitation.* 13 slides.
11. *Inspection of a Warehouse.* 53 slides.

Lectures 8, 9, 10 and 11 are presented on the third day of the program and are followed by the completion of the fumigation started on the first day and by a demonstration of sampling techniques and an examination of packaged commodities and warehouse conditions.

Lecture #1

HOW TO EXTEND THE WORLD'S AVAILABLE FOOD SUPPLY THROUGH IMPROVED PACKAGING, STORAGE AND HANDLING

A 16 mm film without a sound track that requires a showing time of 29 minutes and 14 seconds. The subject sequence and time breakdown will assist anyone desiring to use and to narrate the film. At this time it was felt that it would be more useful to retain the opportunity to prepare a narration to best suit the interest of the audience at each showing. The comments that will be given here should assist anyone desiring to use the film. Each subject is numbered, the prepared comments will follow the same numbering sequence.

BACKGROUND: The film is a compilation of scenes taken in a number of widely scattered locations such as the United States, South and Central America, the Dominican Republic, the Republic of the Philippines and India. Most of the filming was done by the St. Regis Paper Company and it is with their permission that it has been made available as a training aid.
A team of industry and U.S. Government scientists have worked together to improve the types of packages used to protect foods. As early as 1965, when the first packaging research shipment was made, it was apparent to the team that regardless of the merits of the package, certain problems could still result in the loss of substantial amounts of food. The objective of the film, therefore, is to acquaint the viewer with the Quality Assurance programs that are mandatory at the food processing, packaging and rail shipment levels. The film will also illustrate both good and poor storage and handling practices.

The filming was accomplished under rather difficult conditions; therefore, the quality is not truly professional. For this we offer our apologies. However, it is felt that a valuable story is told and the scenes will alert the viewer to actual conditions, exposure and losses that do occur in the food that is available today.

The time breakdown is given as an appendix to this narration.

1. HOW TO EXTEND THE WORLD'S AVAILABLE FOOD SUPPLY THROUGH IMPROVED PACKAGING, STORAGE AND HANDLING. The key word in the title is "Available". The extensive research and field testing that has already been done to help extend the storageability of foods will be continued. As new problems surface they will be examined and we hope, will be solved. Also the objectives of this seminar are to emphasize conditions that may cause spoilage and losses and some of the precautions that can be taken to reduce the losses.
2. FIRST PANNING VIEW OF A FOOD PROCESSING PLANT. The food production plants may be small structures involving one or two buildings or very large facilities such as shown here. Regardless of the size the same rigid regulatory requirements are enforced.
3. "A MODERN CEREAL PROCESSING PLANT".
4. SECOND PANNING VIEW OF A FOOD PROCESSING PLANT. Modern processing plants have no windows that can be opened and the number of doors are held to a minimum. Good storage facilities for new materials as well as the finished foods are also an integral part of a modern facility.
5. LABORATORY DOOR "ANALYTICAL CONTROL LABORATORY". The requirements for cleanliness and meeting the standards for nutrition make constant monitoring a necessity.
6. LABORATORY (BIOLOGICAL) TECHNICIAN AT INCUBATOR, CHECKING CULTURES. In considering the functions of the Analytical Laboratory in the production of food there are two distinct and diverse areas. One encompasses the micro-biological cleanliness which includes the testing for Salmonella, Staphylococcus, total plate counts, mold and yeast counts, aflatoxin and others. Expensive laboratory equipment, well trained technicians, cleanliness and time are the requirements for an effective micro-biological laboratory.

7. LABORATORY (BIOLOGICAL) TECHNICIAN AT MICROSCOPE, MAKING A BACTERIA COUNT. The time required to complete tests will vary from a few hours up to as long as seven days. This type of surveillance is so important since many of the organisms could cause illness and they must not be allowed in foods.
8. EXTRANEOUS ANALYSES PROCEDURES. Also considered as an important analysis for food products is to determine the presence of extraneous materials. This means small particles that are not normally a part of the food. These materials may or may not be significant in causing illnesses. Included here would be whole insects in any stage of development such as eggs, larvae, pupae or adults or even small fragments of insects. Contamination caused by rodents or birds can also be isolated and identified.
9. EXAMINATION FOR EXTRANEOUS MATERIALS BY MEANS OF A MICROSCOPE. The test procedure involves the separation of extraneous materials from the food by means of chemicals. The materials then are placed on filter papers and examined under a microscope. A very well trained analyst is required to properly identify the particles that may be on the filter papers. This is an important test since it would indicate the presence of small insects that could not be seen without magnification. Food products must be free of any live insects at this stage of handling if the food is not to be consumed for several months.
10. QUALITY CONTROL LABORATORY, PANNING VIEW. The second important function of the analytical laboratory is to determine that all product standards have been met. This involves a number of tests some of which are: moisture, granulation, fat, fiber, ash, protein and degree of gelatinization. To be fully meaningful, tests of this type are performed continually as foods are being manufactured and packaged. In other words, if the plant is operating so is the laboratory.
11. TESTING FOR FIBER IN CEREAL FOODS. In the laboratory that is shown in this movie it is possible to have several tests going at one time. To determine fiber in a food requires approximately 3½ hours. In a well equipped laboratory one technician can complete the test for fiber on 12 samples in approximately 4½ hours.
12. WEIGHING A SAMPLE FOR PROTEIN ANALYSIS
13. PROTEIN ANALYSIS. Testing for protein is another important analysis and must be accomplished by well trained analysts. It requires approximately 2½ hours to complete one test. However, on the equipment shown here a total of 12 tests can be completed in 3 hours. Six chemicals and reagents are required.
14. PREPARING A SAMPLE FOR FAT ANALYSIS. The amount of fat in food is important and different levels are required for different foods. The testing is a two step process. The sample to be tested must first be ground to assure uniformity of article size and then thoroughly mixed, after which it is weighed. The weighed portion is then placed in a double wrapper of filter paper. The exact weight is extremely important as is the protection afforded by the filter paper and both must be performed very carefully. The glass beaker used in this test must also be weighed.
15. FAT EXTRACTION ROOM. It is a recommended practice that the extraction racks be isolated and kept off limits to most personnel. Ether is the chemical used in the extraction and since it is very combustible the added precautions are justified.

This has been a very rapid tour of a really complicated laboratory but it should serve as an indication of the careful testing that is being performed to assure that foods are correctly prepared and do meet the requirements for purity, safety and nutrition. Although you have seen how the food processors accept the laboratory as a necessary part of their production, the same tests are also performed by the regulatory agencies of the government. This should be and is reassuring to the consumer.

16. PRODUCT DISPLAY CASE. We are now viewing part of the products that are manufactured by a large company. Over eighty different samples are on display. Again this should be a symbol of reassurance that a wealth of technical ability does exist in the food industry.
17. "PACKAGING". Now that the food has been prepared and has satisfied all of the specifications, it must be protected so the purity is maintained.
18. FOOD PACKAGING. Since so much research and effort has gone into the development of the insect resistant, multiwall paper shipping sack, you will see how that type of sack is filled with food and properly sealed. At no point in this process is the protect touched by human hands or the inside of the sack exposed to contamination. The only direct contact with the outside of the empty or unclosed sack is while placing it onto the filler spout and then directing the filled sack into the heat sealing unit. The bag then moves on a rubber belt a distance of about 8 feet. During that movement the open end of the sack is folded over and subjected to a heating plate. The heat is sufficient to soften the plastic adhesive which upon drying will protect the end of the bag from product spillage or the entry of moisture or insects. By the time the bag reaches the end of the rubber belt it is sealed and ready to go. Government inspectors continually observe the filling and closing of the sacks and if a problem is suspected the unit is shut down until the investigation is complete and if necessary, the problem is corrected. The inspectors also remove sacks from the equipment and weigh them to assure the proper weight.
19. "RAIL SHIPMENT". At this point most sacks move directly to a railcar. However, there are cases where trucks may be used or commodities placed into a warehouse. Most large food processors involved in the type of programs shown here do not warehouse but move directly from the packer into the transportation facility.
20. PREPARATION OF AN EMPTY RAILCAR FOR THE LOADING OF A FOOD PRODUCT. The railcar can present several potential problems. First they should be thoroughly cleaned to assure no insects or harmful chemicals are present. The cleaning should then be followed by covering the floor and walls with heavy paper or cardboard. This protects the sacks from abrasion or puncturing by sharp objects.
21. RAILCAR BEING LOADED AT A FOOD PLANT. The car can then be loaded and by carefully stacking the bags, there should be very little if any damage occur during the shipping.
22. LOADED RAILCAR READY FOR RETAINER DOOR. The doorway of railcars are usually rough and can damage the bags. Special precautions are advisable such as the retainer door which is composed of heavy paper and metal straps.
23. RETAINER IN PLACE ON LOADED RAILCAR. This, when properly applied, should prevent sacks from falling against the car door and being torn or punctured.
24. "OCEAN SHIPMENT". The shipment then moves from the processing plant to the port. The rai[illegible]rs are unloaded and the sacks placed [illegible] warehouses awaiting the arrival o[illegible]ip.
25. SHIP GULF BANKER AT THE PORT OF NEW ORLEANS, LOUISIANA. The storage time may be only for a few days or may extend into several weeks. These warehouses are inspected by both private and governmental agencies to assure conditions are not present that would allow the product to become contaminated.
26. PALLET OF FOOD PRODUCT BEING MOVED TO A SHIP. It is a common practice to store such foods on pallets. These are moved directly to shipside with a minimum of handling.
27. LOADING PALLETS OF FOOD PRODUCTS ONTO SHIP. When sturdy pallets are used as shown here there is usually less damage to the sacks. One problem that requires constant attention is the nails and splinters on the pallets. These,

unless removed or covered with cardboard, can cause damage to the sacks. There is also the ever-present possibility of oil or other materials on the pallets and this could contaminate the sacks unless special precautions are taken. Once the loading is in progress it is difficult to stop on short notice, so if a sudden rain storm develops the sacks may become wet. The same is also true when the sacks are being unloaded at the port of destination.

28. UNLOADING SACKS IN SHIPS HOLD. Again individual handling of each sack occurs in the ships hold and damage can occur.
29. SHIP SYLVIA LYKES IN PORT AT MANILA. This was a test shipment sent to the Republic of the Philippines.
30. ROPE SLINGS USED TO UNLOAD BAGS FROM SHIP. Serious damage often occurs at the point of unloading of ships. The rope slings as shown here exert considerable strain on the corners of the sacks. If the adhesive fails, the bags will open and the product spill. This is, of course, a direct loss and the spilled product may become a source of contamination as it attracts insects, rodents, birds, mold and bacteria. In the case of the unloading of this test shipment, 40 sacks were placed into each sling early in the unloading process. The sacks were hoisted from the ship's hold and moved directly to barges for movement up the Pasig River to the warehouse.
31. LOADING BAGS OF FOOD PRODUCT INTO BARGES. The barges were clean and lined with a smooth surface. Again each bag was picked up and moved to a stack in the barge. Even with careful handlng the white color on the floor of the barge is product and probably was the result of sacks being damaged by the rope slings.
32. BAGS BROKEN DURING UNLOADING PROCEDURES. Three problems were noted in the hold of this ship during the unloading. One, there had been a leak in the ship's plumbing and a number of bags became saturated and the contents molded. Two, rodents had damaged a number of bags and three, rough handling, especially late in the day, took its toll.
33. ROUGH TREATMENT OF BAGS OF PRODUCT WHILE UNLOADING. Some bags fell as far as 40 feet and wherever they contacted a sharp object there was damage. Also the number of bags per sling was increased to 80 which caused additional damage. This was a real learning experience for the research team, maybe a let-down, having followed the shipment from the mill through all of the careful handling, then to be faced with the reality of unloading sent us back to the drawing boards to try to develop a stronger, more durable sack.
34. "BARGE SHIPMENT TO CENTRAL WAREHOUSE". Actually the use of the barges probably caused less strain on the sacks than moving them through Manila on trucks.
35. BARGE MOVING UP THE PASIG RIVER. The product was protected while on the barges both from the weather as well as from pilferage.
36. BARGE DOCKING STATION AT CENTRAL WAREHOUSE. The weather cooperated very well during the unloading of the ship as well as the trip up the river and the unloading of the barges.
37. UNLOADING FOOD PRODUCTS FROM BARGE AT CENTRAL WAREHOUSE. At this time there was no obvious insect activity on or in the bags. About 45 days had elapsed since the sacks had been been filled at the mill and had made the trip half way around the world. The actual number of bags lost had been small and the percent damaged appeared to be very low. The unloading from the barges went very well. The pallets used were new and spreader bars were on the cables. This also should have reduced the damage.
38. "IMPROPER STORAGE PRACTICES". The manager of the warehouse had informed us they used a contracted pest control service and the warehouse was fumigated once a week; there would

be no insect problem. We later found out the fumigation or treatment involved the use of an insecticide fog. The warehouse doors would be closed but the ventilators at the ends of the building were not sealed. Our observation indicated the insecticide application was dramatic in appearance but did not kill the insects.

39. PRODUCT IN COTTON BAGS STORED IN WAREHOUSE FOR ONE YEAR. The members of the research team included two entomologists. During the period that the barges were moving up the river we had sufficient time to inspect commodities that were in storage in the Central Warehouse. By the way, this was to be the storage area for the research shipment for the six month period of the test. Our inspection indicated that the warehouse was heavily infested with rats. Part of the floor was cement, part was not. The rats had burrowed under the floor, no rodent traps or poisons were noted. Insects were present in unbelievable numbers. Cotton bags containing rolled oats had been in storage for over a year. As indicated by the pictures, the insects liked that product. Other foods that were completely spoiled were also held in the same warehouse.
40. "STORAGE PROBLEMS"
41. NEWLY ARRIVED PRODUCT IN COTTON BAGS AFTER THREE DAYS IN WAREHOUSE. Several different types of bags were used in this test, one was cotton. Of course, the cotton offered no protection to insects and in three days after they were placed in the warehouse they were heavily infested with insects.
42. INSECTS ON OTHER BAGS FROM RESEARCH SHIPMENT. Even the bags that contained the insect resistant treatment were soon completely covered with insects. Actually the insects were so numerous in the warehouse that we set up our inspection equipment under a tent outside of the building. Many of the insect pests fly and we felt they would cause difficulty in accurate assessment of insect counts in the commodities in the research bags. To say nothing about the problem of their presence in our hair, eyes and clothing. About the only additional comment here would be "It sure was a good place to test the effectiveness of the research bags."
43. MULTIWALL PAPER BAGS, POTENTIAL INSECT ENTRY POINTS. Two types of closures for the paper bags were included in this test as well as the textile bags. One closure was the tape over stitching and a second was the type with the hot melt adhesive as shown in the earlier scene taken as the bags were being filled at a mill. Any little flaw in any bags was being investigated by curious and hungry insects. A small wrinkle in the tape on a bag would contain three or four insects. Once the insect would reach the thread stitching then the young larvae would have no problem entering the bag. No doubt the fresh product was very attractive to the hordes of insects. Although five different species of insects were plentiful, the predominant type was *Tribolium castaneum*, commonly referred to as the red flour beetle. It can fly so it was no problem for it to move from old commodities to the newly arrived bags. We examined hundreds of bags and in each case wherever there was the slightest flaw, the bugs were there. This doesn't mean they were in the bags but they were checking them out very carefully. It was interesting to note that during the middle of the day the insects disappeared from the outside of the bags. The heat in the warehouse was so intense that it drove them into hiding between and under the bags. Maybe this tells us something. Let's keep the product hot and maybe there won't be a bug problem. This is true, maintain a temperature of about 100°F throughout the commodity and there shouldn't be a serious insect problem. The same is true for low or cool temperatures, get below 45° and insect activity slows down. However, it isn't practical to set up artificial temperature conditions in most cases so unless the natural environment can be used, then this method of pest control just isn't popular. As

we moved from bag to bag and examined each possible entry point, we found the flour beetles already there. Again, keep in mind these bags had only been in this warehouse for three to four days and there did not appear to be an insect problem prior to moving them into the building.

44. "TRANSFER TO LOCAL WAREHOUSE". After realizing the insect and rodent problem in this central warehouse, we decided to try to locate another storage area for some bags. It appeared we would lose all of the value of this test due to the severe conditions.

45. TRUCK UNLOADING OF BAGS OF FOOD PRODUCTS AT SMALL WAREHOUSE. A small clean storage warehouse was located at a school near Manila so arrangements were made to store a few of each type of bag used in the test. These were moved by truck from the heavily infested warehouse in Manila. Of course, in the short storage period in Manila some insects had already entered the cotton bags and possibly other types used in the project. It is interesting to note the number of bags this little fellow is carrying—200 pounds. He said he would have taken more but it was difficult to get through the door. Note the cleanliness in this warehouse as compared to the earlier scenes. Of course it is small and organization is simple, but the bags are stored on racks, the floor and walls are clean and there was no obvious evidence of insects or rodents.

46. STORAGE PRACTICES AT SCHOOL. We requested that no insecticides be used on the test bags during the storage period. The bags were to be left here as well as at Manila for six months, then the contents would be carefully examined for insects or other spoilage.

47. "IMPROPER STORAGE PRACTICES SIX MONTHS LATER". 5 different bag constructions were included in the research shipment to Manila. 50 of each type were hand picked as being in perfect condition, and left in the warehouse for a period of six months. The purpose was to determine if the product would remain insect free for that period.

48. SIX MONTHS LATER, MANILA. Would you believe it? These were the nice, clean, undamaged bags we had placed neatly on pallets six months earlier. There was obvious damage by insects and rodents. Spider and moth larvae had draped the exterior of the bags with a film of webbing. Few of the bags were undamaged. Young rats were found in a nest in one of the bags, roaches had taken their toll, too. We set up the sifting equipment and examined the product in the 250 bags. The insect counts were unbelievable, hundreds of thousands of them. The red flour beetle was the predominant specie, however the cotton bags contained a large population of rice moth larvae. This insect produces a silken web and in some of the bags the webs were at least one inch thick lining the entire interior. The larvae had also cut through the fabric in the bags. What does all this tell us? It comes through loud and clear—if foods are to be held in storage for long periods, then certain control measures are advisable or there will be spoilage. Regardless of the type of packaging used to hold the commodities the protection is limited. In extreme conditions as found here, the value of protective packaging is nullified. The research shipments were sent to several countries and improper storage conditions were noted elsewhere so we, as a team, felt that to reduce food losses would require much more than a good package and that the route to go would be through training programs. Lectures, actual warehouse inspections and printed information, prepared and presented in a non-technical manner has been our approach.

49. SIFTING ONE BAG OF FOOD PRODUCT TO SHOW THE EXTENT OF INSECT INFESTATION. To inspect sizable quantities of food a sifting devise was used. The screen size selected allowed the small particles to pass through and the large particles to remain on top. This meant the product, insect eggs and small larvae would pass through and the adults and large larvae would re-

main on top. It was the material on top of the screen that we would examine. Here we could determine the type of insect present and the approximate numbers. If there was insect activity in a bag, we would carefully examine the empty bag to determine what defects were present.

50. "PROPER STORAGE PRACTICES SIX MONTHS LATER". A total of 100 bags of food, 20 of each of the 5 types included in this test, were stored at the school under good storage conditions.
51. SIX MONTHS LATER AT THE SCHOOL. The 100 bags were opened and the contents inspected. With the exception of the cotton bags, there was very little evidence of insect activity. Even though the bags had been held in the heavily insect infested warehouse in Manila for a few days prior to storage at the school, the insects were unable to penetrate the undamaged bags. This further supported our contention that foods prepared in clean production plants and placed in a well constructed bag would resist spoilage even after long periods of storage and after being handled many times.
52. "PROBLEMS CAUSED BY EXCESSIVE MOISTURE". Moisture in contact with grain or dry food products can cause spoilage.
53. TRUCK LOADED WITH BAGS OF FOOD PRODUCT. We will observe a problem that developed during one of the research shipments to Colombia in South America. The ship was unloaded at the port city of Cartegena and the bags of food transported by truck to Barrenquilla, a distance of about 120 kilometers.
54. BAGS OF FOOD PRODUCT AFTER A RAIN STORM. Although the bags on the open top truck were covered with a canvas tarpaulin, it was not water tight. One of the trucks passed through a rain shower and some of the bags were thoroughly soaked.
55. CLOSE-UP OF BAG CLOSURE AFTER RAIN. Moisture may contact bags during any stage of handling such as loading or unloading from a ship, in the hold of a ship, on a truck or in a warehouse. Faulty construction of a warehouse may allow moisture to enter through the roof, walls, windows, doors or run in as surface moisture. Humidity in the air may condense on or in the bags. Of course, a bag would have to be damaged or of an open weave to allow the product to become wet.
56. COMPARISON: PRODUCT WET BY RAIN AND GOOD PRODUCT. Moisture will cause mold and mold will cause spoilage. The food or grain that becomes wet usually will be lost. We show here the dramatic difference between two multiwall paper bags. One bag had been damaged and rain water entered, the second bag was not damaged and although exposed to rain it had not penetrated to the product. Spoilage, as shown here, can occur in a few days when conditions are ideal for the development of mold. The protection of food from damage by moisture has been a priority in our recent research and the results are encouraging. Losses have been severe in some parts of the world, we hope through better packaging and storage and handling practices that we can reduce those losses.
57. "VERMIN CONTROL". The control of insects and other vermin is very important to the reduction of losses.
58. EXTERIOR VIEW OF A WAREHOUSE IN COLOMBIA. Unfortunately, we do not have the privilege of designing new structures but so often must accept whatever is available. This is a building that was converted into a storage warehouse for food. One of our research shipments was stored here.
59. BAGS OF FOOD PRODUCT STORED IN THE WAREHOUSE. This is orderly storage. The aisles between the piles of bags were wide and the floors clean. The roof was not water tight. In fact it was open around the eaves and birds and other vermin could enter. Even with the external appearance of cleanliness, there was product spillage and insect activity. The cleanliness and pest control practices no doubt reduced the spoil-

age. The food in the research packages that were stored for six months in this warehouse did not become insect infested. There was very little damage by rodents or rough handling.

60. TARPAULIN FUMIGATION. It seems to be an acceptable practice to use fumigation as a means of reduction of the insect problem in many parts of the world. The purpose of a fumigation is to kill all stages of insect life or other pests within the space that is being fumigated. The toxic chemical must penetrate between the bags and through the walls of the bags and throughout the food within the bags. This must be accomplished without causing any harmful changes in the food or damage to the packages. That may sound impossible but it can and is being done regularly. Certain requirements must be met for a successful fumigation. The proper formulation must be selected that will accomplish the intended purpose, then it must be confined at the proper concentration for the proper length of time. A large pile of bagged food may be successfully fumigated without moving the bags. The floor under the pile must be cement or other material that will not allow the fumigant to escape. If fumigation is to be done on dirt floors or on wood, then a gas tight tarpaulin should be placed under the pile. Polythylene sheeting is adequate for that purpose. The pile must also be covered with a gas-tight tarpaulin and pressed firmly against or sealed to the floor. Since fumigants are also toxic to man, it is necessary that their application is by trained persons. It has been our experience that qualified persons are available in most large cities throughout the world. A problem that so often occurs is that of inadequate confining of the fumigant to the space that is to be treated. Either the tarpaulins are not gas-tight or they are not sealed to the floor. There are rather simple and inexpensive devices that may be used to determine the concentration of a fumigant during a fumigation and if these are used then you would know the level of gas present and if the fumigation should be successful. Fumigants do not leave a toxic or lasting residue that will continue to kill. Once the gas is gone, which usually is within two or three days, then the food or other materials being fumigated may again become insect infested. This is one reason it is so important to remove spoiled foods from the proximity of good food. A program that combines the use of insecticide sprays and fogs with fumigation is a good policy.

61. "THIS IS WHAT IT'S ALL ABOUT"

62. FOOD PREPARATION KITCHEN (COLOMBIA)

63. FOOD PREPARATION AND DISTRIBUTION POINT IN BOLIVIA. During the past twenty-five minutes we have followed food from the processing plant through packaging, rail shipment, vessel shipment, movement by trucks and through various types of storage conditions. The time lapse from production until the food is actually consumed will vary from a few months to more than a year. It is almost a miracle that the quality can be maintained throughout such a long period. The actual percent of food completely lost is small compared to the tremendous volume that is available. No one really knows how much is lost or wasted, but as we look to the future and we realize that the population of the world is increasing and there will be a need for more and more food then any losses that can be prevented are important. If the nations of the world are to continue to work together in producing and protecting food then it should be possible to reduce the losses. Further research into protective packaging, better handling practices, improved storage conditions and more effective pesticides are all areas where we can continue to improve. We hope that the film you have just viewed and this narration have given you an insight into what is being done and where problems may still exist. We also hope that through our combined efforts we can continue to provide safe and nutritious food wherever it is needed.

Lecture #1 • Appendix

SUBJECT SEQUENCE AND TIME

	min.	sec.
1. Title: "How to Extend the World's Available Food Supply through Improved Packaging, Storage and Handling"		10½
2. First panning view of a food processing plant		17½
3. "A Modern Cereal Processing Plant"		05
4. Second panning view of a food processing plant		12
5. Laboratory Door: "Analytical Control Laboratory"		13½
6. Laboratory (Biological) technician at incubator, checking cultures		19
7. Laboratory (Biological) technician at microscope, making bacteria count		10½
8. Extraneous analysis procedures		42
9. Examination for extraneous materials by means of a microscope		30
10. Quality Control Laboratory, panning view		24
11. Testing for fiber in cereal foods		11
12. Weighing a sample for protein analysis		17
13. Protein analysis		16
14. Preparing a sample for fat analysis		47½
15. Fat extraction room	1	46½
16. Product display case		14½
17. "Packaging"		05
18. Food packaging	1	10½
19. "Rail Shipment"		05
20. Preparation of an empty railcar for the loading of a food product		15½
21. Railcar being loaded at a food plant		18
22. Loaded railcar ready for retainer door		07½
23. Retainer in place on loaded railcar		07
24. "Ocean Shipment"		05
25. Ship *Gulf Banker* at the port of New Orleans, La.		04
26. Pallet of food product being moved to a ship		10
27. Loading pallets of food product onto ship		33
28. Unloading sacks into ship's hold		13
29. Ship *Sylvia Lykes* in port at Manila		05
30. Rope slings used to unload bags from ship		44
31. Loading bags of food product into barge		20½
32. Bags proken during unloading procedures		11
33. Rough treatment to bags of product while unloading		18
34. "Barge Shipment to Central Warehouse"		05
35. Barge moving up Pasig River		05½
36. Barge docking station at central warehouse		12
37. Unloading food products from barge at central warehouse		40
38. "Improper Storage Practices"		05
39. Product in cotton bags stored in warehouse for one year	1	05
40. "Storage Problems"		05
41. New cotton bagged product in same warehouse after 3 days		11
42. Infestation on other bags from research shipment		39½
43. Multiwall paper bags (potential entry points)	2	52
44. "Transfer to Local Warehouse"		05
45. Truck unloading of bags of food product at small warehouse		35

	min.	sec.
46. Storage practices at school		26
47. "Improper Storage Practices 6 Months Later"		05
48. 6 months later, Manila	2	09
49. Sifting one bag of food product to show the extent of insect infestation		30
50. "Proper Storage Practices 6 Months Later"		05
51. 6 months later at the school		24
52. "Problems Caused by Excessive Moisture"		05
53. Truck loaded with bags of food product		14½
54. Bags of food product after a rain storm		12½
55. Close-up of bag closure after rain		20
56. Comparison: Product wet by rain and good product		56
57. "Vermin Control"		05
58. Exterior view of a warehouse in Colombia		09½
59. Bags of food product stored in the warehouse		39
60. Tarpaulin fumigation	2	31
61. "This Is What It's All About"		07
62. Food preparation kitchen (Colombia)		42
63. Food preparation and distribution point in Bolivia	1	25
Total	29	14

Lecture #2

QUALITY ASSURANCE PROGRAMS IN THE UNITED STATES

When the quality of a food indicates that deterioration has taken place, the finger of responsibility is usually pointed toward the manufacturer of that food. This tendency is not unique to the United States, but seems to be the same throughout the world.

Food can and is being produced that is free of contamination. Unfortunately the exposure to conditions that could cause contamination and deterioration begins as the food moves into the channels of distribution and continues until it is consumed. Each time the food is moved or stored, the protective packaging may be damaged. Once the damage has occurred then the loss of quality may start and it is usually compounded by time.

Extensive precautions are taken as the food is manufactured to assure its purity at time of production and packaging as well as during all other steps of handling. Let us examine the regulatory requirements in the United States. The government has established four agencies that are charged with the responsibility of surveillance. Their inspections are thorough and if contaminated food is observed or suspected, it is immediately taken from distribution and either destroyed, reconditioned or converted to non-food uses. The management of any company that permits contamination of food may be fined and/or imprisoned and the business closed. The requirements are the same for foods that will be consumed in the United States or will be exported.

The surveillance begins as the food is in the raw stage, such as growing in the

fields and continues through harvesting, storage, processing, packaging, warehousing and distribution.

*1 The four agencies are referred to as the FDA, USDA, EPA and OSHA:

1. The *FDA* is the Food and Drug Administration and it is their prime responsibility to examine food production, storage and shipping by means of visual inspections and the collection of samples for laboratory testing. Their inspectors have the authority to enter any facility that produces or stores food and to enter at any time of the day or night.

2. *USDA* represents the United States Department of Agriculture. This is the largest and oldest food regulatory department in the United States. Their responsibilities, in part, duplicate those of the FDA, however the two groups work together to assure complete protection for the consumer.

3. *EPA* is the Environmental Protection Agency. It is their responsibility to assure the cleanliness of the environment. This is a new governmental regulatory agency and it has a wide range of responsibility and authority. Included in that responsibility is the use of all pesticides. We, in the United States, are now closely regulated as to the manufacture, labeling and use of pesticides. The World Health Organization (WHO) has this same interest on a worldwide basis and has established restrictions and residue tolerances.

4. *OSHA* is the Occupational Safety and Health Act. Their authority extends into all businesses in the United States. As a part of their responsibility they assure the safety of the workers in industry and they establish and monitor the standards. The standards include certain restrictions that assure the cleanliness in food production and storage facilities.

The continuous, and often over-lapping, surveillance not only is reassuring to the consumer that the quality of food will be good but it also has resulted in rigid self-imposed standards. Assurance that the regulatory requirements will be met and the quality of food will be within the established standards has resulted in extensive industry sponsored programs.

2 The programs include:

1. Acceptance standards for all materials that are used for the production and packaging of foods.
2. Visual inspection to assure that all of the requirements are met.
3. Laboratory testing that would expose quality deteriorating factors that cannot be detected by visual examination.
4. Cleaning of the premises to assure that conditions that could allow contamination to occur do not exist.
5. The proper use of pesticides to supplement the cleaning programs. The selection and application must meet the standards established by the Environmental Protection Agency and the World Health Organization.

Let us briefly examine some of the laboratory analyses that are performed by food processors as well as regulatory agencies. The objective of the tests is to determine the purity of foods. Foreign material may be detected by the *Analysis for Extraneous Materials.* This method of testing will remove particles that are not normal to the sample being tested. Examples would be insects in the adult, larva, pupa or egg stage. These are often too small to see without the use of a microscope. Also, other materials may be detected that would indicate poor cleaning, processing or storage practices. The procedure involves two steps. In one
3 the food floats to the top in the liquid and heavy particles of extraneous materials remain in the bottom of the flask. The second step, using a Wild-
4 man Trap flask, allows certain extraneous materials to float to the top and

* Numbers in the left hand column indicate Slide Number.

the food remains in the bottom of the flask. Any contamination of insect origin would float to the top. As an alternate and also an approved pro-
5 cedure, the separatory funnel may be used as a replacement for the trap flask. An advantage to the separatory funnel procedure is that it permits the analysis of more samples, it saves time. As an example, in our laboratory sixteen samples can be tested by the separatory funnel procedure during the same time lapse as ten could be
6 handled by means of the Wildman Trap flask. The heavy material that settles into the bottom of the flask is placed on a ruled filter paper. The flotation from the second part of the test is placed on a second filter paper. The two papers are placed under a binocular microscope and examined. A magnification of 30X is satisfactory with a back-up of 60X to examine smaller particles. It is not difficult to recognize and identify whole larvae, pupae and adults of insects. Other types of contamination are much more difficult.

The extraneous procedure is used by regulatory agencies in many countries and also by food industries. It is an accepted and exacting procedure to support or to supplement the visual inspection program.

As an appendix to this presentation you will find a copy of the procedures, laboratory apparatus and reagents that are necessary to perform this test.

7 A second test that is important to monitor the quality of food is to determine if *Salmonella* bacteria are present. This bacteria causes inflamation of the intestines. It may be fatal to infants and adults that are not in good physical condition. It may also cause problems in animals.

8 This test is complicated and requires
9 from five to seven days to complete.
10 It involves pre-enrichment, enrichment, selective plating, presumptive testing and confirmation.

The purpose of mentioning this test is to assure you of the precautions that are taken to determine the purity of foods. There is no tolerance for the presence of *Salmonella* in foods by United States standards. A copy of the procedure, media and reagents is included with the appendix.

A third and final test to be briefly reviewed is one that will determine the presence of *aflatoxin* in food. Aflatoxin is a carcinogen, which means it may cause cancer. Deaths have been attributed to aflatoxin in several countries. *Mycotoxins* are poisonous substances produced as a result of the metabolic activity of certain molds when growing on a suitable food media in a suitable environment. The most common *mycotoxin* is *aflatoxin,* which is a toxic substance produced by the molds *Aspergillus flavus* and *Aspergillus parasiticus*. In the course of this program you will note the emphasis placed on protective packaging and proper storage. One of the reasons this is so important is to prevent the whole grain or food from becoming moist and moldy. Since *Aspergillus* is a common mold, its presence could result in the formation of *aflatoxin*.

11 There are two procedures that may be
12 used to determine the presence of
13 aflatoxin in grain or food. Both tests
14 are somewhat complicated. The pro-
15 cedure referred to as thin layer chromatography requires the preparation of the sample by grinding and weighing out the correct amount, and by means of a chloroform wash, extract from the sample any aflatoxin that may be present. A portion of the extract is placed on a glass plate coated with silica gel, allowed to migrate up the plate, is dried, then is examined under ultraviolet light. If aflatoxin is present, there will be an indication of its presence and it can be calculated in parts per billion.

An alternate method is referred to as millicolumn. It will not be discussed here, however a copy of both procedures is included in the appendix.

The World Health Organization has established a maximum tolerance for aflatoxin in foods. The United States Food and Drug regulations have established a lower tolerance than that acceptable to the World Health Organization. Because of the potential seriousness of illness or death, we cannot emphasize enough the importance of keeping grain and food dry and free of molds.

The foregoing information has placed emphasis on the purity of foods at the time of processing. Now that food must be provided with a suitable container. Extensive research has been conducted by government entomologists, food technologists, biologists and packaging specialists. Many different package materials and designs have been tested; such as cotton, combinations of cotton and plastics, combinations of cotton and paper, all plastic and a combination of paper and plastic. The package that is now used for the protection of much of the food shipped from the United States is a combination of several plies of paper and a layer of polyethylene. This will be discussed at considerable depth later in this program. In addition to the physical structure and protection of the packages, the research has included the use of insecticides and moldicides.

16 Cotton has been used to package many commodities. Cotton alone, as shown here, will not protect the contents of the package against insects, moisture and foreign material such as chemicals, oils and even dirt. Burlap or jute, although a strong material, does not protect the contents of the bags.

Also note that tricalcium phosphate and vitamin A have been used in this shipment. These are essentials in the diet and it was determined that insects did not develop rapidly in a food that contained this added enrichment at a 2% level. The importance of this will be emphasized later in the program.

17 Although the two bags pictured here represent research packages, the multiwall paper bag that is currently in use is quite similar. The body of the package is important but much of the value of protection to that area would be lost if there was not a moisture and insect proof closure. The type shown here is referred to as a POM, which stands for "pasted open-mouth". The adhesive is a plastic that is activated by high temperature.

18 Bag types 3 and 5 are of the POM closure and represent the field testing of bags of various construction. These bags contain one less ply of paper and a heavier film of polyethylene than bags numbered 1 and 6 that were shown on the previous slide.

19 A second type of closure that has been field tested is referred to as TOS which stands for "tape-over-stitching". These are marked as bags number 7 and 8. Note the general structure of the bag is the same as previously shown on bags 1, 3, 5 and 6.

There are two methods of handling the tape that overlaps the thread at the corners of the closures. They can be folded under and glued or left extended. To fold under has increased the cost of the closure and created other problems.

20 This shows the appearance of a multiwall paper bag after stitching and after the tape has been placed over the stitching. It is necessary that the tape extend beyond the edge of the bag to seal the small amount of thread that would be exposed. The importance of this will be pointed out later.

21* After a clean and wholesome product is placed in a properly designed and properly sealed bag, then it should be protected to prevent damage. In the United States most shipments from the

* Slide 21 is omitted.

food processor's plant to the port are made in rail cars. The walls of rail cars
22 are usually rough and if adequate padding is not added then the bags may be damaged. Since several months may elapse from this point to the time of consumption of the food, this protection is important. The interior of this rail car has been lined with a heavy corrugated board and the floor covered with heavy paper. If trucks are used the same protection may be advisable. The floor of either rail cars or trucks may be rough but they also may contain chemicals and foreign materials that could contaminate the food packages.

23 One additional protective measure would be the fumigation of the rail car. Colonies of insects may be well established within the interior of cars. Due to the double wall construction, physical cleaning will not give a complete assurance that all insects have been removed. Spraying the walls of a rail car or truck with an approved insecticide would be beneficial but would not give total protection.

24 The use of shrink wrap to protect a pallet load of bags is being done on some shipments. Shown here are 40 multiwall paper bags ready for export. Not all vessels can handle the loading and unloading of bags that are protected by the shrink wrap. Therefore, even with some advantages to this procedure, it cannot always be used. One advantage of shrink wrap is that the bags are held together as a unit and there is less damage to the individual packages. Another plus is the barrier
25 to contamination by foreign material and moisture that is given by the heavy polyethylene shroud. This is especially important for textile bags such as cotton (as shown here), jute and woven polypropylene.

26 Pallet loads of shrink wrapped bags stack well. The film protects the top layer of bags from damage and contamination from the bottom of a pallet when they are stacked. This warehouse was at a port in the United States.

27 A shipment was examined after it had been shipped overseas. There was little damage to the individual bags. The bags shown here had been moved a minimum of seven times.

28 Plastic slings have also been used on
29 some shipments. The objective is to
30 unitize the load and not involve the cost of the shrink wrap. This method is also restricted by the ability of a ship to handle the unitized load but it does show some promise and does protect individual bags from exposure to potential damage.

Containerized shipments are not pictured here but they offer good protection to food. Again they are restricted to ships and to port facilities. Where they can be used, they should be given serious consideration.

The movie that has been shown and this lecture has set the stage for the subjects that will follow. To this point we have emphasized the protection given to shipments of food until they are loaded aboard vessels. What can be done to continue that protection throughout the handling and storage? That will be covered in the remainder of this seminar.

Lecture #2 • Visual Aids

QUALITY ASSURANCE PROGRAMS IN THE UNITED STATES

*QAP-1 REGULATORY AGENCIES (CHART)
QAP-2 SURVEILLANCE AND CONTROL (CHART)
QAP-3 LABORATORY TESTING—EXTRANEOUS (HEAVY)
QAP-4 LABORATORY TESTING—EXTRANEOUS (LIGHT)
QAP-5 LABORATORY TESTING—EXTRANEOUS (SEPARATORY FUNNEL)
QAP-6 LABORATORY TESTING—EXTRANEOUS (MICROSCOPE)
QAP-7 LABORATORY TESTING—SALMONELLA (CHART)
QAP-8 LABORATORY TESTING—SALMONELLA (3 AGAR DISHES)
QAP-9 LABORATORY TESTING—SALMONELLA (TSI SLANTS)
QAP-10 LABORATORY TESTING—SALMONELLA (BIO-CHEMICALS)
QAP-11 LABORATORY TESTING—MYCOTOXINS (SAMPLE PREPARATION)
QAP-12 LABORATORY TESTING—MYCOTOXINS (EXRACTION)
QAP-13 LABORATORY TESTING—MYCOTOXINS (TITRATION)
QAP-14 LABORATORY TESTING—MYCOTOXINS (PLATING)
QAP-15 LABORATORY TESTING—MYCOTOXINS (U.V. EXAMINATION)
QAP-16 PACKAGING—COTTON BAGS
QAP-17 PACKAGING—MULTIWALL—POM (NUMBERS 1 & 6)
QAP-18 PACKAGING—MULTIWALL—POM (NUMBERS 3 & 5)
QAP-19 PACKAGING—MULTIWALL—TOS (NUMBERS 7 & 8)
QAP-20 PACKAGING—MULTIWALL—CLOSURE (TOS)
QAP-21 OMITTED
QAP-22 TRANSPORTATION—EMPTY CAR (COOPERED)
QAP-23 TRANSPORTATION—LOADED CAR (UNDER FUMIGATION)
QAP-24 SHRINK WRAP—MULTIWALL
QAP-25 SHRINK WRAP—COTTON
QAP-26 SHRINK WAP—IN WAREHOUSE (USA)
QAP-27 SHRINK WRAP—IN WAREHOUSE (PANAMA)
QAP-28 SLING HANDLING—IN WAREHOUSE (FORK LIFT PICK-UP)
QAP-29 SLING HANDLING—IN WAREHOUSE (FORK LIFT PICK-UP—HIGH)

QAP-30 SLING HANDLING—BOTTOM VIEW (DISTRIBUTION OF STRESS)

* Slide number 21 is not included with this series at this time. The identification QAP and the slide number is given on each slide.

APPENDIX

The following information is attached:

1. Analysis for Extraneous Materials in Foods
2. Crack and Flotation Method for Cereal Grains
3. *Salmonella* Testing Method
4. Aflatoxin
   (1) Thin Layer Chromatography
   (2) Millicolumn Method

Not included here but available from the speaker are the following test procedures:

5. Total Plate Count (mesophilic aerobic bacteria)
6. Coliform Plate Count
7. *Eacherichia coli* (Qualitative)
8. Thermophilic Spore and Flat Sour Spore Count
9. Mold and Yeast Count
10. "Rope" Spore Count
11. MPN Method for *Staphylococcus aureus*

Lecture #2 • Appendix #1

ANALYSIS FOR EXTRANEOUS MATERIAL

Apparatus and Reagents

(a) Chloroform
(b) Carbon tetrochloride—technical grade
(c) Isopropyl alcohol
(d) Heptane
(e) 50% glcyerin-alcohol solution—for wetting filter papers prior to microscopic examination (50% glycerin-50% isopropyl alcohol)
(f) Balance and scoop—for weighing samples
(g) 250 ml. hooked-lip beakers (Griffin Low Form with spout)
(h) Glass stirring rods (approximately ¼" diameter × 8" long)
(i) Buchner funnel (Coors #2 or equivalent)
(j) Filter papers (S&S #8 ruled, 7½ cm)
(k) Vacuum pump (Welch Scientific—model 1403 or equivalent)
(l) Small spatula
(m) Paper (white, slicks finish, in 12" wide rolls)
(n) Dry heat oven (capable of 120° ± 5°)
(o) Wildman trap flasks
(p) Graduated cylinder—50 ml. capacity
(q) Petri dishes—100 × 15 mm, plastic, disposable (may be cleaned and re-used)
(r) Fine-tipped probe—for manipulating materials during microscopic examinations
(s) Widefield microscope (B & L Model BKT-5 or equivalent)
Eye-piece 10×
Objectives 1.0×, 3.0× and 6.0×
(t) Illuminator (which will provide a sufficient light source on the microscopic field of view)
(u) Report form (Analysis for Extraneous Material)

Heavy Extraction

Rodent Excerta. Weigh 50 gram sample in 250 ml. hooked-lip beaker. Add chloroform to within ½ inch of the top, mix thoroughly and let settle for at least 30 min. in a slightly tilted position, stirring surface layer occasionally. Carefully decant $CHC1_3$ and float tissue onto Buchner without disturbing heavy residue in bottom of beaker. Add carbon tetrachloride to equal the amount of chloroform and tissue left in beaker, let settle again, and decant as before. Repeat this process, using a 50-50 mixture of chloroform and carbon tetrachloride until very little tissue remains in beaker. Wash residue in beaker onto 7 or 7½ cm ruled filter paper with a stream of cholorform or carbon tetrachloride and examine microscopically.

Trap Flask Method

Light Filth. Draw air through material in Buchner, during the heavy extraction, until the liquid evaporates. Air-dry overnight, or in an oven at 80°C to 100°C until solvent odor is gone. (Caution: In oven drying, phosgene is liberated.) Transfer dried sample to 1 L. trap flask. Add 100 ml. 60% isopropenyl saturated with heptane and mix thoroughly. Wash down sides of flask with isopropenyl-heptane solution until 400 ml. are added, let soak for 30 minutes. Stir in 20-30 ml. heptane and let settle for 5 min. before filling flask with isopropenyl-heptane solution. Trap off top layer onto filter paper. Stir in another 20-30 ml. heptane and make second trap. Examine both trappings microscopically.

LIGHT FILTH IN WHOLE AND DEGERMINATED CORN MEAL (SEPARATORY FUNNEL METHOD)

Apparatus and Reagents

(a) Hydrochloric acid (HCl)
(b) Mineral Oil—Paraffin oil, white, light, 125/135 Saybolt Universal Viscosity (38°C), specific gravity 0.840-0.860 (24°C)
Fisher Scientific Company, No. 0-119 or equivalent.
(c) Liquid detergent
(d) Kilborn separator—1 L. (Scientific Products, No. F7980, or equivalent)
(e) Balance and scoop—for weighing samples
(f) 1.5 L beakers
(g) Glass stirring rods
(h) Buchner funnel—(Coors #2 or equivalent)
(i) Filter paper—(S&S #8 ruled, 7½ cm)
(j) Vacuum pump—(welch model 1403 or equivalent)
(k) Small spatula
(l) Hot plate
(m) Widefield stereoscopic microscope

Weigh 50-gram sample into 1.5 L beaker and add 600 ml HC1 (7+93). Mix to smooth slurry. Add 30 ml mineral oil. Place on hot plate and bring to rolling boil; hold at rolling boil for about 10 min. Transfer quantatively to Kilborn funnel, save beaker and stirring rod for rinsing. Fill separator to about 0.5 inches from top with cold H_2O. After 1.5 to 2.0 min., gently stir contents of separator; let oil layer separate again for about 1.5 to 2.0 min. and slowly drain and discard lower layer until interface is approximately 2 inches above constriction. Fill separator with cold water to within 0.5 inches from top; let oil layer separate again for about 1.5 to 2.0 min., and slowly drain and discard lower layer until interface is approximately 2 inches above constriction. Fill separator with cold water to within 0.5 inches from top; let oil separate for about 1.5 to 2.0 min. and slowly drain and discard lower layer until interface is about 2 inches above constriction. Repeat water wash until lower layer is clear.

Filter mineral oil and water retained in separator through ruled paper, using Buchner funnel. After mineral oil layer has passed through paper, rinse all glassware thoroughly with alcohol, followed by water, then 5% detergent solution and water. Filter each rinse through same filter paper. Examine paper at 30 power on a Widefield microscope.

Lecture #2 • Appendix #2

CRACK & FLOTATION METHOD FOR CEREAL GRAINS

Internal Insect Infestation

Mix grain by passing 6 times thru Jones sampler, recombining separations before each pass. Separate 100 grams; if insects are visible, screen 100-gram sample over #12 sieve, then grind screened sample in Labconco mill (Laboratory Construction Co., 8811 Prospect Avenue, Kansas City, Mo., 64132, or equivalent), set at 0.061. (Dry damp or tempered grain in forced-draft oven for 1 hour at 70-80°F or 2 hours in oven without draft.)

Transfer cracked grain, including any residue in mill, to 2 L. trap-flask. Fill trap flask to the 900 ml. mark with 60% isopropanol saturated with heptane and mix. Stir in 35 ml. heptane and let set for 30 min. Fill flask with isopropanol-heptane solution and trap off top layer. Make second trap using 25 ml. heptane. Filter through 10XX bolting cloth that has been cut into circles and ruled. If trappings contain considerable starchy material, perform an acid hydrolysis extraction by adding enough hydrochloric acid to make a 1 to 2% solution. Bring the solution to a boil, filter hot. View filtered sample under widefield microscope.

Lecture #2 • Appendix #3

SALMONELLA TESTING METHOD

Media and Reagents

Lactose Broth
Brilliant Green Dye 1:100 concentration
Tetrathionate Broth
Iodine Solution
Brilliant Green Dye 1:1000 concentration
Selenite—Cystine Broth
Brilliant Green Agar
Salmonella Shigella Agar
Bismuth Sulfite Agar
Triple Sugar—Iron Agar
Lysine Iron Agar
Purple Broth Base
Lactose
Dulcitor
Sucrose
Veal Infusion Broth
Urea—R Broth
Salmonella O Antiserum poly A-1
Salmonella H Antiserum poly A-2

Pre-enrichment—aseptically transfer 50 grams of the product into a sterile screw-capped jar containing 500 ml of lactrose broth. Samples containing dried milk may be placed in sterile water containing the same amount of brilliant green dye. Add 1 ml of brilliant green dye (1:100 concentration) to broth for more selectivity. Shake to suspend. Loosen cap to allow for the escape of gas. Incubate 18 to 24 hours at 35°C.

Selective Enrichment—transfer 1 ml portions of lactose broth culture into sterile tubes containing 10 ml of tetrathionate broth (add .2 ml of iodine solution and .2 ml of brilliant green dye 1:1000 concentration) and selenite —cystine broth. Incubate 18-24 hours at 35°C.

Selective Plating Media—streak enrichments to petri dishes containing brilliant green agar, Salmonella Shigella agar and Bismuth Sulfite agar. Incubate plates for 2 ± 2 hours at 35°C. Y-plate petri dishes may be used with one 3-agar plate streaked from the tetrathionate broth culture and the other 3-agar plate from the selenite-cystine culture.

Colonies which show Salmonella characteristics are selected for transfer.

Appearance of typical Salmonella colonies.

1. On brilliant green agar—Colorless, pink to fuchsia, translucent to opaque, with surrounding medium pink to red. Some Salmonella appear as transparent green colonies if surrounded by lactose—or sucrose fementing organisms which produce colonies that are yellow-green or green.
2. On Salmonella-Shigella agar—Uncolored to pale pink, opaque, transparent or translucent, but some strains produce black-centered colonies.
3. On Bismuth Sulfite agar—Brown, gray to black sometimes with metallic sheen. Surrounding medium is usually brown at first, turning black with increasing incubation time. Some strains produce green colonies with little or no darkening of surrounding medium.

   If plates do not have typical or suspicious colonies or do not contain growth, incubate additional 24 hours.

Presumptive Test—with an innoculating needle, typical colonies are transferred from the plating media. Growth is stabbed through the center of a triple sugar-iron slant and streaked onto the slant surface of tube. A lysine-iron agar slant is also innoculated by stabbing the center of the agar. Incubate both TSI and LI slants for 24 hours 35°C. Examine slants for characteristic Salmonella reactions.

Positive reaction in lysine iron agar is no color change of the agar, with or without hydrogen sulfide production. Negative reaction would be color change either throughout agar or in butt.

Presumptive Positive Salmonella cultures have alkaline (red) slants and acid (yellow) butts, with or without H_2S (blackening of agar). H_2S-negative TSI cultures which otherwise appear to be Salmonella cannot be excluded from further examination). TSI cultures which otherwise appear not to be Salmonella (including yellow slant) cannot be excluded from further examination and should be treated as presumptive positive TSI agar cultures if corresponding LIA gives typical Salmonella reaction. LIA is useful in detection of lactose—or sucrose-fermenting

Salmonella or lactose-fermenting Arizona organisms which give negative TSI reactions. Further test lysine decarboxylase-positive cultures to detect if they are Salmonella sp., or Arizona organisms.

If TSI fails to give a typical Salmonella reaction, pick additional suspicious colonies from selective medium plate not giving presumptive positive culture and inoculate TSI and LIA slant.

Selection for identification—Apply biochem. and serological identification tests to 3 presumptive positive TSI agar cultures picked from selective agar plates streaked from selenite cystine broth and to 3 presumptive positive TSI agar cultures picked up selective agar plates streaked from tetrathionate broth.

If 3 presumptive positive TSI agar cultures are not isolated from 1 set of selective agar plates, test other presumptive positive TSI agar cultures, if isolated, by biochem. and serological tests.

Confirmation—any TSI and LI culture showing presumptive positive Salmonella reactions should be confirmed both biochemically and serologically.

Inoculate growth from TSI Slants into the following biochemicals and veal infusion broth. Numbers 1 through 4 are carbohydrates prepared as 1.0% solutions in purple broth base.

(1) Lactose broth—10 ml
Positive—no color change
Negative—yellow color

(2) Dulcitol broth—10 ml
Positive—yellow color
Negative—no color change

(3) Sucrose broth—10 ml
Positive—no color change
Negative—yellow color

(4) Urea-R Broth—3 ml
Positive—no color change
Negative—color change to pink or red

(5) Veal infusion broth—5 ml
Inoculate with biochemicals for use in the Polyvalent Agglutionation test

Incubate for 24 hours at 35°C. Examine and record results. Samples showing positive Salmonella reactions are tested further by the Polyvalent O slide agglutionation test and the Polyvalent H tube test.

Positive reactions should be specifically identified through serological typical.

*IDENTIFICATION OF SALMONELLA BY BIOCHEMICAL TESTS

	Escherchleae		Salmonella	
	Escherichia	*Shigella*	*Salmonella*	*Arizona*
Indol	+	− or +	−	−
Methyl Red	+	+	+	+
Voges-Proskauer	−	−	−	−
Simmons' Citrate	−	−	d	+
Hydrogen Sulfide (TSI)	−	−	+	+
Urease	−	−	−	−
KCN	−	−	−	−
Motility	+ or −	−	+	+
Lysine Decarboxylase	d	−	+	+
Arginine Dihydrolase	d	− or (+)	(+) or +	+ or (+)
Ornithine Decarboxylase	d	d(1)	+	+
Phenylalanine Dearinase	−	−	−	−
Malonate	−	−	−	+
Gas from Glucose	+	−(1)	+	+
Lactose	+	−(1)	−	d
Sucrose	d	−(1)	−	−
Mannitol	+	+ or −	+	+
Dulcitol	d	d	d(2)	d
Adonitol	−	−	−	−

* P. R. Edward, W. H. Ewing. "Identification of Enterobacteriaeae"

References:

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Lecture #2 • Appendix #4

AFLATOXINS
PEANUTS AND PEANUT BUTTER (Adaptable to Other Agricultural Products)

Equipment:

(a) Apparatus for sample size reduction—Hobart vertical cutter/mixer; Wiley mill; Straub, Bauer; Waring blender; or equivalent.
(b) Chromatographic tubes—22 x 300 mm with Teflon stopcock, reservoir type (250 ml).
(c) Funnel—150 mm with fluted S&S No. 588 or equivalent paper to fit (18.5 cm); Whatmann #4 (18.5 cm).
(d) Steam bath
(e) Hollow polyethylene stoppers—13 mm top, 7 mm bottom diameter.
(f) Thin layer chromatographic apparatus, glass plates 20 x 20 cm; applicator; mounting board; spotting template; microsyringe, 10 ul; desiccating storage cabinet; developing tank; longwave 15 watt UV lamp (use with UV absorbing eyeglasses) or Chromato-Vue cabinet equipped with one or two 15-watt lamps.
(g) Vials—4 dram, foil-lined screw-cap (Kimble Products No. 60910-L).
(h) Wrist-action shaker—Burrell or equivalent.
(i) Flasks—500 ml. GOS Erlenmeyer

Reagents:

(a) Solvents—ACS grade Acetomitrile, acetone, benzene, chloroform, hexane, methyl alcohol and anhydrous ether.
(b) Boiling chips—SIC (Carborundum Co.). Float off fines and extraneous matter with H_2O, wash with acetone and dry.
(c) Diatomaceous earth—(1) Acid-washed Celite 545, (2) Hyflo Super-Cel.
(d) Silica gel for thin layer chromatography —Applied Science Absorbosils 1 or 5; Mallinckrodt Silic AR 4G or 7G; Brinkmann—Art. 7744.
(e) Sodium sulfate—anhydrous ACS grade.
(f) Silica gel for column chromatography —Merck (Darmstadt) 0.05-0.2 mm; Brinkmann Art. 7734 (or equivalent).
(g) Benzene-acetonitrile solution—98+2.
(h) Acetone-chloroform developing solvent: (10-90).

Preparation of Sample:

Whole grains or large granulation meals will have to be ground to a fine meal.

Extraction:

Weigh 50 gr sample into 500 ml G-S Erlenmeyer. Add 25 ml H_2O, 25 gr diatomaceous earth and 250 ml chloroform, secure stopper with tape. Shake 30 min: on wrist-action shaker and filter through fluted paper. If filtration is slow, transfer to Buchner funnel pre-coated with approximately 5 mm layer of diatomaceous earth and use light vac. Collect first 50 ml portion of filtrate for column chromatography.

Column Chromatography:

Place ball of glass wool loosely in bottom of 22 x 300 gm chromatography tube and add approximately 5 gr of anhydrous sodium sulfate to give base for silica gel. Add chloroform until tube is approximately ½ full, then add 10 gr silica gel (0.05-0.2 mm). Wash sides of tube with approximately 20 ml chloroform and stir to disperse silica gel. When rate of settling slows, drain the chloroform to ⅔" above the silica gel. Slowly add 15 gr anhydrous sodium sulfate, drain the chloroform to the top of the sodium sulfate layer. Add the 50 ml sample extract to the column, elute at maximum flow rate with 150 ml hexane, followed by 150 ml anhydrous ether and discard. Elute aflatoxins with 150 ml methyl alcohol-chloroform (3+97), collecting this fraction from time of addition until flow stops. Add a few boiling chips and evaporate to near dryness on steam bath; transfer residue to vial with chloroform. Add 2-3 boiling chips and evaporate to dryness. Seal vial with hollow polyethylene stopper and cap. Save for Thin Layer Chromatography:

Thin Layer Chromatography:

(a) Preparation of plates. Coat 20 x 20 glass plates with .25 mm thickness of silica gel suspension, and let stand until gelled (approximately 10 min.). If necessary, thickness of gel can be adjusted to provide good resolution of aflatoxins and tightness of spots. Dry coated plates for 2 hrs. at 80°C and store in desiccating cabinet with active silica gel desiccant until just before use. Scribe line 16 cm from bottom edge as solvent stop; scribe line or remove gel 0.5 cm in from each side.

(b) Preliminary Thin Layer Chromatography. This step may be omitted when approximate aflatoxin content is known. Uncap vial containing sample extract, add 500 μl benzene-Acetonitrile (98+2), and reseal with polyethylene stopper. Shake vigorously to dissolve. Puncture stopper to accommodate 10 μl syringe needle. In subdued incandescent light and as rapidly as possible, spot one 2.5 and two 5.0 μl spots on imaginary line 4 cm from bottom edge of T.L.C. plate. Keep vial for quantitative analysis. On same plate, spot 2.0, 5.0 and 10.0 μl standard aflatoxins. Spot 5.0 ul standard used on top of one of the two 5.0 μl sample spots as internal standard. Spot at least one 5 μl resolution reference standard, to show whether adequate resolution is attained.

Place enough developing solvent in developing tank to obtain a depth of ¾ inch. Place plate in tank and develop for 40 min. at 23-25°C or until aflatoxins reach R.F. 4 to 7. Remove plate, let air-dry in darkened room, and illuminate plate from below by placing it flat, coated side up, on longwave UV lamp or view plate in Chromato-Vue cabinet. If aflatoxins are present but concentration is too great, then evaporate to dryness on steam bath and redissolve in calculated volume of benzene-Acetronitrile. Spot a new plate in the same manner. Calculate concentration of aflatoxin B_1 in μg/kg from formula: μg/kg = (S x Y x V) / (X x W). Where S = μl aflatoxin B_1 standard in μg/ml; V = μl of final dilution of sample extract; X = μl sample extract spotted giving fluorescent intensity equal to B_1 standard; W = grams of sample applied to column (10 g if 50 ml of extract is used).

FAST SCREENING METHOD FOR DETECTING AFLATOXIN IN AGRICULTURAL PRODUCTS OTHER THAN COTTONSEED PRODUCTS

The rapid millicolumn detection method has been applied to commodities other than cottonseed and shows promise as a more general aflatoxin detection test. It has been successfully applied to peanuts, peanut meal, almonds, filberts, walnuts, Brazil nuts, pecans and white corn to detect aflatoxins at levels as low as 10 μg/kg. However, when applied to ground whole pistachio nuts and to yellow corn and yellow corn meal, interferences due to chlorophyll in the pistachio and xanthophyll pigments in the yellow corn migrated along with the aflatoxin band on the millicolumn and obscured the band. These interferences were overcome by the addition of a lead acetate solution. Positive identification of aflatoxins were obtained at levels as low as 10 μg/kg.

Reagents:

(a) Extraction solvent. Mix 850 ml. of acetone and 150 ml. of distilled water.
(b) Ammonium sulfate solution (saturated). Dissolve 700 grams of ACS ammonium sulfate (granular) in 1000 ml. of distilled water.
(c) ACS reagent grade benzene and hexane.
(d) Development solvent. Chloroform: acentonitrile: 2-propanol (93:5:2 v/v).
(e) Celite, acid washed 545 (Johns Manville Corporation).
(f) Absorbent cotton. Soak in hot chloroform, squeeze, air dry.
(g) Sodium sulfate, Anhydrous powder, ACS.
(h) Acidic alumina. (80-200 mesh), Brockman activity grade I. Adjust to activity grade II by adding 3% H_2O, shake well and equilibrate overnight.
(i) Silica gel. Mallinckrodt CC-4 (100-200 mesh), Mallinckrodt CC-7 (100-200 mesh) or E. Merck 7734 (0.05-0.2 mm) distributed by Brinkmann Instruments. Dry for 2 hours at 110°C, store in desiccator.

Equipment:

(a) High-speed blender, Waring Model EP-1 or equivalent, fitted with one-quart jar and lid.
(b) Funnels, filtering, 100 mm diameter.
(c) Paper, filter, Whatman #4, or equivalent.
(d) Separatory funnels, pear shape, 200 ml or 250 ml capacity.
(e) Viewing cabinet, Chromato-Vue model C-4 or C-6 with two long-wave UV lamps and contrast UV screening filter (Ultraviolet Products, Inc., San Gabriel, Calif., 91776, or equivalent), perferably fitted with a C-50 transilluminator for viewing tubes under transmitted UV.
(f) Vials, Kimble 60975, 2 dram capacity, with polyethylene friction top. Screw-capped vials can be substituted.
(g) Test tubes, small size, approximately 15 x 150 mm.
(h) Millicolumn. Make from 6 mm O.D. (4 mm I.D.) Pyrex tubing cut in approximately 20 cm lengths. For convenience in filling, columns can be flared into a funnel top.
(i) Packing of millicolumn. Plug end of millicolumn with small piece of cotton, tamp well. Pour in acidic alumina to a depth of 1.5 cm (0.2 gm) and top with silica gel to a depth of 9.0 cm above the alumina (0.5 gm). Plug top of column with small piece of cotton, tap firmly several times to pack, and tamp cotton plug firmly. Store columns in a desiccator over silica gel desiccant.

Extraction:

Weigh a 50 gram sample into a 1 quart blender jar, add approximately 10 grams of filter aid, 150 ml of extraction solvent, and blend at high speed for 3 min. Filter through a folded 18.5 cm circle of Whatman #4 paper, collecting 50 ml. of filtrate.

Purification:

To the 50 ml add 20 ml of ammonium sulfate solution and 130 ml of distilled water. Stir, and let stand approximately 2 min. for flocculation of preciptate. Add approximately 10 grams celite filter aid, stir, filter through 18.5 cm Whatman #4 filter paper. Measure 100 ml filtrate (equivalent to 25 ml of original filtrate) into 200 ml separatory funnel. Add 50 ml Hexane—shake for 1 minute and discard hexane layer (top). Add 3 ml of benzene to remainder, shake for 30 seconds. When layers separate, discard lower layer. Wash benzene layer one with 50 ml distilled water, *swirling gently* to avoid emulsions. Discard lower layer, transfer benzene phase to a small vial. Add small amount of anhydrous sodium sulfate to vial, shake to remove water droplets.

Column Development:

Insert a prepared millicolumn into the benzene extract and allow to wick up the column until the solvent front reaches approximately 1 cm above the alumina zone. Remove column, wipe the outside to remove adhering extract and immediately insert in 5 ml of the development solvent contained in a test tube, and develop for 5 minutes. Examine the developed column under either reflected or transmitted long wave ultraviolet illumination, or a combination of both, in a suitable viewing cabinet. The presence of aflatoxin contamination is denoted by a sharp blue fluorescent band about 1 cm above the alumina zone. A barely distinquishable blue fluorescent band indicates about 10-20 μg/kg of total aflatoxins ($B_1 + B_2$), while increasingly intense bands indicate higher levels of contamination. A very faint white or gray, but not blue, fluorescent band indicates either the absence of aflatoxins or contamination in the range of 0-10 μg/kg. With experience this band can be readily distinguished from the blue fluorescent band due to aflatoxins.

Lecture #3

FUMIGATION PROCEDURES

I. GENERAL DISCUSSION

A. What are fumigants?
a. Insecticide which is a gas when it is in its intended state
b. An insecticide is intended to penetrate masses of material to kill all stages of an insect

B. How do they differ from other insecticides?
a. Gas—(not liquid or solid)
b. Penetration
c. Must be used only in a confined area
d. Designed to kill all insects within the confined area
e. The use of fumigants requires expertise in
1. Sealing of structures, equipment or rooms
2. Absolute knowledge of the physical and chemical qualities of the fumigant
3. Absolute understanding of the safety measures needed to insure human safety
f. They are designed to do a completely different job than other insecticides
1. A tool to help bring the hidden and exposed infestation to a zero point so that other insecticides can be used more effectively

C. When should a fumigant be selected?
a. When there is an uncontrollable infestation in
1. Floors
2. Walls
3. Voids
4. Rail cars
5. Cracks
6. Other transportation vehicles that can't be readily controlled by other insecticides
b. When there is an infestation within the food in food containers such as
1. Infested bags
2. Rail cars
3. Trucks
4. Ships, etc.

D. Are fumigants the only tool needed for insect control? Absolutely not—they are of value only when they can be used as a part of a total sanitation program, involving knowledgeable
a. Clean-up programs
b. Insecticide programs
1. Inside
2. Outside
c. Storage and handling procedures
d. Warehousing procedures

II. FUMIGANTS—PHYSICAL CHARACTERISTICS

A. Methyl Bromide
a. Gas above 40°F
b. Packaged
1. Small cans (1 or 1½ lb. cans)
2. Large cylinders up to 500 lbs.
c. Released as a gas
d. Heavier than air—3.5 times weight of air
1. Moves downward
2. When used in large structures, one should use fans
e. Odor—none, unless used with other gases (chloropicrin, ethylene dibromide)
f. Color—colorless
g. Can there be an additive to enable odor detection? (Use caution as there may be separation of chemicals)
1. Ethylene dibromide
2. Chloropicrin

B. Phosphine
a. Packaged as a solid
1. Phostoxin
2. Detia
b. Released as a solid
c. Slow break-down
d. Same weight as air
e. Very good penetration
f. Strong odor—(carbide-like), detected at .025 ppm
g. Color—colorless

III. DOSAGE AND EXPOSURE

A. Methyl Bromide
a. 1½ lbs./1000 cu. ft. dosage
b. 24-48 hrs. exposure
B. Phosphine
a. 165 pellets/1000 cu. ft. dosage
b. 36-48 hrs. exposure

IV. DETECTION DEVICES

A. Methyl Bromide—Halide detector
B. PH_3—Auer or Draeger detector with tubes

V. SAFETY PROCEDURES

A. Methyl Bromide
a. Always have full-face gas mask on while working with methyl bromide
b. Fumigate in well-vented areas
c. Don't work in high concentrations of methyl bromide
d. Always work in pairs—never alone
e. When in doubt, use Halide detector
1. After fumigation to see if it is safe to enter after opening a fumigation
2. If you suspect a tarp leakage
f. Safety problems associated with methyl bromide
1. Chronic or cumulative type of poison
2. Methyl bromide is absorbed through the skin
3. Methyl bromide is heavier than air, consequently it can pocket
4. Alcohol and methyl bromide do not mix

B. Phosphine
a. Work in pairs—never fumigate alone
b. Always have a full-face mask with proper canister available when working with PH_3
c. Wear cotton gloves when handling pellets or tablets or be certain to wash hands carefully with soap and water after handling
d. Have a gas detector available to check safety or re-entry
e. Never stack a large group of pellets or tablets together because phosphine is combustible at 1.79% or about 18,000 ppm
f. Dispose of the hydrated alumina by burning, burying or pouring into a solution of detergent and water
g. Safety advantages of PH_3
1. Slow decomposition with slow evolution of the gas
2. Strong odor
3. No residue
4. Not chronic-type of poison
5. Easy to handle without wearing a mask

VI. HOW TO APPLY FUMIGANTS

A. Methyl Bromide
a. Have the stack properly prepared—run poly tube above the center of the stack—place poly tarp and seal the poly to the floor
b. Application of methyl bromide in small cans
1. Methyl bromide should be applied from outside the area to be fumigated using
(a) Jiffy applicator—to open can
(b) Poly tubing—to transport methyl bromide from can to fumigation area (under poly tarp)
(c) Drip pan to protect the material under methyl bromide outlet
2. Full-face mask with proper canister should be worn at time of application in case problems arise, example:
(a) Tube breaks
(b) Can bursts
(c) Tarp is not properly sealed
c. Application of methyl bromide in cylinders
1. Methyl bromide should be applied from area outside of the area to be fumigated and transported to the fumigation area (tarped bags) via poly tubing
2. Full-face mask with proper canister should be worn at time of application

B. Phosphine
a. Pellets (Phostoxin)
1. Place pellets on papers so the ash can be easily recovered after fumigation is completed
2. Protect hands with cotton gloves—if gloves are not worn, wash hands carefully with soap and water immediately after handling fumigant
3. Place papers on floor of area to be fumigated (under poly tarp)
4. Have full-face mask with proper canister for protection against phosphine on hand in case of emergency. It is generally not necessary to be wearing mask while applying most types of phosphine-producing fumigants since they break down so slowly
5. Seal poly tarp to floor
b. Tablets (Phostoxin) & Detia bags
1. Protect hands
2. Place papers on floor in fumigation area
3. Have full-face mask with proper canister available
4. Place tablets on papers
(Note: If a can of tablets or Detia bags is opened, it should be completely used up. This is not true of pellets.)
5. Seal poly to the floor

VII. POTENTIAL HAZARDS

A. Methyl Bromide
a. Product

1. Excessive residue
2. Off-odor when baked
(a) High fat
(b) Iodized salt, etc.
b. Personnel
1. Chronic poison
2. Skin absorption
3. Possible burns if
(a) Spilled on skin
(b) Working in high concentration for extended periods of time

B. Phosphine
a. Product
1. Keep ash out of food product in case it is eaten prior to complete decomposition
b. Personnel
1. Exposure to high concentration without mask could cause death

VIII. OPENING PRECAUTIONS

A. Methyl Bromide
a. Wear mask to open
b. Check with Halide detector to make certain there have been no leaks causing a dangerous build-up of methyl bromide in the area outside the fumigation area
c. To open and air fumigated stack, pull tarp only part way back—wait 30 min. before completely removing tarp. Fans may be needed to assist in proper aeration
d. Allow stack plenty of time for complete aeration before working in the area
e. Double check with Halide detector before working the area.

B. Phosphine
a. Have full-face gas mask at the Ready-To-Wear position
b. Partially open fumigated area and allow 30 min. to air
c. After 30 min. aeration period, take gas reading with Auer or Draeger gas detector
d. Remove the papers one at a time from fumigation area and pour the ash into a bucket containing detergent and water. Stir until the dust goes into solution. (It is often advisable to wear a full-face gas mask during the stirring operation.) Pour the solution into a trash container, on the ground, or into a sewer (it is rendered harmless by the detergent and water).

Fumigation is a very valuable tool that, if used properly, can help you maintain adequate control safely and economically.

IX. FILM: "THE ENEMY WITH-IN"

Participants arriving at the warehouse site for inspection and fumigation demonstration.

Lecture #3 • Visual Aids

FUMIGATION PROCEDURES

FUM-1 FUMIGATION MATERIALS. Accumulate all materials that will be required prior to starting to fumigate. A check off list would be helpful.

FUM-2 PREPARATION OF POLYETHYLENE COVERING. Have a large area to work on the covering prior to placing it over the stack of bags. Be careful that the polyethylene does not get damaged.

FUM-3, 4 PREPARATION OF POLYETHYLENE COVERING. Be sure to make all seams or overlaps secure and gas tight.

FUM-5 HOISTING POLYETHYLENE COVERING. Again use care to avoid puncturing or other damage to the covering.

FUM-6 COVERING STACK OF BAGS.

FUM-7 SEALING COVERING TO FLOOR. Sand is being placed on the covering to secure it to the floor. This is a particularly critical area when methyl bromide is used. Methyl bromide is heavier than air and would escape if a good seal is not attained.

FUM-8 WALKING BOARDS AND FUMIGANT. The boards will protect the covering from possible damage from shoes. Note the cans of fumigant (methyl bromide) are distributed in readiness to be opened.

FUM-9 APPLICATION OF FUMIGANT. Note there are two persons making the application. With methyl bromide they should be wearing gas masks.

FUM-10 SAND SNAKES. Weighted bags, sometimes referred to as sand snakes, may be used to hold the covering to the floor. If there is soil directly under the pile of bags instead of concrete, then a sheet of plastic should also be placed under the pile. Fumigants will leak out into the soil and may not be effective in treatment of the bags of grain or food.

FUM-11 REMOVING SAND OR OTHER WEIGHTED MATERIALS AFTER THE FUMIGATION. If fumigant is still present under the covering then the persons removing the sand should be wearing gas masks.

D. Wilbur and W. Schoenherr checking equipment in preparation of fumigation demonstration.

Bill Schoenherr and Don Wilbur shown at fumigant demonstration. Bill Schoenherr is checking the detector.

FUM-12 MC-2 IS METHYL BROMIDE THAT CONTAINS 2% CHLOROPICRIN. The chloropicrin is also called tear gas and may warn persons to stay out of an area where the fumigation is in progress.

FUM-13 JIFFY-APPLICATOR AND CAN OF METHYL BROMIDE

FUM-14 CAN OF METHYL BROMIDE IN PLACE IN JIFFY-APPLICATOR. This serves as a device to puncture the can and the fumigant passes through the tube. The open end of the tube should be inserted into the space being fumigated. Be sure and seal the hole in the polyethylene covering after the tube is removed.

FUM-15 READY TO FUMIGATE. This would be enough methyl bromide to treat approximately 1000 cubic feet or 28.32 cubic meters. The cans shown here would each contain one pound (453.59 grams) of methyl bromide.

FUM-16 RELEASE METHYL BROMIDE AT THE HIGHEST LOCATION. A plastic tube can be placed at the high point of a pile that is to be fumigated with methyl bromide. The other end of the tube would attach to the Jiffy-Applicator. The polyethylene covering would be placed over the pile after the tube is secured in place.

FUM-17 READY TO COVER WITH GAS TIGHT TARPAULIN.

FUM-18 PHOSTOXIN. A chart explaining the release of Ph_3 (H_3P) from phostoxin.

FUM-19 PHOSTOXIN CONTAINERS—PELLETS AND TABLETS

FUM-20 CONTAINERS OPEN SHOWING RELATIVE SIZE OF PELLETS AND TABLETS

FUM-21 SIZE COMPARISON, PHOSTOXIN, PELLET—TABLET—ASPIRIN (WHITE)

FUM-22 AUER TESTER TO DETERMINE CONCENTRATION OF PHOSPHINE

FUM-23 NOTE COLORATION ON TUBE. This gives an immediate indication of the parts-per-million of phosphine in the area being tested (fumigated).

FUM-24 ACTION. Auer tester pulling PH_3 through plastic tube.

FUM-25 DEMONSTRATION OF AUER TESTER DURING FOOD STORAGE SEMINAR.

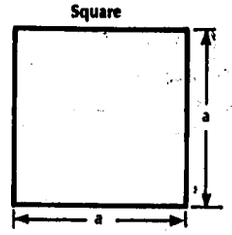
Lecture #3 • Appendix

CONVERSION FACTORS

To convert—	*Into—*	*Multiply by—*
VOLUME		
Cubic feet	Cubic meters	0.02832
Cubic meters	Cubic feet	35.3107
AREA		
Square feet	Square meters	0.0929
Square meters	Square feet	10.76
Square meters	Square yards	1.196
Square yards	Square meters	0.8361
LIQUID		
Ounces (liquid)	Milliliters	29.57
Pints (liquid)	Liters	0.47317
Liters	Pints (U.S. liquid)	2.113
Quarts	Liters	0.9463
Liters	Quarts (U.S. liquid)	1.057
Gallons	Liters	3.7853
Liters	Gallons (U.S. liquid)	0.2642
WEIGHT		
Pounds	Grams	453.5925
Grams	Pounds	.0022046
Ounces	Grams	28.3495
Grams	Ounces	0.03527

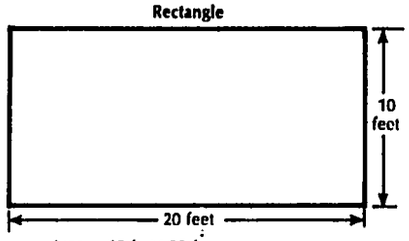
AREA is the surface included within a structure. Examples would be the floor or walls. This may be beneficial when determining the amount of spray to mix and apply to an area. If the label on an insecticide recommends 1 gallon of mixed spray to 100 square feet, an area 10 feet long and 10 feet wide would equal 100 square feet or 9.29 square meters and would require one gallon of spray.

Square



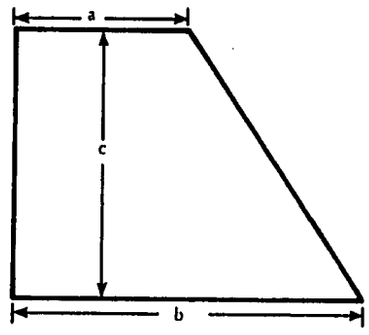
Area = a × a

Rectangle



Area = 10 ft. × 20 ft. =
200 square feet
200 × 0.0929 = 18.58 square meters

Trapezoid



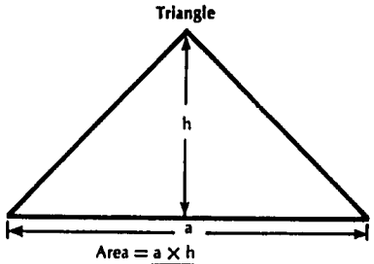
$$\text{Area} = \frac{(a + b)}{(2)} \times c$$

Example: a = 10 feet
b = 20 feet
c = 15 feet

$$\frac{(10 + 20)}{(2)} \times 15 =$$

15 × 15 = 225 sq. ft.
225 × 0.0929 = 20.9 square meters

Triangle



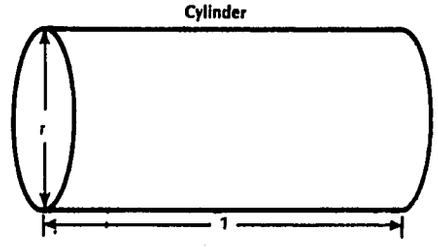
$$\text{Area} = \frac{a \times h}{2}$$

Example: a = 20 feet
h = 7.5 feet

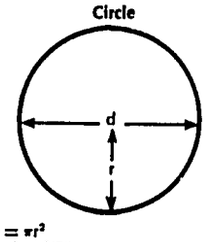
$$\text{Area} = \frac{20 \times 7.5}{2} = \frac{150}{2} =$$

75 square feet
75 × 0.0929 = 6.97 square meters

Cylinder



Circle

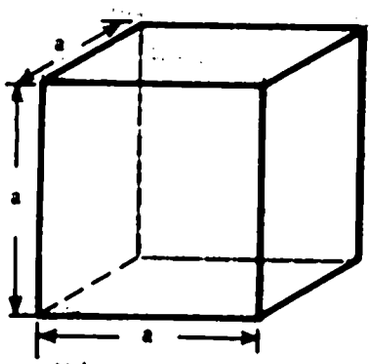


Area = πr^2
Example: π(Pi) = 3.14159265
d = 10 feet
r = ½d
r^2 = 25 sq. ft.
3.14 × 25 = 78.5 sq. ft.
78:5 × 0.0929 = 7.29 square meters

Volume = $\pi r^2 \times 1$
Example: π(Pi) = 3.14159265
r = 5 feet
r^2 = 25 sq. ft.
1 = 20 feet
3.14 × 25 ×20 = 1570 cu. ft.
44.46 cubic meters

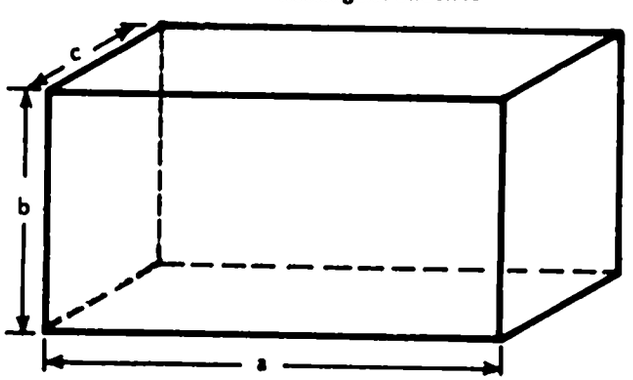
VOLUME is space as measured in cubic units. An example would be a warehouse 100 feet long, 20 feet wide and 15 feet high would contain 30,000 cubic feet. Converted to the metric system it would be approximately 849 cubic meters. It is necessary to know the volume when determining the dosage for fumigation and use of insecticides applied by mist, fog or ultra low volume.

Square Structure



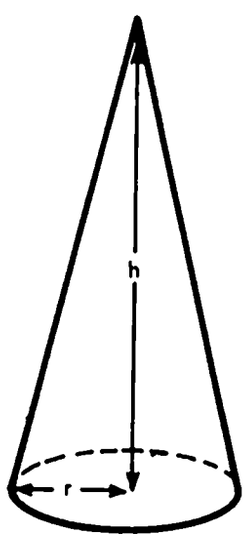
Volume = a × a × a

Rectangular Structure



Volume = a × b × c
Example: a = 20 feet
b = 10 feet
c = 5 feet
20 × 10 × 5 = 1000 cu. ft.
28.32 cubic meters

Cone



$$\text{Volume} = \frac{(\pi r^2)}{(3)} \times h$$

Example: $\pi = 3.14159265$
$r = 10$ feet
$h = 20$ feet

$$\frac{(3.14 \times 100)}{(3)} \times 20$$

$$\frac{314}{3} = 104.6 \times 20 =$$

2093 cubic feet
59.08 cubic meters

Lecture #4

RODENT CONTROL

A complete rodent control program involves a great deal more than killing rodents.
A. Elimination of Harborage
1. Inside
2. Outside
a. Trash
b. Holes
c. Weeds
d. Tall grass

B. Rodent-proofing Structures Via Construction
1. Fix holes in walls
2. Check door closures
3. See that doors are not left open

C. Proper Warehousing Procedures
1. Eliminate inside harborages, trash, holes in walls, etc.
2. Store product away from the wall

D. Set Up a Complete Baiting Procedure
1. Primary defense outside
2. Inside baiting
3. Inside trapping

E. Rodenticides. With the exception of exterior gassing of rodent burrows, the primary type of rodenticide to be used around food and food storage should be of the anti-coagulant type.
1. Types of anti-coagulants
a. Dry
b. Wet
2. Frequency of baiting
a. All bait must be fresh so that it will be acceptable to the rodent
b. Dry bait must not be allowed to become moldly or infested
3. Types of bait containers—All should be covered
a. Fountains
b. Bait trays
c. Bait boxes
(1) Metal
(2) Cardboard
(3) Plastic

Note: A new problem arises via the use of anti-coagulant or any killing bait and that is that is that the rodent usually dies in a hard-to-get-to area, thus creating a new problem.

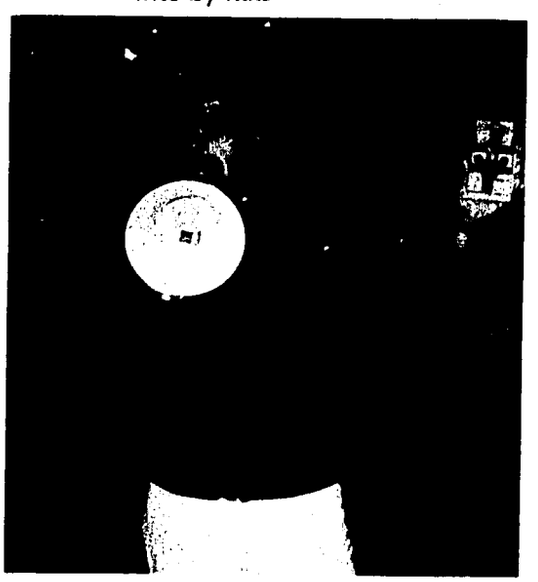
4. Trapping. Trapping can be an excellent form of rodent control, but it is one of many tools necessary for complete control.
a. Types of traps
(1) Wind-up
(2) Spring
5. Potential Problems of a Baiting Program
a. Non-acceptance of the bait
b. Infestations of the bait
c. Resistance to the anti-coagulant baits

Rodent control is a necessary part of any food warehousing sanitation program, for rodents destroy food, eat food and contaminate food products and food containers. They can be controlled.

Lecture #4 Visual Aids

RODENT CONTROL

ROD-1	Title
ROD-2	Norway Rat
ROD-3	Mouse
ROD-4	Chart, Comparison of Roof and Norway Rats
ROD-5	What Do Commensal Rodents Eat
ROD-6	Diseases Associated with Rodents
ROD-7	Rodents Cause Diseases
ROD-8	Damage Caused by Rodents
ROD-9	Example of Plastic Pipe Chewed Into by Rats



Don Wilbur demonstrating one of the best known rodent controls: rat trap.

ROD-10 Rodent Burrow Under Warehouse
ROD-11 Rats and Mice Pollute Food
ROD-12 Multiwall Paper Bags Stained and Damaged by Rodents
ROD-13 Norway Rat on Bag
ROD-14 Rodent Footprints in Commodity on Floor of Warehouse
ROD-15 Size Comparison, Rat and Mouse Excreta Pellets
ROD-16 Shape Comparison, Cockroach and Mouse Excreta Pellets
ROD-17 Rodent Hair From One Rat Pellet
ROD-18 Ultra-Violet (Black) Light Used to Determine Presence of Rodent Urine
ROD-19 Paper Chewed by Rodent (Mouse) Under Regular Lighting
ROD-20 Same Piece of Paper as Viewed Under Ultra-Violet Light. The stains are from urine.
ROD-21 How To Control Rodents
ROD-22 Cats and Rodent Control. Note the trap in the background.
ROD-23 Starve Them Out
ROD-24 Railroad Track Areas. Due to spillage of grains and foods these may serve as an attractant for rodents.
ROD-25 Remove Their Shelter
ROD-26 Non-Selective Herbicides Keep Areas Free of Weeds
ROD-27 Pallets Discarded Outside of Warehouse. Shelter and possibly food for rodents. Should be neatly stacked well off the ground if left outside of a warehouse.
ROD-28 Railroad Ties. Any object left directly on the ground may serve as shelter for rodents.
ROD-29 Young Rats Removed From Nest Under Boards
ROD-30 Rodent Burrow in Debris. It is important to keep areas around the exterior of warehouses clean.
ROD-31 Storage of Used Equipment Outside of a Warehouse. This is an open invitation to rodents. If it must be kept, store it in an organized manner well off the ground.

Don Wilbur and W. Schoenherr demonstrating a more sophisticated mouse trap.

ROD-32 Build Them Out

ROD-33 Hole in Wall. Such openings are an easy access point for rodents to enter a warehouse or other building.

ROD-34 Well Used Opening Under Building

ROD-35 Protection of Windows and Doors is Important Measure in a Rodent Control Program

ROD-36 Metal Strip, 12 Inches Wide, on Side of Building Prevents Rodent From Climbing Wall. This should be at least 3 feet or 1 meter above the ground level. This will reduce the chance of rodents entering holes in walls above the strip or through windows. They will travel on wires and tree limbs as a means of entering a building well above the ground level.

ROD-37 Roll Type Door From Outside. The dock is about 1 meter above the ground but not shielded to prevent rodents from reaching the top of the dock.

ROD-38 Same Door as Shown on Slide 37, From Inside. This door does not fit tight enough to prevent rodents from entering the building.

ROD-39 Trapping

ROD-40 Spring Traps for Rats and Mice. These are prepared to add a bait or may be used with the expanded trigger as shown.

ROD-41 Ketch-All Trap

ROD-42 Ketch-All in Warehouse. A mark or number on the wall to designate the location of a trap is helpful.

ROD-43 How to Kill Rodents (Baits)

ROD-44 Placement of Bait Stations Around Exterior of Property

ROD-45 Close-up of Bait Station. The weight is to avoid damage from wind.

ROD-46 Placement of a Rodenticide Within a Warehouse. Demonstration at Food Storage Seminar held in Jamaica.

ROD-47 Close-up of an Open Bait Station, Using Liquid and Dry Baits

ROD-48 Rodent Excreta Pellets in Building. This type of condition would indicate the need for the use of baits or traps.

ROD-49 Badly Damaged Rodent Bait Station. Apparently used as nest.

ROD-50 Gassing. Fumigants may be beneficial in the gassing of rodent burrows or used within buildings.

ROD-51 Dusting a Rodent Burrow with Calcium Cyanide

Lecture #5

INSECT PESTS OF PROCESSED CEREALS AND BAGGED GRAIN

I. WHAT IS AN INSECT?

Insects are distinguished by—

A. An exoskeleton, which provides protection from physical damage and dehydration

B. Three body divisions
Head—has eyes, antennae, mouthparts
Thorax—has wings and legs
Abdomen—has the gut, spiracles, and reproductive organs

C. Two pairs of wings—both pairs of wings on most insects are usually visible; on other insects such as the housefly one pair of wings are very small and difficult to see.

D. Six legs that are basically five-jointed. These are the most conspicuous features that set insects apart from other animals. Another striking characteristic is the way in which insects grow and develop. They must molt to grow. Also, all insects go through some change in form of body to reach the adult stage. In some species, cockroaches for instance, the young look much like the adult. This is incomplete metamorphosis. In other species the insect goes through complete change of body form as they proceed through the egg, larval, pupal, and adult stages. This is complete metamorphosis.

Most common stored-product insects go through complete metamorphosis. That is, they all have egg, larval, pupal, and adult stages. The larval stage is the rapidly growing, worm-like stage, the pupal stage is one

Seminar staff demonstrating hand spraying/fogging method at warehouse. Staff: Left to Right: Bill Schoenherr, Don Lawson and Don Wilbur.

of transformation. The adult is the reproductive stage. The growth process requires much food, and the food these insects eat deprives us of nourishment. They often first eat the germ, which contains much of the protein content, and then the starch. Thus not only the quantity but also the quality is depleted.

II. MOST STORED-PRODUCT INSECTS ARE EITHER MOTHS OR BEETLES

A. Moths—There are about *100,000* species of moths, but probably only about 10 or 12 are important stored-product pests. The adults have two pairs of wings covered with scales that often form distinctive color patterns. The adults have nonfeeding mouthparts called a proboscis. The larva has a head, three thoracic segments, and 10 addominal segments. The thorax has three pairs of true legs. Abdominal segments 3 through 6 and segment 10 have false legs (prolegs). The larvae have biting, chewing mouthparts and are responsible for all feeding damage caused by moths.

B. Beetles—There are more than *250,000* described species of beetles, and about 600 have been found associated with stored products. Many of these species, however, feed not on the product itself but on refuse or fungi associated with spoiled products. The adults have membranous rear wings which are covered by the hard leathery front wings. The larva has well developed, biting mouthparts and a thorax with three pairs of legs; however, *the abdomen does not have prolegs.*

Lecture #5 • Visual Aids

INSECT PESTS OF PROCESSED CEREALS AND BAGGED GRAIN

SPI-1* Schematic Illustration of a Grasshopper, Showing the Main Parts of a Typical Insect

SPI-2 Sketch of a Moth Larva

SPI-3 Sketch of a Beetle Larva

SPI-4 *Tribolium Castaneum* Adult (Red Flour Beetle: Gorgojo De La Ilarina). This species and *T. Confusum* (confused Flour Beetle) are usually the most common species in warehouses. It can develop from egg to adult in 6 weeks and can live 3 years. Females produce about 450 eggs.

SPI-5 *T. Castaneum* Larva

SPI-6 *T. Castaneum* Pupa

SPI-7 *Cryptolestes Ferrugineus* Adult (Rusty Grain Beetle). About 2 mm long with long antennae. Develops from egg to adult in 6 weeks.

SPI-8 *C. Ferrugineus* Larva. Very mobile.

SPI-9 *Rhyzopertha Dominica* Adult (Lesser Grain Borer: Capuchino De Los Granos). This insect is a very strong penetrator and can bore through almost any flexible packaging material. Develops from egg to adult in 6-8 weeks.

SPI-10 *R. Dominica* Larva. Usually found inside of grain, but is also found in bagged cereals.

SPI-11 *R. Dominica* Pupa. Usually found inside of grain.

SPI-12 Wheat Damaged by *R. Dominica*

SPI-13 Rice Damaged by *R. Dominica*

SPI-14 *Dinoderus Minutus* (Bamboo Powder Post Beetle). Similar in appearance to *R. Dominica*, but slightly more robust.

SPI-15 *Lasioderma Serricorne* (Cigarette Beetle: Carcoma Del Tabaco). This insect feeds on a very wide variety of stored products. It is a good penetrator.

SPI-16 *L. Serricorne* Larva. Very sluggish.

SPI-17 *L. Serricorne* Pupa. Usually found in a cocoon-like protective structure.

SPI-18 *Stegobium Paniceum* Adult. Similar in appearance and habits to *L. Serricorne.*

SPI-19 *Oryzaephilus Surinamensis* Adult (Sawtoothed Grain Beetle: Carcoma Dentada De Los Granos). This flattened insect can find very small openings in packages. Develops from egg to adult in 3-4 weeks and can live 3 years.

SPI-20 *Sitophilus Oryzae* Adult (Rice Weevil: Gorgojo Del Arroz). About 4 mm. long, has markings on wings and can fly.

SPI-21 Brown Rice Damaged by *S. Oryzae.*

SPI-22 *Sitophilus Granarius* Adult (Granary Weevil: Gorgojo Del Trigo). Similar in appearance to *S. Oryzae* but does not have markings on wings and cannot fly. This insect, *S. Oryzae,* and a closely related species, *S. Zeamais,* are extremely important insects attacking grain.

SPI-23 *S. Granarius* Larva in Wheat.

SPI-24 *S. Granarius* Pupa in Wheat.

SPI-25 *S. Granarius* Adult in Wheat.

SPI-26 *Tenebroides Mauritanicus* Adult (Cadella: Carcoma Grande De Los Granos). One of the largest insects attacking stored cereals and grains. A powerful penetrator.

SPI-27 *T. Mauritanicus* Larva.

SPI-28 *T. Mauritanicus* Pupa.

SPI-29 *Carpophilus Obsoleetus Adult.* Characterized by short wing covers. Often feeds on decaying vegetable matter.

SPI-30 *C. Obsoletus* Larva.

SPI-31 *C. Obsoletus* Pupa.

SPI-32 *Plodia Interpunctella* Adult (Indian Meal Moth: Polilla De La Fruta Seca). Feeds on a wide variety of stored foods. Develops from egg to adult in 6-8 weeks.

SPI-33 *P. Interpunctella* Larva. 12 mm. long, forms webbing.

SPI-34 *P. Interpunctella* Pupa.

SPI-35 *Trogoderma Variabile* Adult. Sometimes called the Warehouse Beetle. It is related to *T. Granarium* (Khapra Beetle: Trogoderma Del Grano), a very serious pest of grain and not found in the United States.

SPI-36 *T. Variabile* Larva.

SPI-37 *T. Variabile* Pupa.

SPI-38 *Tenebrio Molitor* Adult (Yellow Mealworm). Large (15 mm.) insect, mostly found in damp situations.

SPI-39 *T. Molitor* Larva.

SPI-40 *T. Molitor* Pupa.

SPI-41 *Periplaneta Australasiae* Nymphs and Egg Case. Although not truly stored-product pests, the cockroaches are often found in warehouses that are not kept clean.

SPI-42 *P. Australasiae* Adult. These insects illustrate incomplete metamorphosis.

SPI-43 *Blatella Germanica.* All stages.

SPI-44 *Blatta Orientalis* Adult.

SPI-45 *Periplaneta Americana* Adult.

* These slides describe names, stages, typical damage, and some distinguishing characteristics of a few common species of insects found attacking processed cereals and bagged grain. Common names are given in parentheses.

Don Wilbur shown applying the hand-spray technique.

Lecture #6

APPLICATION OF INSECTICIDE SPRAYS AND FOGS

1. Insecticides—What are they?—Anything used to control insects.
A. Basically 3 major categories
a. Fumigants
b. Residual
c. Contact

2. What forms do insecticides come in?
a. Solid
b. Liquid
c. Gas

3. How are insecticides applied?
A. Fog
a. Wet
b. Dry
B. Spray
C. Dust

4. What types of common carriers are used to mix with insecticide concentrates?
A. Oil
B. H_2O
C. Air

5. Most common types of insecticides
A. Contact insectcides
a. Pyrethrins
b. Fumigants
B. Residual insectcides
a. Malathion
b. Dursban
c. Baygon
d. Diazinon
e. Methoxychlor
f. DDVP (Vapona)
g. Diatomaceous earth or silica

6. Why use insecticides?
A. Primarily to help maintain minimum sanitation standards
B. To prevent actual economic loss of food to insects

7. Insecticide Selection
A. Residual—preventive
B. Contact—corrective

8. Application methods and when to select specific types of application
A. *Fogging*—is selected as an excellent tool for control of flying and/or exposed insects. Fogging is one of the more common and popular means of applying *Contact* insecticides such as pyrethrin mixtures. It can, however, be used to apply residual insecticides as well.

The prime hazards of this type of application are: (1) A potential hazard to the individual exposed to an atmosphere of insecticide, and (2) a potential hazard of contaminating the food or food containers with the insecticide or its carrier (oil).

There are several types of fogging devices available, some of which appear to be more effective than others; but again, it must be realized that a fogging operation must not be confused with a fumigation, for there is no penetration of product, bags, or walls with a fog.
B. *Spraying*—is most commonly used in conjunction with properly selected residual materials such as malathion, baygon, diazinon, etc., where the prime value of material will come for many days after the material has been applied. Careful selection of a good residual insecticide, along with a careful spraying application, can give protection of specific areas for considerable periods of time, provided the proper clean-up program is also instituted.

9. When should a residual insecticide be selected?
A. The primary function of a residual insecticide is to provide protection against future invasion of a specific area, consequently a residual should be used after:
a. The surface is thoroughly clean
1. Usually a perimeter around presently stored product
2. Or an area upon which product will be placed
b. The product is adequately protected from accidental contamination
B. A residual insecticide will only provide surface protection—not penetration.

10. When should a contact insecticide be selected?
Again it must be pointed out or re-emphasized that a contact fog or spray kills only the exposed insects and this process should not be confused with fumigation.

A. As a spray
a. The area should be carefully cleaned before a spray is used.
b. Never mix more contact or residual insecticide than you plan to use in a short period of time—the insecticide could:
1. Lose strength
2. Settle out
Remember that you must contact the insect with the spray at the time the spray is released, for there is no residue.
B. Types of problems a contact spray is designed for
a. Heavy insect problem
b. Problem of roaches or other exposed insects
C. Types of problems a contact fog is designed for
a. Extensive flying-insect problem
b. Roaches or other partially-exposed insects

11. Insecticide Application
A. Sprayer tips
a. Don't over-fill sprayer
b. Label sprayer as to what insecticide is in it
c. Try to use the sprayer for one purpose:
A sprayer for contact
A sprayer for residual
A sprayer for weed control, etc.
d. Do not pump up a high pressure in sprayer
1. Splash-back
2. Air-borne contamination
3. Burst sprayer
4. Burst hose
5. Hard on sprayer life
e. Do not put more insecticide in sprayer than you will use over a short period of time
1. Settle out
2. Lose strength
3. Damage sprayer
f. Clean sprayer very carefully after each use
B. Fogging tips
a. Don't put in more insecticide than will be used in a short period of time
b. Make certain that those running the fogger have proper respiration and eye protection from the insecticides being used
c. Make certain that the insecticides selected won't leave any harmful residues
d. Make certain that the fogger is properly cleaned after usage
C. Application of contact or residual insecticides
a. Apply at the recommended rate—too much could be as bad as too little
b. Don't mix more than you plan to use over a short period of time
c. Make certain that the material selected was designed for the particular problem you have in mind.

Lecture #6 • Visual Aids

APPLICATION OF INSECTICIDE SPRAYS AND FOGS

ASF-1 CLEANING. Insecticide sprays should not be used to replace cleaning. After a surface such as a warehouse floor has been cleaned, then a spray may be advisable to kill insects that are in the cracks and crevices or that may enter the structure and contact the sprayed surface.

ASF-2 LABELS. All pesticides should have a label on the outside of the container. The label should give the instructions for application. There may also be a warning statement if the chemical is particularly toxic. The label should be read and understood prior to using any of the pesticide.

ASF-3 MEASURE ACCURATELY. If a concentrated insectcide is to be used, the instructions on the label will list the necessary information for proper mixing. Improper mixing may alter its effectiveness, may be hazardous to the applicator or commodity and may waste money.

ASF-4 THOROUGHLY MIX. A sprayer may require shaking to assure the proper mixture is maintained.

ASF-5 SEPARATION. Some formulations will tend to settle-out or stratify. It is advisable to mix only the amount required for the job, then to use it quickly. Even then it is advisable to shake the sprayer to maintain the correct mixture.

ASF-6 APPLICATION. The proper application is important to assure the spray reaches the desired target without contaminating food.

ASF-7 INSECTICIDE FOG DEVICE. This device will disperse a wet fog. The wet fogs will tend to settle-out rather quickly on horizontal surfaces. It is important to select the proper formulation for use in this type of device to avoid staining or contaminating food. Compressed air is necessary to use this unit.

ASF-8 INSECTICIDE FOG DEVICE. This device has an electric motor and it will produce a wet fog. The same precautions are advisable as stated under number 7. Usually the insecticide used in these devices contains pyrethrins.

ASF-9 FOGGING. This shows the use of a fog to treat around a stack of bags that are under fumigation. This was taken in a warehouse in Colombia in South America. The objective is to reduce the potential of insects crawling onto the fumigated bags after the gas has all escaped.

ASF-10 RAILCAR. Boxcars often harbor insects. They, like trucks, should be cleaned and treated with an insecticide if it is suspected that insects may be present. The device in the open door produces a smoke.

ASF-11 INSECTICIDE SMOKE. The micron size of the insecticide droplets are very small when produced by a smoke generator. This is referred to as a dry fog. It will tend to stay suspended in the air for a long period unless there are openings in the railcar, truck or building being treated.

ASF-12 ULV, ULTRA-LOW VOLUME. This may also be referred to as ultra-low dosage, ULD. Equipment is available that will operate by electricity or by a gasoline engine. The micron size is ideal for the control of exposed insects. This is not a fumigant and it will not penetrate into grain or commodities.

ASF-13 NOZZLE FROM THE MICRO-GEN. This is the nozzle that has been removed from the ULV generator. It shows how an air turbulence is created that causes the formation of the desired insecticide particle size.

ASF-14 DEMONSTRATION OF A MICRO-GEN UNIT.

ASF-15 LETHALAIRE. This is a self-contained pressurized unit that will disperse insecticide. It is suitable for small areas but not economical for large spaces. Usually the insecticide is pyrethrin. The fog produced by this type of unit will kill insects that are exposed.

ASF-16 APPLICATION OF A SPRAY TO THE WALL OF A WAREHOUSE. Note the personal protective equipment that is being used. This would probably be a residual insecticide.

ASF-17 APPLICATION OF A FOG. Note the applicator is wearing a mask. Large amounts of fog in the air can be irritating to the eyes, nose and throat. Normally the door would be closed as would all other openings. Otherwise the fog would drift out of the building and not be fully effective.

ASF-18 APPLICATION OF A WET SPRAY TO A WAREHOUSE WALL. The objective here is to wet down the wall so any insect that contacts the surface would be killed. The formulation selected for this type of application depends on regulations and potential hazard to foods. Both must be carefully considered and understood.

ASF-19 APPLICATION OF A FOG. Certain insecticides can come into direct contact with the exterior of bags. It should be a food type formulation of insecticide and the bag should be constructed of materials that will not allow the chemical to penetrate through to the food.

Lecture #7

TYPES OF DAMAGE TO PACKAGED FOOD COMMODITIES

A seemingly intact package of food is opened only to find the contents heavily infested with insects or badly molded. How did it occur? There may be obvious damage to the package or it may require close examination to determine the route of entry of the contamination. The objective in this discussion is to point out some of the conditions that could serve as the route or routes of entry or sources for deterioration.

If an insect problem has developed within a bag there are usually insects crawling on the outside, too. When insects are observed around a bag or stack of bags, it should serve as a warning and would suggest that a thorough inspection should be made. Any obviously damaged bags should be separated from good bags and any spilled product removed. Insects require food and if food is not present, they will leave the area.

It really isn't as simple as the foregoing comments may indicate. Several talents are important in finding and holding down an insect population. Some of these have already been discussed in earlier lectures and others are still to come.

To be considered are:

1. Cleaning, which means the removal of all residue that could serve as food for insects. This means not only from the open areas but from corners, between bags, around and under pallets.

2. Product that is, or may be, out-of-condition should be moved to an isolated area. If insects are noted, then fumigation would be advisable.

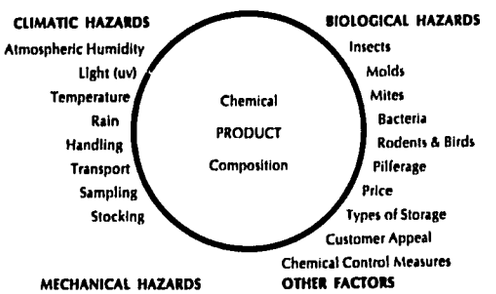
3. Contaminated material should be destroyed or disposed of quickly.

4. Inventories should be moved as soon as possible and kept on a "first in-first out" basis.

5. Product should be so stacked that it is easy to inspect; examples would be open spaces between the stacks of food and walls and between stacks.

Damage to the package and its contents could be divided into four categories. They are:

1. Climatic hazards
2. Mechanical hazards
3. Biological hazards
4. Other factors, such as pilferage, chemicals, etc.



One of the problems that has made it difficult to give answers to inquiries from overseas is the lack of accurate data or assessment of the conditions that have actually caused the loss of food. As already mentioned, some of the causes are obvious; however, some of them are difficult to determine. Many forms have been devised for reporting losses; however, few, if any, of those have been successful because of the aforementioned difficulty. A method of reporting that is just now being tested in the field will give helpful information. (Refer to Appendix.) The slides and comments will show the types of conditions that may cause loss of commodities.

In the six countries where extensive observations and field tests have been conducted it is estimated that 90% of the problems would have been solved if the five recommendations had been followed. Again it is understandable that the solution is not simple and will require training and follow-up. We hope that seminars of this type can be conducted at many locations and that the information will be presented in a meaningful and beneficial manner.

Lecture #7 • Visual Aids

TYPES OF DAMAGE TO PACKAGED FOOD COMMODITIES

TDP-1 Four Categories of Damage (chart)
TDP-2 Good Warehousing Practices—pallets and adequate space (Panama)
TDP-3 Climatic Hazard—problem caused by rain and humidity
TDP-4 Climatic Hazard—excessive mold on exterior of bags
TDP-5 Climatic Hazard—some bags removed from stack
TDP-6 Climatic Hazard—close-up of badly molded bag
TDP-7 Climatic Hazard—cotton overwrap opened to expose multiwall bag interior
TDP-8 Climatic Hazard—multiwall opened to show interior plies no more damage
TDP-9 Climatic Hazard—product exposed and in good condition
TDP-10 Mechanical Hazard—grease from fork lift truck
TDP-11 Mechanical Hazard—damaged pallets
TDP-12 Mechanical Hazard—wear-destroyed paper, plastic exposed
TDP-13 Mechanical Hazard—TOS bag, tape fatigue (comment on tape tear)
TDP-14 Mechanical Hazard—TOS bag, tape wear damage
TDP-15 Mechanical Hazard—TOS bag, corner ear tear
TDP-16 Mechanical Hazard—POM bag, adhesive failure
TDP-17 Mechanical Hazard—POM bag, adhesive failure
TDP-18 Mechanical Hazard—puncture or snag
TDP-19 Biological Hazard—flour beetles on exterior of CSM bags
TDP-20 Biological Hazard—pallets of wheat flour (at 6 mo. storage)
TDP-21 Biological Hazard—close-up of cotton bag(s)
TDP-22 Biological Hazard—close-up of cotton bag (mold and insects)
TDP-23 Biological Hazard—close-up of cotton bag (insect entry at stitch)
TDP-24 Biological Hazard—close-up of interior of cotton bag
TDP-25 Biological Hazard—close-up of paper bag (insect entry at stitch)
TDP-26 Biological Hazard—rodent damage
TDP-27 Temporary Salvage of Damaged Bags
TDP-28 Biological Hazard—close-up of moldy bag
TDP-29 Biological Hazard—stacks of experimental mold-resistant and standard IRT POM bags
TDP-30 Biological Hazard—extremely moldy surface of mold-resistant IRT POM bag
TDP-31 Biological Hazard—inner surface of outer ply of extremely moldy, mold-resistant bag
TDP-32 Biological Hazard—inner polyethylene liner of extremely moldy mold-resistant bag
TDP-33 Biological Hazard—surface of moldy bag wiped clean (note printing)
TDP-34 Loss Status Report—CSM bags, mold (Loss type 201)
TDP-35 Loss Status Report—soy-fortified rolled oats bag, infested, tapered closure (Loss type 616)
TDP-36 Loss Status Report—soy-fortified rolled oats bag, infested, tape improperly positioned, bottom (Loss type 621)
TDP-37 Loss Status Report—cornmeal bags, mechanically torn (Loss type 101)
TDP-38 Loss Status Report—sorghum grits bag, infested with insects (Loss type 604)
TDP-39 Loss Status Report—wheat-soy blend bags, short weight (Loss type 301)

COMMODITY CODES

005—Bulgar
007—Corn
009—Cornmeal
011—CSB (Corn-Soy-Blend)
012—CSB, Instant
013—CSM, Instant
014—CSM (Corn-Soy-Milk)
015—Grain Sorghum
018—Non-Fat Dried Milk
019—Rolled Oats
021—Rice, Milled
023—Soy Fortified Bulgur
025—Soy Fortified Cornmeal
027—Soy Fortified Flour 6%
029—Soy Fortified Flour 12%
031—Soy Fortified Rolled Oats
032—Soy Fortified Sorghum Grits
033—Full Fat Soy Flour
035—Defatted Soy Flour
039—Veg. Oil, Soybean Salad
040—Veg. Oil, Peanut
041—Wheat
043—Wheat Flour
045—Wheat Rolled
046—Whey Soy Drink Mix
047—WHB (Wheat-Soy-Blend)

LOSS LOCATION CODES

1—Lost during ocean transport
2—Lost during in-country transport
3—Lost in Customs warehouse
4—Lost in Agency warehouse
5—Other

LOSS TYPE CODES

BAG FAILURES WITH SPILLAGE (Contents *not* contaminated, deteriorated, or infested)

Damaged Bags

101—Mechanically ripped, torn, cut or punctured
102—Burst
103—Loosened adhesive when bag *is* water damaged
104—Punctured by insects
105—Other bag damage problem

Defective Bags

110—Leaking longitudinal or side seam
111—Leaking closure, bottom
112—Leaking closure, top
113—Corners peeling
114—Wrinkled along fold, bottom
115—Wrinkled along fold, top
116—Tapered closure
117—Loosened adhesive when bag *is not* water damaged

Exposed Stitching

118—Tape improperly positioned, top
119—Tape wrinkled, top
120—Tape not adhering, top
121—Tape improperly positioned, bottom
122—Tape wrinkled, bottom
123—Tape not adhering, bottom
124—Other defect or stitching problem

MOLDY BAGS

201—Combined with spilled commodity
202—Spilled commodity absent

SHORT WEIGHT BAGS

301—Quantity received less than specified weight
(Note: Include number of bags affected on reverse side)

CONTAMINATED but *NOT* INFESTED

401—Soiled by rodents, birds, or animals
402—Mixed with water
403—Mixed with chemicals, pesticides, petroleum products, etc.
404—Contains rope spores in original bag
405—Contains noxious seeds (Original bag or bulk grains)
406—Other Contamination problem

DETERIORATED but *NOT* INFESTED or CONTAMINATED (Commodity is discolored and/or tastes or smells unclean, stale or musty)

501-523—Deteriorated *and* Bag Failure
(Note: Use suffixes 01-23 from 100 series i.e., Deteriorated and Corners Peeling = 500 + 13 = 513)
525—Undamaged and opened bags
526—Undamaged and unopened bags
527—Patched, taped, overslipped, or rebagged commodity

INFESTED WITH INSECTS

601-623—Infested *and* Bag Failure
(Note: Use suffixes 01-23 from series i.e., Infested and Burst = 600 + 02 = 602)
625—Undamaged and opened bags
626—Undamaged and unopened bags
627—Patched, taped, overslipped, or rebagged commodity

INFERIOR GRADE

701—Excess dockage
702—Excess broken kernals
703—Excess other grain or leguminous seeds
704—Other problem affecting grade

OTHER UNSPECIFIED REASON FOR LOSSES

801—Specify Reason _____

MONTHLY COMMODITY LOSS STATUS REPORT

Country	Signature	Sheet of	Form No.
ACIREMA	Henry A. Highland	1 1	
Agency	**Name and Title**	**For Month of**	**Year**
CARE/ACIREMA	H. A. HIGHLAND DIRECTOR	DECEMBER	1976

COMMODITY CODE	CONTRACT NUMBER	LOSS LOCATION CODE	LOSS TYPE CODE	QUANTITY LOST AND NOT RECOVERED (lbs.)	POTENTIAL LOSS BUT RECOVERED (lbs.)
014	PV(FF)24438	4	201	2000	2000
031	MP(FF)16384	4	616	150	--
031	MP(FF)21285	4	621	300	--
009	MP(FF)18340	2	101	20	30
032	MP(FF)38462	3	104	50	--
047	MP(FF)28131	5	301	67 bags (670 lb.)	--

INSTRUCTIONS

1. Select COMMODITY CODES, LOSS LOCATION CODES, and LOSS TYPE CODES from reverse side of this sheet.
2. Use only one LOSS TYPE CODE per line.
3. Enter total of QUANTITY LOST AND NOT RECOVERED (lbs.) on the Commodity Status Report.
4. A typical example of POTENTIAL LOSS BUT RECOVERED is a torn bag with exposed commodity which was recouped (overslipped, taped, rebagged).

Lecture #8

PROTECTION OF PACKAGED COMMODITIES FROM INSECTS

We have seen that the food processor may follow all necessary procedures to avoid insect contamination of his product. However, he may have little control over conditions encountered after the product leaves his plant. Packaged foods may be exposed to insect infestation in railcars or trucks, during central
*1 warehouse storage, on ships, in outlying warehouses, and at the final distribution points. Insect-resistant packages can protect foods from infestation in all of these shipping and storage situations.

There are two important prerequisites for the manufacture of insect-resistant packages. *First,* the package must be constructed so as to prevent the en-
2 trance of insects through seams, clos-
3 ures, the weave of fabric, or any other
4 opening through which the insect can crawl or deposit eggs. *Second,* some insects can bore through almost any flexible packaging material in use today. To prevent the entrance of these
5 penetrators the package must be chemi-
6 cally treated to prevent these insects from boring into the package.

7 What procedures can be taken to pre-
8 vent invasion and penetration? In the United States only pyrethrins synergized with piperonyl butoxide is registered for use as an insect-resistant package treatment. Pyrethrins is obtained from plants and is virtually nontoxic to mammals. The insecticide combination must not exceed approximately 64 mg. of pyrethrins and 640 mg. of piperonyl butoxide per square meter on the outer surface of multiwall paper bags. All bags must contain at least 22.7 kilograms of dry cereal products.

Extensive, long-term tests at the Stored-Product Insects Research and Development Laboratory clearly proved that very low residues occur in commodities stored in these bags.

Insect-resistant shipping bags are now being used to ship most types of processed cereals from the United States in our AID programs. These bags currently consist of 5 outer plies of paper and 1 inner ply of 3-mil polyethylene film. The outer longitudinal seams are sealed so that there is no more than 4.7 mm. of unglued edge, to eliminate insect harborage. The outer surface of the outer ply is treated with synergized pyrethrins and is accordingly labeled with a U.S. government registration number. The paper is treated prior to manufacture of the bag, and the manufacturers conduct rigid tests by chemical analyses to be certain that the coatings are applied correctly.

9 Two types of insect-tight closures are authorized for these bags. The one used most often is commonly called the pinch-bottom closure. On this bag, which is gusseted, the extended flap at each end of the bag is composed of the stepped plies of paper. Sealing is accomplished with a wide band of heat-activated adhesive. The flap is folded over and sealed to the opposite face of the bag. Both ends of the bag
10 are sealed in a like manner. Defective
11 seals consist of incomplete adhesive of
12 the folded-over flap (usually corner
13 peel), short folded-over flap (which
14 should measure 4.12 cm.), tapered folded-over flap, wrinkled folded-over flap, or misaligned folded-over flap. Another defect is a partially sealed longitudinal seam.

The other type of insect-tight closure is the tape-over stitching in which insect-resistant treated paper tape is heat-sealed over the stitched ends of a flat tube bag (this package has no gusset).
15 The cut-off stitch chain extending from each side of the bag is supposed to be completely enclosed by the paper tape. This prevents small insects from crawl-

* Numbers in the left hand column indicate Slide Number.

ing up the channel formed by the tape over the stitching. The tape and longitudinal seams are sealed so that there are no unbonded edges. This bag also consists of 1 inner polyethylene and 5 outer paper plies, and the exterior ply is treated with synergized pyrethrins.

16 Defects consist of improperly positioned tape, wrinkled tape, tape not adhered, thread not enclosed or covered by the tape, thread line not 12 mm. from the edge of the tape, and thread
17 not 9.5 mm. to 19 mm. from the top or bottom of the bag.

Certain commodities are shipped in fabric bags made of jute, cotton, or woven polyproplene. These bags provide no protection from insect infesta-
18 tion. Insects gain entry by crawling
19 through the gaps formed by the stitch-
20 ing, through the weave of the fabric, or by the female depositing eggs through the weave.

Commodities shipped in IRT paper sacks include:
Flour, soy fortified
Rolled oats, soy fortified
Cornmeal, soy fortified
Sorghum grits, soy fortified
Soy flour (full fat)
Soy flour (defatted)
Wheat flour (blend A)
Wheat soy blend
Wheat soy blend, sweetened and flavored
CSM
CSM, instant
CSM, sweetened and flavored
CSB
Cornmeal
Rolled oats

These are shipped in insect-resistant bags because research has shown that protein fortification of processed cereals makes them more susceptible to attack by stored-product insects.

Commodities currently shipped in non-insect-resistant fabric bags are:
Bulgur
Bulgur, lysine fortified
Bulgur, soy fortified
Rolled wheat
Wheat flour, baker's soft
Wheat flour, baker's hard
Wheat flour, durum
Wheat flour enriched, lysine fortified
Rice, milled
Wheat flour is also shipped in multiwall paper bags that are not treated with synergized pyrethrins.

Examination of Bags for Infestation

How can bags be examined for infestations? The presence of insects crawling about on the bag surfaces can indicate the existance of a major infestation. If stored-product insects are seen anywhere on or around fabric bags of processed cereals or grains, including floors, pallets, or on other packages or stored grains, it is almost certain that the fabric bags will be infested. Under these same conditions, however, IRT bags would *probably* be free of insects, providing the bags are intact and providing recommended storage periods have not been exceeded. If insects succeed in gaining entrance into insect-resistant-treated (IRT) bags through seams, closures, or tears, high populations can build up inside the bag and penetrators will bore out of the bag to disperse.

To examine IRT paper bags for the possibility of infestation, look for penetrations in the bag walls and for insects in the corner fold of pinch-bottom closures. Also, insects can often be found harboring between stacked bags, especially when the bags have been stored for long periods. If insects are only found harboring between bags, it does not necessarily mean that they have succeeded in gaining entrance to the bags. It is, however, a good indication that the bags should be carefully examined for tears and defective construction. Consideration must at this point be given to fumigating the entire lot of bags.

If the bags are fumigated, the tarpaulins can be left in place until the bags are to be moved. Of course, the cover must be removed and the stack well aerated before the bag can be safely handled. A word of caution is required here: Insect-resistant-treated paper bags and all multiwall paper bags of flour from the United States contain a polyethylene film liner that delays the escape of the fumigant from inside the bag. Therefore, for safety reasons, one must allow at least 1 full day between removal of the fumigating tarpaulin and handling of the bags.

Miscellaneous Procedures for Protecting Packaged Commodities

What are some other procedures for protecting packaged commodities? When the packages are delivered to the warehouse for storage, they should
21 be carefully examined for damage and
22 faulty construction. IRT bags with any tears or faulty construction should be segregated and used as soon as possible. Torn fabric bags should be mended in the interest of good housekeeping, to prevent spillage of the commodity from the bag.

Where possible, commodities in IRT bags should be stored separately from commodities in fabric bags. This helps minimize exposure of the IRT bags to the heavy infestations that can build up in non-insect-resistant fabric bags.

23 Stocks must be arranged so that the oldest stock can be shipped first. The effective life of the insect-resistant treatment is limited; therefore, old bags can become infested. Also, moving out older stock first will help minimize the buildup of large populations in fabric bags.

24 Stocks that are heavily infested or otherwise damaged must be removed immediately. Experience and worldwide observations have shown that the prin-
25 cipal sources of reinfestation are either damaged bags or stocks that are concealed or neglected in hidden areas of the warehouse. Legal procedures must be formulated and administered promptly to dispose of these materials and to prevent the storage of these materials in warehouses maintaining active stocks of packaged commodities. If infested damaged stocks cannot be promptly disposed of, move them away from uninfested stock and fumigate.

26 Inspect carefully and frequently for insect infestations. Remember that some insects can complete a generation in as little as 30 days. It is said that one pair of flour beetles could produce 3.5 million progeny in about 90 days.

Finally, it is of utmost importance that the sanitation procedures discussed at this meeting be followed with all possible diligence. Good housekeeping and sanitation procedures come first. Destruction of existing infestations should be considered a necessary step to be taken because of failure to follow good housekeeping sanitation and warehousing procedures.

Don Lawson demonstrating proper inspection techniques for bagged commodities at the conference facility.

Lecture #8 • Visual Aids

PROTECTION OF PACKAGED COMMODITIES FROM INSECTS

PCO-1 Sketch of insect-resistant packaging concept.

PCO-2 Insect eggs in seam of a fabric bag, to show relative size of the eggs and weave of the fabric.

PCO-3 Insect larva about to enter a needle hole in a sewn paper bag.

PCO-4 Insect larva entering a hole 1/100 inch (0.25 mm.) in diameter. Also shown is an insect egg and a typed period (typed on a standard typewriter).

PCO-5 Insect penetration holes in a paperboard carton such as those used to pack breakfast cereals.

PCO-6 Insect penetration holes in the tape and on the flaps of a corrugated paper shipping case.

PCO-7 Insect penetrations in a sewn multiwall paper bag (close-up).

PCO-8 Statement found on insect-resistant paper bags to indicate the treatment and construction features.

PCO-9 Closed ends of pinch-bottom and sewn multiwall paper bags.

PCO-10 Loose corner of a pinch-bottom closure.

PCO-11 Corner peel of a pinch-bottom closure.

PCO-12 Unsealed corner of a pinch-bottom closure.

PCO-13 Partially sealed (1) and fully sealed (2) longitudinal seams on multiwall paper bags.

PCO-14 Sewn and taped closure on a multiwall paper bag showing stitching before tape was applied. Stitching thread is exposed (top).

PCO-15 Unsealed end of tape on a sewn multiwall paper bag shows channel for entrance of insects.

PCO-16 Exposed thread on sewn, taped closure, showing possible point of entry for insects.

PCO-17 Insect under tape of a sewn, taped closure.

PCO-18 Insect penetrations on a fabric bag.

PCO-19 Extreme insect damage to cotton bags stored in an infested warehouse.

PCO-20 Insect penetrations in a woven polypropylene bag.

PCO-21 Damaged insect-resistant bag in a stack, showing how a reservoir for insects can be maintained in an otherwise well kept warehouse.

PCO-22 Torn exterior of an insect-resistant bag showing how easily accessible the contents are.

PCO-23 Table on an insect-resistant treated (IRT) sack showing date of the IRT treatment.

PCO-24 Heavily infested, neglected stocks cereal in insect-resistant, damaged bags.

PCO-25 Heavily damaged dry milk bags.

PCO-26 Population growth of flour beetles.

Lecture #9

TYPICAL MOVEMENT OF COMMODITIES IN OVERSEAS PROGRAMS

It is difficult for persons that have not traveled overseas and actually observed the complexity of distribution to fully understand the number of times each food container is handled. To design an inexpensive package to withstand the abuses that are a normal occurrence has, in itself, been a real challenge.

A recent research shipment of CSM and wheat flour to Colombia could be used as a typical example. Let us follow that shipment from the processing plants in the United States to final destination.

The empty bags were placed by the packing equipment. Each bag was inserted on the spout and filled. The bags were then moved through the closing equipment, falling onto a rubber conveyor belt and moving to a rail car. In the rail car they were moved by hand and stacked. The rail car then moved to a seaport location. At that point they were unloaded by hand. The bags were placed on wooden pallets and moved by means of a fork-lift truck into a warehouse. Pallet loads were stacked and held until time to load into a ship. Again the pallets were moved by a fork-lift truck to ship-side and hoisted into a hold. The bags were removed by hand and stacked in the hold. At destination port, the ship was unloaded in much the same procedure as the loading. Some ports do not use pallets for holding the bags while hoisting from the ship; rope slings and even an occasional cable sling have been observed. Where pallets are used, as was the case in the Colombia test, the pallets were moved by fork-lift truck into a warehouse. They were moved a second time by a fork lift and then loaded by hand onto a truck. The truck traveled a distance of approximately 75 miles from the port city of Cartagena to Barranquilla. The truck was unloaded by hand, the bags placed on wooden pallets and moved by fork-lift truck into the warehouse and again stacked. After clearance by custom officials, the pallets were moved to a truck, the bags hand-placed on the truck and taken to a distribution warehouse. There are usually several more moves required to get the bags to the point of consumption.

The number and types of handlings would total as follows:

NUMBER AND TYPES OF HANDLINGS

		Mechanical			*Conveyances*		
	Manual	*Conveyor Belt*	*Fork Lift*	*Cable Hoist*	*Box Car*	*Ship*	*Truck*
Packing & Loading	1	1					
Rail Shipment	2				1		
Port Storage (USA)			2				
Water Shipment	2			2		1	
Port Storage Cartegena, Colombia	1		3				1
Port Storage, Barranquilla, Colombia	1		1				1
Totals	7	1	6	2	1	1	2

No doubt you are now wondering if it is possible to get a package through so many handlings in a safe or undamaged condition. Well, some do make it; however, let us list the conditions of possible damage or contamination.

1. Rough walls in rail cars.
2. Rail cars may leak water.
3. Rail cars may contain chemicals that contaminate the product.
4. Nails, splinters and sharp edges on wooden pallets each time pallets are used and each time pallet loads are stacked one on top of another.
5. Puncture of bags by the metal prongs on a fork-lift unit.
6. Bags scraping sharp objects while being moved by the fork-lift vehicles.
7. Rough or sharp objects on the ship.
8. Water damage on the ship; rain, sea water or the ship's plumbing.
9. Contamination by chemicals stored in the same hold on the ship.
10. Rain during the loading and unloading.
11. Rough bed on trucks used to haul the product.
12. Water damage during the movement by truck (this did occur in the research shipment to Colombia).
13. Damage in warehouses caused by sharp objects, water or chemicals.
14. At all points during storage and conveying there is always the threat of damage by birds, rodents or other animals and of penetration of the packages by insects.

When we look at all of those potential problems it is no wonder that some food does deteriorate or does receive severe damage. However, those conditions have not been pointed out to indicate it is a hopeless problem; but, instead, to indicate where it is felt that additional understanding and attention may be required.

Lecture #9 • Visual Aids

TYPICAL MOVEMENT OF COMMODITIES IN OVERSEAS PROGRAMS

TMC-1	Map of route of travel—Colombia test shipment
TMC-2	Number and types of handling (chart)
TMC-3	Placing empty bag on packer
TMC-4	Filled and closed bags
TMC-5	Belt conveyor from packer to rail car
TMC-6	Loading into rail car
TMC-7	Arrival at U.S. port warehouse
TMC-8	Unloading from rail car at U.S. port
TMC-9	Storage in port warehouse (U.S.)
TMC-10	Storage in port warehouse (U.S.)
TMC-11	Ship—Gulf Banker
TMC-12	Loading into ship at U.S. port
TMC-13	Starting to place bags on pallet in ship's hold
TMC-14	Pallet load ready for hoisting
TMC-15	Pallet load being lowered from the boat
TMC-16	Loading into barge
TMC-17	Truck movement
TMC-18	Loading truck—port warehouse
TMC-19	Storage in port warehouse (India)
TMC-20	Storage in port warehouse (Manila)
TMC-21	Transport of bags on cart
TMC-22	Cart arriving at use-point

Lecture #10

WAREHOUSE CONSTRUCTION AS IT RELATES TO SANITATION

Sanitation can be a relatively simple matter in new warehouses that have been designed and constructed with this in mind. Unfortunately, most of the storage of food is in structures that do not lend themselves to simplified control of vermin.

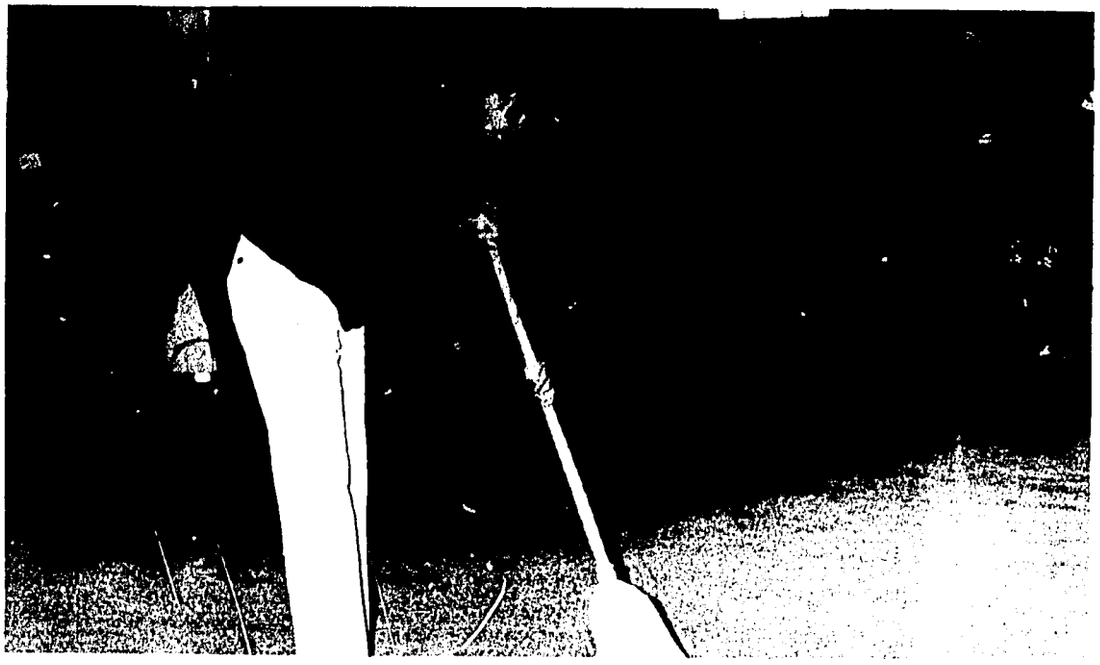
What are the ideal conditions to be considered in the design of a warehouse?

1. Adequate space for the intended use
2. Protection from rain and surface water
3. Good ventilation
4. Good lighting, either by artificial means or by windows
5. Windows that prevent the entry of vermin
6. Doors that fit closely enough to prevent the entry of rodents, birds and other vermin
7. No holes in the outer walls that would permit the entry of vermin
8. Cement floors
9. Windows, doors and ventilators that can be closed tightly for fumigation

Sounds like a warehouse manager's dream, doesn't it? There are structures that meet those conditions in a number of countries. I recall visiting two such warehouses in a country not too far from here. No insects or rodents were noted in those two warehouses and no damaged product was around. They followed the five recommendations of good warehousing practices.

Now what can you do with structures that do not meet all of the requirements? The objective should be to avoid any conditions that permit the entry of vermin, rain or surface water and to have surfaces that can be cleaned. Accumulations of equipment and supplies that are no longer needed should be removed from a food storage building. The yard area immediately surrounding the building should be free of conditions that would be attractive to vermin or would offer food or shelter to vermin.

No doubt those comments seem idealistic but they do make sense. If you can prevent a problem, then you do not have the expense of corrective measures or the losses that go with contamination and product deterioration.



Don Wilbur shown demonstrating the proper techniques involved in good warehousing.

To stop rodents from entering a building, the openings must not be larger than ¼-inch for mice or ½-inch for rats. It isn't easy to get a door to close that tightly or to provide a screen of that small an opening. The ¼-inch opening will not be of value in preventing the entry of insects. Small mesh wire is required to keep out insects and even then it may not be completely successful. Cleanliness and stock rotation, along with the use of pesticides, have proven to be the most successful program.

Birds do not usually present a problem in warehouses, however, we have encountered unusual conditions and there has been severe damage. This is especially true where there is whole grain. Wire that would keep rodents out would also keep out birds. There is an important health hazard in that birds do carry Salmonella and if they nest or roost in the area of food handling or storage, they may cause contamination. With that in mind, it is desirable to keep them out of a warehouse even if they do not damage the food.

Water can cause a rapid loss of food quality. This could result from exposure of the product to excessive humidity, from rain or from surface run-off. Many of the foods stored in warehouses are either grain or contain some cereal products and when these are exposed to moisture, they will become moldy. The mold in itself may cause product loss but one must not overlook the potential health hazard caused by mycotoxins. Mycotoxins may develop when Aspergillus molds are, or have been, present.

It is most unfortunate that there are usually budgetary problems associated with construction. The most usable space is required for the least expenditure of money. This is a problem in most construction. The holding-down costs usually results in the cutting of corners and the preventive measures that could be a part of the original structure are omitted. The result is usually an expensive and continual program of cleaning and pesticide application or of losses of commodities. Such calculations should be considered carefully whenever new construction or renovation is considered.

Lecture #10 • Visual Aids

WAREHOUSE CONSTRUCTION AS IT RELATES TO SANITATION

WCS-1	Title Slide—"Built-in Sanitation" (Danville, Ill.)
WCS-2	Panama, Internal—Well designed
WCS-3	Barranquilla, Internal—Faulty roof design
WCS-4	Barranquilla, External—Well designed
WCS-5	Barranquilla, Internal—Well designed
WCS-6	Barranquilla, External—Close-up of wall damage
WCS-7	Bucaramanga, External—Note problem areas
WCS-8	Bucaramanga, Internal—Note problem areas
WCS-9	Santa Domingo, External—Well designed
WCS-10	Santa Domingo, External—Close-up of problem areas
WCS-11	Santa Domingo, External—Attempted correction
WCS-12	India, External—Note problem areas
WCS-13	Malabon, Internal—Good storage design

Lecture #11

INSPECTION OF A WAREHOUSE

The ability to inspect and to accurately interpret the observations is a very important part of quality assurance. Inspection is of little value without follow-up corrective and preventive measures. We have already discussed the importance of insects, the use of pesticides and the design of buildings. That information is necessary in order to inspect and to recommend the correct follow-up. The frequency and the thoroughness of an inspection should be determined by the conditions that are present. It is an unusual situation that does not require at least one inspection every 30 days.

How does one establish an inspection procedure and what are the requirements?

A. A prerequisite is a knowledge of the problems that may be encountered. That is the reason this important subject has been placed last on the agenda.

B. The property to be inspected should be divided into several areas such as:
a. Yard area surrounding the building(s)
b. The building or buildings
c. Products stored within the building(s)

C. Each inspection area should be examined with the following considerations:
a. In the yard area surrounding the building, the following conditions should be noted:
1. Are rodents present?
2. Are there refuse or other conditions serving as an attractant or breeding area for insects?
b. The actual building should be examined for:
1. Openings that permit the entry of birds—are they screened?
2. Openings that permit the entry of rodents—are they screened?
3. Does the roof leak? If so, have the products been adequately protected so they do not get wet?
4. Can rain contact the products because of open windows or doors?
5. Does surface water get into the building? If so, have the products been stored on pallets or in such a manner so as to keep them dry?
c. Products within the building:
1. Are the products stored in an orderly manner?
2. Is there space between piles allowing sufficient room for inspection and cleaning?
3. Is there space between piles and walls or partitions?
4. Is there refuse stored in the same building?
5. Are the floors, walls and beams free of accumulations of food that would attract insects and rodents?
6. Are the products stored off the floor, such as on pallets?
7. Is the exterior of the packages of products clean?
8. After moving a few bags, is it free of insects or products between the bags?
9. Is there evidence of insect activity?
10. Is there evidence of rodent activity?
11. Is there evidence of bird activity?
12. Is there mold on the outside of any packages of food?
13. Have damaged bags been separated from undamaged bags?
14. Is there a program for rapid disposition of damaged or out-of-condition products?
15. Are insecticide sprays or fogs used? If so, are the results satisfactory?
16. Is there a program for the fumigation of insect-infested products? If so, does it appear to be successful?
17. Is there a program of stock rotation such as first in-first out?

The foregoing questions will not cover every situation and some may be deleted and others added to fit certain conditions.

Requirements other than a knowledge of the problems that could be present, and the corrective measures to use, would include a flashlight and sharp object, such as a knife. The light permits the inspection of dark areas and the knife is used to probe into cracks, etc.

Rodents and insects prefer to live and feed in areas of subdued lighting. In cases of heavy rodent or insect populations, they may be observed during daylight hours out in the open. When this does occur, it usually indicates a very heavy population and product loss may have already occurred.

Frequent inspections are important and they should be considered as a requirement in any facility that stores food. Who should perform the inspection is not important, as long as he is qualified. The inspections should be on a pre-determined frequency, and there should be follow-up.

If the recommendations that have been submitted as a part of this seminar are followed, there should be little loss of products because of contamination or deterioration.

Lecture #11 • Visual Aids

INSPECTION OF A WAREHOUSE

WIS-1 Good Warehousing Practices
WIS-2 Inspect Warehouse on a Routine Basis
WIS-3 Outside Areas
WIS-4 Have a Pest "Build-Out" Program
WIS-5 Refuse and Pallets
WIS-6 Segregate Broken Packages From Good
WIS-7 Keep Product at Least 18" From The Wall
WIS-8 Keep Aisles Clean and Orderly
WIS-9 Have a Planned Insect Control Program
WIS-10 Have a Complete Rodent Control Program
WIS-11 Clean Empty Bags, Fumigate
WIS-12 First In, First Out, Stock Rotation (FIFO)
WIS-13 Title Slide
WIS-14 Inspection Tools
WIS-15 Sieve
WIS-16 Bagged Grain Stored Outside Under Rubberized Tarpaulins. The coverings served several purposes; protection from the sun, rain and birds and to confine the fumigants.
WIS-17 Close-up of Bags Stored Under Tarpaulin as Shown on Slide 16. Note there was a tarpaulin placed under the pile to reduce the loss of fumigants and to give some protection from surface moisture. The dark spots on the bags are dead insects. These may have been killed by the fumigants or by the heat that developed under the tarpaulins.
WIS-18 Rodent Trails in Grass Near a Warehouse
WIS-19 Pallet Storage Outside of a Warehouse
WIS-20 Equipment improperly stored outside of a warehouse
WIS-21 Rodent Burrow Under The Floor of a Warehouse
WIS-22 Young Rats Removed From a Nest Found Under a Board That was on the Ground Outside of a Warehouse
WIS-23 A Dock and Roll-Up Type Door
WIS-24 Inside View of the Door Shown on Slide 23. Actually the problem indicated here has no relationship to the type of door. The problem is the amount of space around the door that would not prevent the entry of rodents.
WIS-25 Rodent Entry Point in Cement Under a Door
WIS-26 A Neat and Orderly Warehouse. Note the bags have pallets between the floor and the bottom row of bags, the piles are well spaced allowing room for cleaning, inspecting and application of insecticides.
WIS-27 Neat and Orderly Storage
WIS-28 Records to Help "FIFO"
WIS-29 Inspection of Special Research Shipment
WIS-30 Inspection Under Bag and Along Gusset. Note there is insect webbing on the gusset near the top of this bag.
WIS-31 Oil Stain on Bag. This may indicate contamination by an undesirable material.
WIS-32 Insect Trails in Dust. This is a typical trail that would be made by the adult of the flour beetle *(Triboleum)*.

WIS-33 Insects Affected by Insecticide Residue. This also is the adult of the flour beetle but the very erratic pattern indicates that the insects were being paralyzed by the effects of the spray that was on the floor.

WIS-34 Inspection and Training

WIS-35 Disposition of Spoiled Products. It is important to dispose of out of condition foods quickly to avoid the contamination spreading to other products. Fumigation may be advisable to reduce the problem until disposition can be made.

WIS-36 Note Insect Penetrations Into This Bag

WIS-37 Spilled Product Around This Pile Indicates There is a Problem

WIS-38 Inspection of Bags Shown in Slide 37. Note the large number of beetles that were hiding between the bags. Rodent excreta pellets were also present.

WIS-39 Additional Damage. The holes in the bags were cut by the larvae of the Rice Moth.

WIS-40 Old Commodity That is Heavily Infested

WIS-41 Old Commodity Poorly Stacked and Heavily Infested by Insects. Dark spots on bags are beetles. Water was running along the floor and contaminating the bottom row of bags.

WIS-42 Product Spillage Caused by Rodent Damage to Bags. Also note webbing and beetles.

WIS-43 Rat Pellets on Floor of Warehouse. As a part of every inspection there should be attention paid to the presence of rodents. The excreta pellets are an easy to recognize sign.

WIS-44 Rodent Tracks in Dust on Warehouse Floor. Both mice and rats were present here.

WIS-45 Rodent Control Devices Should be Inspected. This is to determine if there has been rodent activity and if the baits are in good condition.

WIS-46 Damaged Bait Station. This should be repaired and cleaned or disposed of.

WIS-47 Ketch-All Traps Should be Inspected. This trap will not work as a small rodent is wedged in the moving parts.

WIS-48 Sifting of Product Indicates Possible Problems

WIS-49 Obvious Evidence of Rodent Activity. The dark line is a milliped.

WIS-50 Obvious Evidence of Rodent Damage to the Packages

WIS-51 Birds Leave Evidence of Their Presence. Birds will damage bags, contaminate food and cause illness.

WIS-52 Dirty Pallets. The webbing indicates that insects have been or are on the pallets.

WIS-53 Cleaning Pallets. It is a good practice to wash or sweep pallets. Spraying with an approved insecticide can also be helpful.

WAREHOUSE INSPECTION FOR SANITATION

Yard Area Surrounding The Warehouse

1. Are rodents present? ____ (look for pellets, tracks, burrows, holes, signs of feeding)
2. Are there refuse or other conditions serving as an attractant or breeding area for insects? ____ (spilled cereals or grains, birds nests, weeds, trash, piled pallets or damage)

Warehouses

1. Are there openings (windows, ventilators, open eaves, etc) that permit the entry of birds? ____ Are they screened? ____
2. Are there openings that permit the entry of rodents? ____ Are they screened? ____
3. Are traps or rodent bait stations in use? ____ Are the rodent control devices being used properly? ____ (cleaned and serviced regularly; properly located; correct bait?)
4. Does the roof leak? ____ If so, have the products been adequately protected so they do not get wet? ____
5. Can rain contact the products because of open windows or doors? ____
6. Does surface water get into the building? ____ If so, have the products been stored on pallets or in such a manner so as to keep them dry? ____

Products

1. Are the products stored in an orderly manner? ____
2. Is there space adequate between stacks for inspection and cleaning? ____
3. Is there adequate space between stacks and walls or partitions? ____
4. Is there refuse or other infested materials stored in the same building? ____
5. Are the floors, walls, and beams free of accumulations of food that would attract insects, rodents, or birds? ____
6. Are the products stored off the floor, such as on pallets, racks or bamboo mats? ____
7. Is the exterior of the packages or products clean? ____
8. Are there insects or spilled products between the stacked bags?
9. Is there evidence of activity by insects ____. rodents ____ birds ____?
10. Is there mold on the outside of any packages of food? ____
11. Have damaged bags been separated from undamaged bags? ____
12. Is there a program for removal and rapid disposition of damaged or out-of-condition products? ____
13. Are insecticide sprays or fogs used? ____Is someone responsible for checking for effectiveness? ____ If so, are the results satisfactory? ____
14. Is there a program for the fumigation of insect-infested products? ____ If so, does it appear to be successful? ____
15. Are adequate records kept for a program of stock rotation such as first in-first out? ____

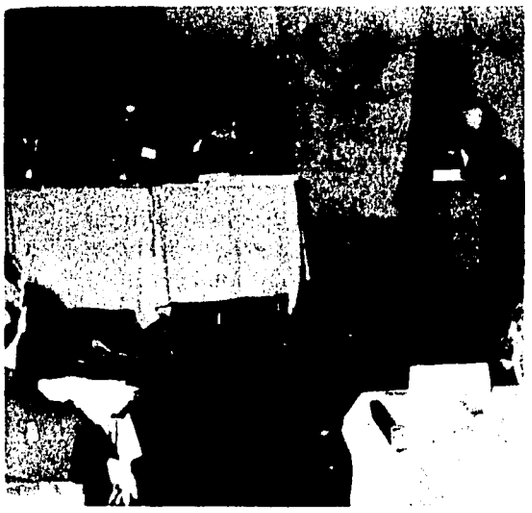
CLAIMS PROCEDURES

Mr. Dave Bell, Agricultural Stabilization and Conservation Services, Prairie Village Commodity Office (USDA) gave a presentation on filing claims.

Mr. Bell reviewed the instructions to Voluntary Agencies and Intergovernmental Organizations covering the control, filing, pursuit, adjudication and collection of marine claims arising from shipments of Title II PI. 480 commodities.

On Nov. 1, 1976 the AID Title II Public Law Regulations were amended. Some of the changes in these regulations are applicable to various aspects of ocean carrier cargo loss and damage claims. The revised instructions, together with a covering letter from Director, Prairie Village ASCS Commodity Office were sent to all agencies. The instructions are, for the first time, divided into two sections: (1) Headquarters Section for United States personnel and (2) Field (or Mission) Section for overseas personnel. The new instructions contain more narrative and elaborates on many more aspects concerning documentation of marine claims than in the past. The importance of obtaining the prescribed documentation on a timely basis was stressed. All changes to the instructions affecting claims were reviewed as to clarity.

Mr. Dave Bell, Agricultural Stabilization and Conservation Services, Prairie Village Commodity Office (USDA) gave a presentation on claims. His presentation included hand-outs.



The staff shown during the question and answer session at the end of the seminar program and course outline.

A short question-and-answer session followed this presentation.

The hand-out materials on claims included the revised instructions with covering letter, a copy of Regulation 11, and samples of submitted claims.

The Commodity Status and Recipient Status reporting requirement was reviewed briefly by Joan C. Johnson, FFP/W Seminar Project Manager. This is a reporting requirement for all voluntary agencies and government to government programs in which PL 480 Title II commodities are distributed.

Mr. James G. Schlick, Commodity Specialist, Agricultural Stabilization and Conservation Services (USDA) is shown giving his presentation on U.S. D.A. commodity procurement process.

Joan C. Johnson, FFP/W Seminar Project Manager during presentation on the Commodity Status/ Recipient Status reporting requirement.

EGYPTIAN STORAGE PROCEDURES

Mr. Hussein Mahamoud Hussein, Director of The Inter-Ministerial Committee for Foreign Voluntary Aid-Egypt. Mr. Hussein described briefly Egypt's storage facilities, transportation and distribution systems.

SUDAN STORAGE PROCEDURES

Mr. Abdel Rahim Khogali, Asst. Manager, WFP School Feeding Program, Government of Sudan, presenting paper on Sudan.

Sudan, the largest country just in the heart of Africa, has an estimated population of 16 million. Sudan covers about 2.5 million square kilometers of land and has a wide range of soil, and climatic conditions varying from the desert in the North to the tropical rainfall area in the South. Sudan's population is largely dependent on agriculture and livestock.

The UN/FAO World Food Program provides food aid as part of an agreement with the Government of Sudan. Mr. Khogali went on to explain and outline how the food given is transported and monitored through the joint agreement between the Government of Sudan and WFP. He listed the terms of this agreement which included port handling, commodity storage, infestation, warehouse sanitation, and periodic inspections. He outlined well-planned storage and handling procedures implemented in the school feeding program in Sudan.

ZAMBIA FOOD STORAGE AND HANDLING

Mr. William F. Mantanyani, Manager, Grains and Fibres Division, National Agricultural Marketing Board of Zambia, gave a presentation on food storage and handling in Zambia.

The Republic of Zambia lies in the Southern portion of Central Africa and derives its name from the Zambezi River which rises in the North-Western corner of the country. It is a large country and is entirely landlocked. Its population is approximately 4.5 million.

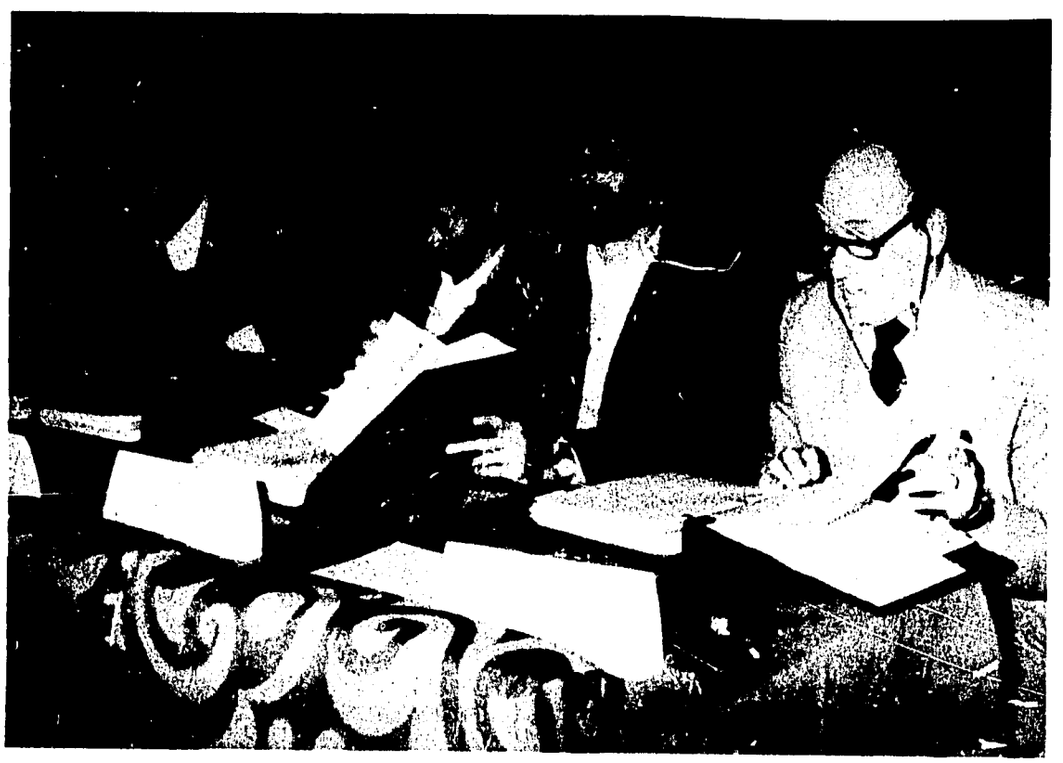
Agriculture, as a business as opposed to subsistence agriculture, is now expanding. The main crops grown in Zambia are Maize, Tobacco, Sugar, Groundnuts and Cotton. Poultry farming has grown into a sizeable industry. The Agricultural industry is second only to Copper mining in importance in the National economy. Increased production of both crops and livestock is already being undertaken through State projects and farm cooperatives.

The nation's requirement of Maize, the staple diet, is increasing annually and is currently 5.5 million bags. Maize is planted in Zambia normally during the period between October and November and harvested between June and August. The harvested maize is offered by the farmers to the National Agricultural Marketing Board (NAMBOARD) after it has been dried down to a moisture content of 12.5%. NAMBOARD provides facilities for the immediate delivery of the crop at depots located in major rural depots and along the rail-line.

At present NAMBOARD uses four (4) types of storages as follows: (1) Silos, some of which were built in the early fifties, (2) covered sheds, (3) hardstandings covered with tarpaulins, and (4) temporary stacks. Mr. Mantanyani described in detail each of these type storage facilities, stressing, when applicable, any insect problems experienced and the corrective action taken. He mentioned that Zambia has six reinforced concrete silos, the most recent three built in 1974. He reviewed their storage capacity and capabilities.

Zambia's distribution and transportation for both bagged and bulk grain was described, from the storage area to the mills and areas of consumption.

Mr. Mantanyani concluded his presentation by saying that it is the future policy of NAMBOARD to handle the stored maize in bulk. He cited the advantages to be gained from the bulk storage over that of bag storage.



Participants reviewing training handbooks during seminar sessions in Alexandria.

CLOSING CEREMONIES

Peggy Sheehan is shown here awarding a certificate to one of the seminar participants during the closing ceremonies.

The closing ceremonies included the distribution of seminar certificates to the participants.

Acknowledgements were made to all those who worked many hours during the seminar to ensure its success. The Office Staff, Technical Staff and those responsible for coordinating the many details of this seminar were applauded.

Training kits consisting of the lecture series with accompanying slides and a 16mm film were presented to representatives from participant countries and agencies. These training materials are to be loaned to in-country agencies for use in their country training programs on food storage and handling.

Closing remarks were made by Mr. Hussein Mahamoud Hussein, Director of The Inter-Ministerial Committee (IMC) for Foreign Voluntary Aid.

DISTRIBUTION OF TRAINING KITS

Rome: World Food Headquarters
Egypt: USAID/Mission CARE/CRS
Lesotho: D. Brown
Rwanda: Richard Adams
Zambia: W. Mantanyani
Ivory Coast: E. Moore—USAID
Ethiopia: P. Strong—USAID
Sudan: Robert Koepp—WFP
Tanzania: Jack Fazio—CRS
Somalia: F. Strippoli—WFP
Burundi: Philip G. O'Rourke
Zaire: Ian Pattinson—Office National Cereals
Botswana: Desmond Taylor—WFP
Malawi: P. O. Jones—WFP

ACKNOWLEDGEMENTS

The Office of Food for Peace, Washington, wishes to thank all of those who contributed toward the success of this seminar and cite in particular:

—The U.S. Mission for their support throughout the seminar.
—The U.S. A.I.D. Mission headed by Mr. Donald S. Brown for their pre-planning, logistical support and all-around assistance.
—The U.S. Information Agency, Alexandria for the loan of audio-visual equipment for use at the seminar.
—The Egyptian Inter-Ministerial Committee for Foreign Voluntary Aid for all their support during the seminar. This support by the Host Government Agency was vital to the success of this seminar.

SEMINAR HANDOUT MATERIALS

Avitrol
P.O. Box 45141
Tulsa, Oklahoma 74145 (USA)
Index: Birds

Bernz-O-Matic Corporation
Rochester, New York 14613 (USA)
Index: Safety

Chemagro
Mobay Chemical Corporation
P.O. Box 4913
Kansas City, Missouri 64120 (USA)
Index: Insecticides

Ciba-Geigy Corporation
Agricultural Division
Greensboro, North Carolina 27409 (USA)
Index: Insecticides

Degesch
Postfach 2644
D6 Frankfurt AM Main 1 (Germany)
Index: Fumigation, Safety, Insecticides

Dow Chemical Company
Midland, Michigan 48640 (USA)
Index: Fumigation

Dragerwerk Ag Lubeck
P.O. Box 1339
D-2400 Lubeck 1
(Federal Republic of Germany)
Index: Safety

Food Machinery Corporation
Niagara Chemical Division
Middlepor, New Jersey 14105 (USA)
Index: Insecticides

Great Lakes Chemical Corporation
P.O. Box 2200
West Lafayette, Indiana 47906 (USA)
Index: Fumigation

H. D. Hudson Manufacturing Company
500 North Michigan Avenue
Chicago: Illinois 60611 (USA)
Index: Equipment

Imperial Chemical Industries Limited
Plant Protection Division
Fernhurst, Haslemere, Surrey (England)
Index: Insecticides

The Industrial Fumigant Company
923 State Line
Kansas City, Missouri 64101 (USA)
Index: Insecticides

Jersey Brand Products, Limited
Bower Perma-Guard
2875 Laurier Street
Montreal, Quebec (Canada)
Index: Insecticides

Kness Manufacturing Company, Incorporated
P.O. Box B 550
Albia, Iowa 52531 (USA)
Index: Rodents

Micro-Gen Equipment Corporation
8127 Vidor Avenue
San Antonio, Texas 78216 (USA)
Index: Insecticide, Equipment

Mine Safety Appliance Company
400 Penn Center Boulevard
Pittsburgh, Pennsylvania 15235 (USA)
Index: Safety

Phostoxin Sales Company
P.O. Box 469
Alhambra, California 91802 (USA)
Index: Fumigations

Prentiss Drug & Chemical Company, Inc.
363 Seventh Avenue
New York, New York 10001 (USA)
Index: Insecticides

Rid-A-Bird Incorporated
P.O. Box 22
Muscatine, Iowa 52761 (USA)
Index: Birds

Root-Lowell Corporation
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CRITIQUE

FOOD STORAGE PRACTICES SEMINAR
Alexandria, Egypt
January 17-21, 1977

Summary of Critiques prepared by participants at the Alexandria, Egypt Food Storage Seminar. Total number of Critiques submitted—61.

I. SUMMARY OF QUESTIONS:

1. The training aids (slides, film, notebook, etc.) were?
Excellent, 41; Good, 17; Adequate, 2; Inadequate, 1.

2. The physical facilities (meeting room, lighting, seating, hotel, etc.) were?
Excellent, 27; Good, 24; Adequate, 9; Inadequate, 1.

3. Administrative arrangements (hotel reservations, funding, etc.) were?
Excellent, 43; Good, 14; Adequate, 3; Inadequate, 1.

4. The lectures and demonstrations were:
Excellent, 33; Good, 23; Adequate, 5; Inadequate, 1.

In response to questions #5 and #6 a number of suggestions were received. Listed below are those most frequently cited on the critiques for the seminar:

5. Was the subject matter of the seminar adequate to meet your needs?
—Would like more information included on control of birds.
—Should include presentations on climatic storage conditions for tropical areas.
—Include information on construction of warehouses from locally available material found in poor countries.
—Include information on administration and management of warehousing.
—Include information on underground storage. The type usually found in Africa.
—Include information on physical and nutritional changes which occur as a result of infestation, contamination, etc.

6. Please give your suggestions for improving the seminar. Comments:
—Explore ways of extending the length of the seminar. There is a lack of time to cover all subjects, in depth.
—Desirable to include participants in the demonstrations:
—Break seminar down into smaller groups for demonstration purposes.
—Use of actual infested areas for demonstrations on fumigation.

7. Have you received adequate information for you to implement recommendations that have been presented?
The majority indicated yes to this question.

8. Has the information and recommendations been practical?
The majority indicated yes, although a few stated that some of the lectures may be too sophisticated for some of the participants.

In response to Question #9 on follow-up activities, FFP received 32 requests for seminar materials. Also received requests for extra copies of the Seemore warehouse posters.

In response to #10 the participants indicated that they would share the information and would conduct mini-seminars and spread the word.
As of May, 1977 FFP/W had been advised of five such in-country training seminars utilizing the materials from the Alexandria Food Storage seminar.

ANNEX A

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ANNEX B

FOOD STORAGE SEMINAR QUESTIONNAIRE

Circle the correct answer.

1. Most insects have:
   A. Three body divisions, 2 pairs of wings, 6 legs
   B. An inner skeleton
   C. Two body divisions, 2 pairs of wings, 8 legs
2. Most insects that attack stored products are:
   A. Larvae
   B. Moths or beetles
   C. Cockroaches
3. Beetles are distinguished by:
   A. Small rear wings
   B. Abdomen with 3 pairs of legs
   C. Hard front wings and membranous rear wings
4. Adult moths have:
   A. Scales on the wings
   B. Very small rear wings
   C. Feeding mouth parts
5. Flour beetles (*Tribolium* species) are:
   A. The largest stored-product beetle
   B. Red-brown in color
   C. Very rare
6. Lesser grain borers (*Rhyzopertha dominica*):
   A. Are common in candy
   B. Always live outside of the individual grain
   C. Are excellent penetrators
7. Cigarette beetles (*Lasioderma serricorne*):
   A. Cannot penetrate any package
   B. Are only found on stored tobacco
   C. Feed on many stored products
8. Sawtoothed grain beetles (*Oryzaephilus surinamensis*):
   A. Are "invading" insects
   B. Feed only on sawn teeth
   C. Are found only in Surinam
9. Fumigants are applied:
   A. To walls and floors
   B. As a surface treatment
   C. As a space treatment
10. Fumigants, at room temperature, are:
    A. Solids
    B. Gases
    C. Liquids
11. Roden bait stations should be cleaned and serviced:
    A. Infrequently
    B. Regularly
    C. When all the bait is gone
12. Methyl bromide is a:
    A. Fumigant
    B. Surface treatment
    C. Fogging treatment
13. Methyl bromide is:
    A. Heavier than air
    B. Odorless
    C. Both A and B
14. Phosphine:
    A. Weighs about the same as air
    B. Has a distinctive odor
    C. Both A and B
15. Phosphine is detected with a:
    A. Halide detector
    B. Auer tube
    C. Flame detector
16. When working with methyl bromide you should *always* wear:
    A. Gloves
    B. Face mask
    C. A smile
17. When using phosphine you should:
    A. *Never* stack a large quantity of pellets or tablets together
    B. Always wet the pellets or tablets with water
    C. Work alone, for safety
18. Methyl bromide is poisonous to:
    A. Insects only
    B. Rodents only
    C. Most living things

19. Warehouse pallets should:
    A. Not be used, to avoid insect and rodent harborage
    B. Be stacked against walls
    C. Always be used to get stored items off the floor

20. Insect contamination can be minimized by:
    A. Use of insect-resistant packages
    B. Avoiding movement of oldest stock, to prevent damages to packages
    C. Storing leaking bags in the warehouse, as attractive baits

21. Insects can enter:
    A. Tightly sewn cotton bags
    B. Woven polypropylene bags
    C. Both A and B

22. Insecticides can be classified as:
    A. Fumigants, residuals, contact sprays
    B. Fogs, space treatments
    C. Solids

23. Insecticides can be applied as:
    A. Fogs, sprays, dusts
    B. Liquids, dusts, fumigants
    C. Both A and B

24. Application by fogging is principally to kill:
    A. Hidden larvae
    B. Flying and exposed insects
    C. Insects hidden behind walls

25. Fogging may be considered a:
    A. Fumigation
    B. Surface treatment
    C. Space treatment

26. Spraying is principally to apply a:
    A. Fumigant treatment
    B. Residual treatment
    C. Fogging treatment

27. Rodent harborage can often be found:
    A. Inside the warehouse
    B. Outside the warehouse
    C. Both A and B

28. Anti-coagulant rodenticides:
    A. Kill immediately
    B. Take several days to kill
    C. Are the most dangerous rodenticides that are used

29. Rodents can enter an opening that is:
    A. 1/2 inch (1.25 cm.)
    B. 1 inch (2.5 cm.)
    C. 3 inches (7.5 cm.)

30. Insect-resistant packages must have:
    A. Insect-tight construction
    B. Insect-resistant treatment
    C. Both A and B

31. Penetrating insects can easily bore through:
    A. Paper, polyethylene, foil
    B. Tin cans, glass
    C. Insect-resistant-treated paper

32. Residual treatments kill insects that:
    A. Crawl on surfaces
    B. Move around inside bags
    C. Fly in the air

33. Dispose of phosphine residual ash by:
    A. Pouring ash and detergent in water
    B. Pouring on the ground
    C. Either A or B

34. Proper warehousing procedures include:
    A. Storing product away from walls
    B. Keeping the warehouse filled at all times
    C. Minimal use of insect control and sanitation procedures

35. Insect-resistant-treated bags are treated with:
    A. Nothing, but are insect tight
    B. Pyrethins plus piperonyl butoxide
    C. Pyrethrins plus piperonyl butoxide; therefore they do not have to be insect tight

36. The following is shipped in insect-resistant bags:
    A. CSB and cornmeal
    B. Wheat flour
    C. Bulgur and rice

37. Heavy infestations require the following as compared to light infestations:
    A. More fumigant
    B. Less fumigant
    C. The same quantity of fumigant

38. Fabric bags:
    A. Are easily infested
    B. Are difficult to infest
    C. Are never infested

39. One of the principal sources of reinfestation after fumigation is:
   A. Damaged bags or neglected, exposed stocks
   B. Insects brought in from the ships
   C. Insects escaping from other bags

40. Inspections are required:
   A. Only after treatment with an insecticide
   B. At regular, frequent intervals
   C. Only when insects or rodents are seen

CORRECT ANSWERS:

1.	A
2.	B
3.	C
4.	A
5.	B
6.	C
7.	C
8.	A
9.	C
10.	B
11.	B
12.	A
13.	C
14.	C
15.	B
16.	B
17.	A
18.	C
19.	C
20.	A
21.	C
22.	A
23.	C
24.	B
25.	C
26.	B
27.	C
28.	B
29.	A
30.	C
31.	A
32.	A
33.	A
34.	A
35.	B
36.	A
37.	C
38.	A
39.	A
40.	B

NUMBER OF CORRECT ANSWERS OUT OF 81 ALEXANDRIA QUESTIONNAIRES RECEIVED AND MARKED

1.	78
2.	41
3.	14
4.	35
5.	49
6.	64
7.	42
8.	58
9.	68
10.	63
11.	78
12.	74
13.	37
14.	51
15.	41
16.	68
17.	69
18.	70
19.	77
20.	65
21.	64
22.	74
23.	52
24.	61
25.	47
26.	52
27.	75
28.	58
29.	63
30.	59
31.	72
32.	74
33.	66
34.	66
35.	65
36.	50
37.	66
38.	62
39.	54
40.	78

ANNEX C

WAREHOUSE INSPECTION

YARD AREA SURROUNDING THE WAREHOUSE

1. Are Rodents present?_____ (Look for pellets, tracks, burrows, holes, signs of feeding)
2. Are there refuse or other conditions serving as an attractant or breeding area for insects?_____ (Spilled cereals or grains, birds nests, weeds, trash, piled pallets or damage)

WAREHOUSES

1. Are there openings (windows, ventilators, open eaves, etc.) that permit the entry of birds?_____ Are they screened?_____
2. Are there openings that permit the entry of rodents?_____ Are they screened?_____
3. Are traps or rodent bait stations in use?_____ Are the rodent control devises being used properly?_____ (Cleaned and Service regularly; properly located; correct bait?)
4. Does the roof leak?_____ If so, have the products been adequately protected so they do not get wet?
5. Can rain contact the products because of open windows or doors?_____
6. Does surface water get into the building?_____ If so, have the products been stored on pallets or in such a manner so as to keep them dry?_____

PRODUCTS

1. Are the products stored in an orderly manner?_____
2. Is there space adequate between stacks for inspection and cleaning?_____
3. Is there adequate space between stacks and walls or partitions?_____
4. Is there refuse or other infested materials stored in the same building?_____
5. Are the floors, walls and beams free of accumulations of food that would attract insects, rodents or birds?_____
6. Are the products stored off the floor, such as an pallets, racks or bamboo mats?_____
7. Is the exterior of the packages or products clean?_____
8. Are there insects or spilled products between the stacked bags?_____
9. Is there evidence of activity by insects_____ rodents_____ birds_____?
10. Is there mold on the outside of any packages of food?_____
11. Have damaged bags been separated from undamaged bags?_____
12. Is there a program for removal and rapid disposition of damaged or out-of-condition products?_____
13. Are insecticide sprays or fogs used?_____ Is someone responsible for checking for effectiveness?_____ If so, are the results satisfactory?_____
14. Is there a program for the fumigation of insect-infested products?_____ If so, does it appear to be successful?_____
15. Are adequate records kept for a program of stock rotation such as first in—first out?_____

ANNEX D

SEMINAR ORGANIZATION/PRE-PLANNING

Administrative Checklist

For those who are thinking of preparing a mini-seminar on food storage and handling, the checklist we used for our preparations might be of use.

1. Questionnaires mailed 60 days in advance.
2. Funding secured to cover costs of seminar
3. *Facilities*
   a. Hotel Accommodations for all attending seminar
   b. Meeting Room
      (1) Adequate size
      (2) Location
      (3) Availability on required dates
   c. On-Site Facilities
      (Request only routine sanitation practices be employed prior to seminar.)
      (1) Adequate size to accommodate attendees
      (2) Location (name and address)
      (3) Availability on required dates
      (4) Commodities on hand—Grain and cereal products
         (a) in multi-wall bags
         (b) in cotton or jute bags
         (c) in woven polypropylene bags
4. *Services*
   a. Transportation for Staff, Attendees and Guides, from Quarters to sessions and return
   b. Refreshments
      (1) Coffee breaks
      (2) Lunches
      (3) Hospitality and/or dinner
5. *Personnel* (Other than staff and Guests)
   a. Translators
   b. Local pest control operator (if desired)
   c. Secretarial services with duplication equipment
6. *Equipment*
   a. Mailing of equipment and supplies from U.S.
   b. Meeting room
      Public address system
      Translation equipment to be used by interpreters
      Audio-visual equipment
      —16mm movie projector—sound
      —Super-8mm movie projector—sound preferred
      —35mm slide projector with remote control
      —Screen—6 foot preferred
      Blackboard
      Easel with paper—black felt-tipped pens
   c. *Warehouse*
      Portable public address system
      2 tarpaulins for fumigation, 40 feet by 80
      2 tarpaulins for fumigation, 40 feet by 80, preferred 5 mil polyethylene minimum or gas-tight vinyl-covered canvas
      Phosphine—pellets or tablets
      Methyl bromide—cans
      Jiffy applicator with 10-foot plastic tube for methyl bromide cans
      Sand snakes (4 or 6 inch canvas tubing) to hold down edges of tarpaulin
      Hand sprayer, 2 or 3 gallon capacity
      Fog device, any model that is available, ultra-low-volume (ULV) preferred. Insecticide (spray), residual or contact, formulation permissible for use in country
      2 full face gas masks with 2 canisters for methyl bromide and 2 for phosphine
      Halide detector for detection of methyl bromide—with 20-foot plastic tubing
      Auer (or similar) detector with tubes for phosphine—with 20-foot plastic tubing
      10 fumigation warning signs as may be required in country.

ANNEX E

SEMINAR FOLLOW-UP REQUESTS

FFP/W received 32 follow-up requests for copies of the lecture series. These requests have been filled as per the lecture number indicated and the language preference desired. The lecture series has been translated into French and Spanish. FFP/W is now responding to requests from participants who attended the earlier three seminars for copies of the lecture series. The accompanying slides and film are at a premium and requests will be filled based on availability of supply.

The warehouse posters included as an insert in the training manual handbook are now available in French, Spanish and Arabic, as well as English. A limited number can be obtained upon request.

All requests for above materials should be directed to Peggy A. Sheehan, Food for Peace, Agency for International Development, Washington, D.C. 20523.

ANNEX E

SEMINAR IN
FOOD STORAGE AND HANDLING PRACTICES
Alexandria, Egypt
January 17-21, 1977

Request for follow-up assistance

Please fill in the following:

Name:_____

Mailing Address:_____

_____

Please place in X in the left column where follow-up material is requested. Also list language or languages of preference. Lecture 2 through 11 includes lecture notes and slides. Slides are 35 mm. size. The number of slides with each lecture is listed in brackets.

Request	Lecture Number	Title	Language
____	(1)	How to Extend the World's Available Food Supply Through Improved Packaging, Storage and Handling (16mm silent film, 29 minutes)	____
____	(2)	Quality Assurance Programs in the United States (30)	____
____	(3)	Fumigation Procedures (25) 16mm Movie with sound on Phostoxin (may be available on a loan basis)	____
____	(4)	Rodent Control (51)	____
____	(5)	Insect Pests of Processed Cereals and Bagged Grain (45)	____
____	(6)	Application of Insecticide Sprays and Fogs (39)	____
____	(7)	Types of Damage to Packaged Food Commodities (39)	____
____	(8)	Protection of Packaged Commodities from Insects (26)	____
____	(9)	Typical Movement of Commodities in Overseas Programs (22)	____
____	(10)	Warehouse Construction as it Relates to Sanitation (13)	____
____	(11)	Inspection of a Warehouse (53)	____

Mail this form to: Ms. Peggy A. Sheehan
Chief, Program Operations Division
Office of Food for Peace
Room 523 PP
Agency for International Development
Washington, D.C. 20523 U.S.A.