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Village Technology Handbook

SECTION 4: FOOD PROCESSING AND PRESERVATION

FOREWORD

Progress is the result of man's mastery of the world he lives in. The VILLAGE TECHNOLOGY HANDBOOK is aimed at helping villagers to master the resources available to them: to improve their own lives and to bring their villages more fully into the lives of the nations of which they form a basic and important part.

Village development takes on special importance in the light of the fact that 80 percent of those who live in less-developed countries live in villages. If progress is to come to nations, progress must come to villages.

Technical information is a basic factor in progress, along with other basic factors: political, social and economic. The VILLAGE TECHNOLOGY HANDBOOK was conceived by VITA Volunteers in 1962 as a means of bridging the "technical information gap" which keeps the world's villages from learning from one another's experience. The book's aim is to gather in one publication information from many sources which has been found helpful in villages.

This handbook was first published by the U.S. Agency for International Development in two volumes in 1963 and 1964. In the 1970 edition, the two earlier volumes are integrated into one book, the editing has been made more uniform, some new information has been added and the illustrations have been improved. The entire handbook has been checked for accuracy by VITA Volunteer specialists. A new feature in this edition is the incorporation of information on other publications which cover in detail subjects which are discussed only briefly here. VITA plans to continue to improve the handbook in future editions to make it increasingly effective as a key to existing technology for village workers.

The information in the handbook has come from many sources. VITA hopes that criticism and new information will come from many of the same sources--and from other sources. The questionnaire on page ix was designed to stimulate this flow of criticism and information. VITA will test new information and then disseminate it to those who need it.

VITA is grateful to the U.S. Agency for International Development for its financial support of the revision and for its help in reviewing the contents. Thanks are also due to the Federal Extension Service, U.S. Department of Agriculture, for its help in reviewing the section on "Home Improvement".

A NOTE ON USING THE HANDBOOK

This handbook describes techniques and devices which can be made and used in villages. Hopefully the book will generate new ideas as well as pass on information which has already been tried.

Some of the practices suggested here can be adopted on an individual basis. Others, however, will require cooperation by many people and, perhaps, by government agencies. In many cases, it

would be well to seek out extension services existing in your area. If local government or university extension services are available, they will be able to give you information well suited to local conditions. In some cases, there may be a need for a credit union or a consumer, marketing, housing or service cooperative. Information on credit unions is available from:

CUNA International, Inc.
World Extension Department
Box 431
Madison, Wisconsin 53701
U.S.A.

Information on cooperatives is available from:

Agricultural Cooperative Development International
Suite 1200
1430 K St., N.W.
Washington, D.C. 20005
U.S.A.

When the materials suggested in the handbook are not available, it may be possible to substitute other materials; but be careful to make any changes in dimensions made necessary by such substitutions.

Dimensions are given in metric units in the text, with English units in parentheses. Only metric units are given in the illustrations. Conversion tables are given in the Appendix.

Reference materials, along with information on where they can be obtained, are listed at the end of a specific entry when they pertain to that entry. When they refer more generally to the field covered in a section of the book, they are given at the end of the section. If you cannot get these publications, VITA may be able to help you.

If you want to use translations of material in the handbook, we ask you to let VITA know. The material you want may already be translated; if it is not, and if you translate it, VITA would like to make your translation available to others.

If you have questions on the material presented here, if you run into problems in implementing the handbook's suggestions, or if you have other technical problems, do not hesitate to ask for the personal help of a VITA Volunteer specialist. Write to:

VITA
3706 Rhode Island Avenue
Mt. Rainier, Md. 20822
U.S.A.

VITA's Volunteer Translation Service can translate letters in languages other than English, but correspondence moves much more quickly when carried on entirely in English. To help VITA Volunteers find a useful solution to your problem as quickly as possible, you should:

1. Be quantitative--give measurements, sketches or, when possible, photos.

2. Explain what materials are available and what limitations there are on cost.

3. Describe the best solution, if any, found so far in the area.

4. Explain any pertinent social or cultural conditions.

5. Indicate a deadline for action, especially if immediate attention is needed.

6. Don't expect miracles on the first reply. Successful problem-solving often takes a number of letters back and forth.

WHAT IS VITA?

VITA (Volunteers in Technical Assistance) was established in 1959 as a private, non-profit organization responding to requests for assistance in economic and social development. VITA mobilizes and coordinates the work of over 7,000 volunteer professionals representing 96 countries, 2000 corporations, universities, and other institutions. The VITA talent bank represents know-how in commerce and industry, agriculture and education, engineering and public health, in addition to many other fields.

VITA provides the most appropriate knowledge to specific calls for assistance from individuals, organizations, small businesses and self-help development groups. In its brief history VITA has responded to over 25,000 requests. VITA meets people's needs through the mail, by telephone, and by on-site counselling. Requests have come from village councils, community development volunteers, farmers, small business owners, and from members of national and international public and private institutions. VITA's unique method matches people with need and people with knowledge to give. This partnership increases the opportunity for the success of the requester's project.

One of the most effective ways that VITA shares its information with many people in through its Publications Program. The VILLAGE TECHNOLOGY HANDBOOK has played an important role in helping to disseminate that information. Supplementing this book is VITA's Technology Manual series, how-to-do-it booklets, which cover a wide spectrum of subject matter. A publications list is available on request.

In its OVERSEAS LIAISON PROGRAM, VITA encourages the formation of similar technical assistance programs throughout the world. Cooperation with these and other organizations working in the developing countries will give VITA access to on-the-spot background information on the technological aspects of international development.

VITA is financed by contributions from private individuals, foundations and industry, and by government grants.

SYMBOLS AND ABBREVIATIONS USED IN THIS BOOK

@ . . . . at
" . . . . inch
' . . . . foot
C . . . . degrees Celsius (Centigrade)
cc . . . cubic centimeter
cm . . . centimeter
cm/sec . centimeters per second
d or dia. diameter
F . . . . degrees Fahrenheit
gm . . . gram
gpm . . . gallons per minute
HP . . . horsepower
kg . . . kilogram
km . . . kilometer
l . . . . liter
lpm . . . liters per minute
l/sec . . liters per second
m . . . . meter
ml . . . milliliters
mm . . . millimeters
m/m . . . meters per minute
m/sec . . meters per second
ppm . . . parts per million
R . . . . radius

QUESTIONNAIRE

NOTE TO THE READER: VITA's publications are compiled by VITA Volunteers because they want to help people in developing areas. With your field experience, you are in a unique position of being able to increase the usefulness of this work by sharing what you have learned with the people who will use the publications in the future. You are strongly urged to complete the following questionnaire (using additional sheets if necessary), cut it out and send it to:

VITA
3706 Rhode Island Avenue
Mt. Rainier, Md. 20822
U.S.A.

Date _____

Name _____ Agency _____

Address _____

_____

1. Which items from the VILLAGE TECHNOLOGY HANDBOOK have you put into practice?

2. Have results been good or otherwise?

3. Have you made improvements or modifications in any of the devices or techniques? If so, please describe them, including photographs or sketches if possible.

4. Have you devised any new equipment or techniques not described in the handbook which may be of use to others? If so, please describe them.

5. Did you find the handbook useful, too simple, too complex, incomplete?

6. Other comments and suggestions:

TABLE OF CONTENTS

Storing Food at Home

You work hard when you grow food and prepare it to eat. If you buy food it takes money. You do not want to waste it. To keep food clean and safe in the home you must have good storage space, suitable containers and a way to keep foods cool and dry.

IMPORTANT

Only water which is pure enough to drink should be used for washing or cooking food. If the purity of water is in doubt, it should be boiled for 10 minutes or disinfected.

***

HOW TO CARE FOR VARIOUS KINDS OF FOOD

Different kinds of food need special care. Treating each food properly will make it keep longer.

Dairy Foods

Fresh milk is safe if it is boiled. If you do not have refrigeration, boiled milk will keep longer than milk that has been pasteurized. Cream will keep longer if it is boiled.

After milk and cream are boiled, then cooled, store them in clean containers in a cool place. In warm climates these foods will keep longer if stored in an iceless or mechanical refrigerator.

If canned, evaporated, condensed or dried milk is used, add water and boil for 10 minutes. Unsafe milk should not be added to hot or cold beverages.

Cooked foods using milk or cream spoil very quickly. Use them immediately in hot climates. Do not store.

Dried milk in its original containers will keep for several months in a cupboard or on open shelves. Close the container properly after using. The milk will take up moisture and become lumpy if exposed to air. Then it is hard to mix with water and food.

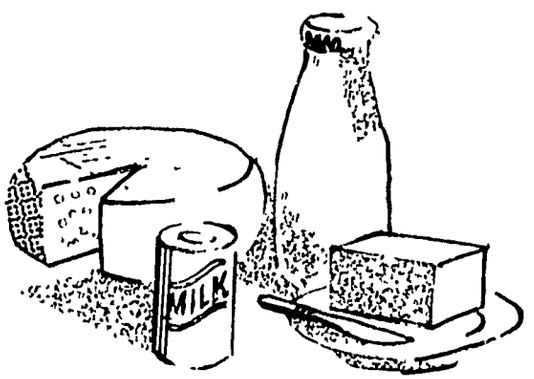


FIGURE 1

Canned evaporated milk and condensed milk may be stored at room temperature until opened. Before opening shake the can to avoid separation of the milk. After opening, cover tightly and store in an iceless or mechanical refrigerator if possible.

After dried milk has had safe water added to it, store it the same as fresh fluid milk.

Butter should be kept in a cool place, in a covered container.

Keep hard cheese in a cool place. Wrap tightly in a clean cloth or paper to keep out air. Put in a box or metal container if possible. Before using, trim away any mold that forms on the surface.

Soft cheeses should be stored in a tightly covered container in a cool place.

Fresh Meat, Fish, Poultry

The moist surfaces of dressed meats, poultry and fish attract bacteria that cause spoilage. Keep these foods clean, cold and dry. They should be allowed some air when stored. Wrap loosely with a clean cloth or paper. Wipe or scrape off any dirt before wrapping.

These foods spoil very quickly. They should not be kept long in warm, moist climates.

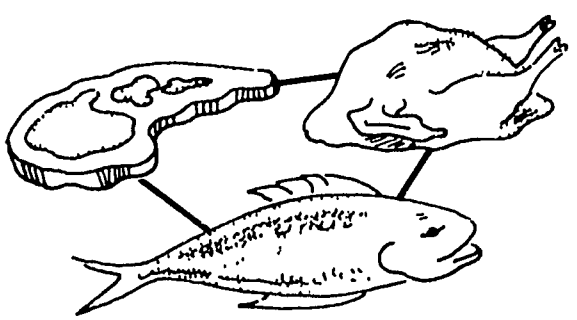


FIGURE 2

Rubbing cured or smoked meats with dry baking soda may help prevent molding. If meat is attacked by insects or shows spoilage, cut out the bad part.

Eggs

Sort eggs as soon as they are brought from the poultry yard or market. Cracked ones should be removed and cooked for immediate use. Spoiled eggs should be thrown away. Rough handling, changes in temperature, and fertility affect the keeping quality of eggs.

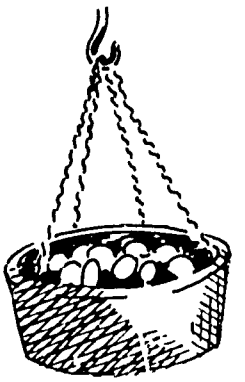


FIGURE 3

Keep eggs in a covered container in a cool, dry, clean place.

Wash all eggs in cooled boiled water just before using. Water removes the thin film on the shell which protects the egg. This film helps to stop evaporation, the entrance of harmful bacteria and the absorption of odors.

Fresh Fruits and Vegetables

Most fresh fruits and vegetables need to be kept clean and in a cool place with good air circulation. Such conditions help to prevent spoilage.

Sort fruits and vegetables before storing. Use bruised ones immediately, throw away decayed or spoiled ones. Ripe fruits and vegetables should be used in 2 or 3 days. Allow them to ripen in the open air out of the sun. Wash fruits and vegetables before using them.

Fruits and vegetables stored in boxes, baskets, barrels and bins should be sorted frequently to remove decayed or spoiled ones. Some fruits such as oranges and apples may be wrapped in separate papers. The wrappers help to keep the fruit from bruising each other and also help to avoid mold.

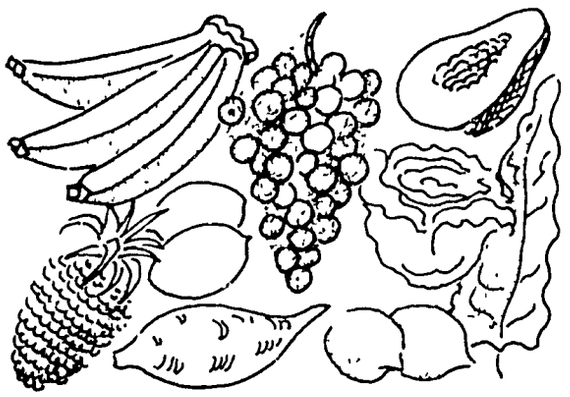


FIGURE 4

If possible, soft fruits such as berries, peaches, and plums should be spread out on clean wrapping paper or in shallow pans or platters rather than deep containers.

Fats and Oils

Keep all fats cool, covered and in lightproof containers. Heat, light and air help to make fats rancid.

Mold on the surface of fats shows moisture is present. Remove the mold carefully. If possible, heat the fat to drive off the moisture.

Foods like nuts and chocolate which have some fat may get rancid. Nuts keep best when left in shells. Keep these foods cool and clean, in light-proof containers.

Baked Goods

Cool bread, cakes, pies, cookies and other baked goods rapidly after they are taken from the oven. Be sure the place is free from dust and insects. Wrap bread with a clean cloth or paper.

Store baked goods in a clean tin box or other suitable container off the floor.

Molds grow on bread. Scald and air the bread box at least once a week. In hot humid weather do not shut the bread box tightly when it is filled with fresh bread.

Store bread, crackers, and crisp cookies in separate containers to retain crispness.

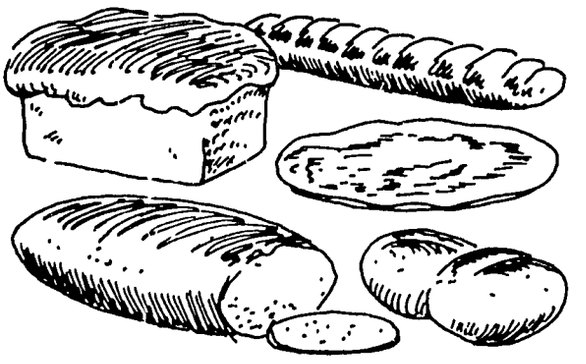


FIGURE 5

Dried Foods

Dried meats and dried fruits and vegetables may be kept in closely woven cloth bags. Hang these bags of food in a cool, dry place. If these dried foods are hung in a damp place they are likely to mold.

Open bags of dried foods should be kept in a pottery or metal container. Cover the container tightly to keep out insects and rodents.

Canned Goods

Canned foods should be kept in a clean, dry, cool place. Arrange so air may circulate around the cans. Canned vegetables and fruits may leak. Destroy any swelled or leaking cans. Clean off other cans left on the shelf. Wash the shelves with hot soapy water.

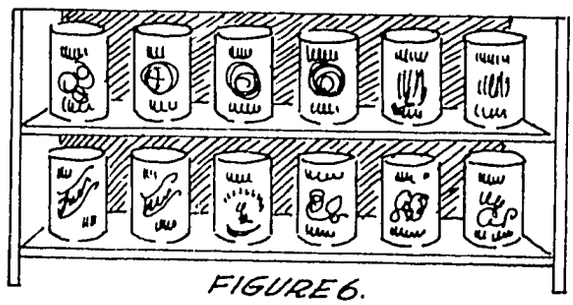


FIGURE 6.

Leftover Cooked Foods

Moist cooked foods, particularly those made with milk, eggs, meat or fish, spoil easily. Leftover cooked foods should be cooled quickly. Store in an iceless or mechanical refrigerator or a cool place. Use at the next meal.

Leftover cooked foods should be brought to a boil or thoroughly heated before being served again.

WHEN IS FOOD SPOILED?

Food generally shows when it is spoiled. Check it often. It may have an unpleasant appearance, taste or smell.

Look for these signs of food spoilage:

- slime on the surface of meats
- bad odors
- sour taste in bland foods

It is important to destroy spoiled foods as soon as they are found. Throw away any food that has a bad smell. Chopped meat, eggs, and sea food usually spoil rapidly. Watch grains for signs of weevils. Look for insects and mold in dried foods. Destroy the part which has insects or mold at once.

If any jars or cans of food are leaking or bulging, get rid of the food. It can make you sick.

WHY FOOD SPOILS

Foods may be spoiled by:

- bacteria and molds
- parasites of meat animals
- insects and rodents
- warm air, freezing temperatures and light
- too little or too much moisture

Dirt and careless handling increase food spoilage. Good care of food in the home can help avoid waste. Keep food in a clean and safe place.

Bacteria are living things so small you can't see them.

Many are harmful. They live almost everywhere. Sometimes food is made unsafe because bacteria causing disease have gotten into it. Food can carry these diseases:

- amoebic dysentery and other dysenteries
- typhoid
- botulism
- tuberculosis
- diptheria
- salmonellosis

People may appear healthy and still carry these disease bacteria in their bodies. When they handle food, the bacteria may be passed on to the food. Then the food is unsafe for others.

Bacteria in foods may be destroyed by:

- drying
- heating
- exposure to the sun
- removal of air
- chemical substances

Molds can be harmful. They grow where it is damp. Molds look like delicate velvety or powdery growths of various colors spread through food.

If meat or cheese have mold on the surface, cut away the moldy part. The food that is left may be eaten. Throw away moldy canned foods.

Parasites, such as tapeworm and trichina, live in meat animals. The tiny larvae of these parasites may be in the lean meat. They are waiting to complete their development in the human body or some other place.

Thorough cooking of meat is the best way to destroy these parasites. Preservatives such as salt and smoke do not destroy them. There is great danger in eating uncooked sausages even though they have been smoked.

Bacteria need water to live. Removing water prevents their growth. Foods are dried to preserve them. Then they are kept dry. Some foods that are dried are meat, fish, beans, peas, grapes, figs and currants. They are dried in the sun or smoked over a fire.

Cooking foods destroys many kinds of bacteria.

When foods are canned, air is removed and the container is sealed. This process removes air that many bacteria need to grow.

Many chemical substances either destroy certain harmful bacteria or prevent their growth. For food, two of the simplest to use are common salt and sugar. Salt is used for meat and vegetables. Sugar is used to preserve fruits.

Insects and Rodents may destroy foods. They may also leave dangerous bacteria on them.

The house fly may spread typhoid fever, cholera, dysentery and tuberculosis.

The "fly specks" often found on food or dishes may have disease germs and the eggs of dangerous parasites in them.

The rat destroys many types of food.

To help keep these pests out of food:

- keep it covered or in closed containers
- get rid of garbage and trash

Poisoned bait, powders, or sprays may be necessary to rid storage areas of household pests.

Ask your health department sanitation or other official to tell you what pesticide to use, where to get it and how to use it. These people have special training on how to control household pests. They want to help you.

Use pesticides with care. They are POISONOUS to people and animals. Keep them out of reach of children. Never store insecticides in the same place you store food. Always wash off any dust, spray, or solution that gets on you. When spraying remove dishes, pots and pans, other cooking utensils, and food from the room. If you have a cupboard with solid, tight fitting doors store the dishes and cooking equipment here while spraying. Never use oil spray or solutions near a fire.

Temperature affects food. Many fresh fruits ripen rapidly when left in a warm room. If they are left at room temperature too long after they are ripe they spoil. Nuts become rancid more quickly if left in a room where the air is warm.

Freezing temperatures can ruin the texture and flavor of some foods. Frozen potatoes are watery and have an unpleasant flavor.

Light makes fresh fruits and vegetables ripen faster. Some canned and dried foods keep their color longer in lightproof containers such as tin cans.

Moisture in the air is necessary where green leafy vegetables are stored. If there is not enough moisture in the air, the moisture from these vegetables will evaporate into the air. Then they become wilted or limp. These vegetables keep best when stored in an iceless or mechanical refrigerator.

Crackers and cookies lose their crispness by absorbing moisture from the air. They should be stored in a dry place where there is no moisture in the air.

CONTAINERS FOR FOOD

It is very important to have good containers for storing food. Some foods must be stored in containers with tight fitting covers. Generally each food is best stored in a separate container. Label food containers to save time and avoid mistakes.

Dry foods should be stored in glass, pottery, wooden, tin or other metal containers. The type of container will depend on the food to be stored and whether the container can be washed. Dry tin quickly to avoid rust.

For moist and watery foods the choice of containers is more limited. Leakage must be avoided. You must consider the effect acids in watery foods have on metals. A container that can be washed and aired before fresh supplies are stored in it is best.

Pottery jars are good for storing many kinds of food. Jars that are glazed on the inside are best. They can be washed easily. If the jars do not have a tight fitting cover, make one. Use a plate, saucer, or piece of metal. A good cover helps to keep out insects and rodents.

Glass jars with tight lids are also good for storing many foods. Foods that are affected by light should not be stored in glass jars unless the jars can be stored in a dark place. Glass jars can be used again. Wash them in hot soapy water. Rinse them with hot water that has been boiled for 10 minutes. Dry them in the sun if possible.

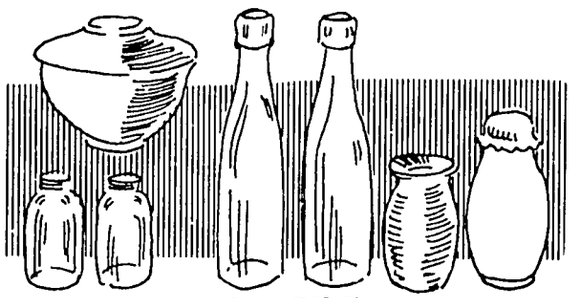


FIGURE 7

Bottles are good for storing liquids and some dry foods. In many countries people preserve fruit and vegetable juices in bottles.

Coconuts, gourds and calabashes may be used for storing some dry foods for a short time. Covers can be made of closely woven materials. Insects tend to eat away the soft lining of these containers. So they are not good for storing meal and flour for long. Wash these containers often to keep out weevils. Dry in the sun.

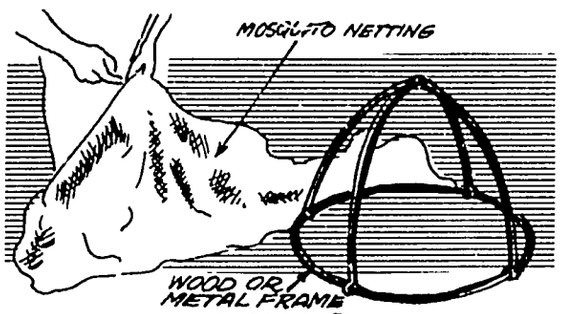


FIGURE 8

A simple cupboard can be made from a wooden box with shelves. The door is made of chicken wire so air can circulate. Use it to store root vegetables and some fruits.

Tin cans of all sizes are good for storing foods. Sometimes the lids of cans containing food have been removed with a hand or mechanical can opener. Then the lid does not fit. If you use these cans to store food, make a cover out of a plate, saucer, or a piece of metal.

FIGURE 9. IN ETHOPIA COVERED BASKETS ARE HUNG FROM THE RAFTERS TO STORE DRIED FRUITS AND VEGETABLES AND BREAD.

Use a food cover to keep out flies and other insects when you store food on a table in an uncovered container. You can make a food cover out of mosquito netting and a metal or wooden frame (see Figure 8). Store foods this way for a short time only.

A bread box may be made of metal or wood. Punch holes in each end for air circulation.

Open baskets are good for storing fresh fruits and vegetables for short periods. A tight cover is not needed for these foods.

Care of Food Containers

Food containers must be kept clean. Wash and dry containers before fresh supplies are stored in them.

Water for washing containers should be clean and hot. Boil it for 10 minutes. Use soap. Rinse the containers carefully with clear clean water. Dry them in the sun if you can.

Do not store food in containers which have held kerosene, gasoline, heavy oil or insecticides.

Containers holding food that does not need to be kept cool may be stored on shelves or on a table.

FIGURE 10. IN THIS PHILIPPINE HOME SOME FOODS ARE STORED ON OPEN SHELVES. OTHER FOODS ARE STORED IN CUPBOARDS WITH VENTED DOORS SO AIR CAN CIRCULATE.

THE STORAGE AREA

A good storage area is:

- well ventilated
- cool and dry
- free of rodents and insects
- clean and neat

You may store food in the kitchen in cupboards on open shelves, or in a closet with shelves. Sometimes a separate room next to the kitchen, called a pantry, is used for storing food. Also cellars, caves and outdoor pits are used in some parts of the world for food storage.

Good Ventilation

Ventilation is important for good food storage. Good circulation is needed around food to carry off odors, to keep the right temperature and the right amount of moisture. Food needs to breathe. Good ventilation helps to keep food cool.

Keep the Storage Area Cool and Dry

Many fresh fruits soon spoil in a warm place. Then they are unsafe to eat. Cooking oils, table fats, and

other foods with fat in them may get a stronger flavor if stored in a warm place. A dry storage area helps to avoid mold on foods such as bread, cheese and berries. It also prevents rust on tin cans in which food may be canned or stored.

Keep the Storage Area Clean

There is no substitute for cleanliness. Scrub shelves, cupboards and floors often. Paint, whitewash, or line shelves with clean paper. Clean the walls, then paint or whitewash them. Keeping the storage area clean helps to keep away household pests.

Remember, cleaning destroys insecticides. Apply them after you clean not before.

KEEP FOODS COOL

Some foods are quite perishable. They are:

- fresh meat, fish and poultry
- some fresh fruits and vegetables
- milk, butter, margarine and cream
- leftover cooked foods

In a warm climate it is best to buy these foods in small quantities and use them quickly rather than store them. If you have to store these foods, keep them as cool as possible. This is one way to keep them fresh and prevent spoilage.

EVAPORATIVE FOOD COOLER

The evaporative food cooler is cooled by the evaporation of water from its cloth cover. The cloth is moistened as capillary action moves water from the pans through it.

If the climate is dry and the cooler is kept in a breezy spot in the shade, it will cool food considerably below the prevailing temperature. To be safe, the cooler must be kept clean. The cooler's cloth cover keeps flying insects out. The water-filled lower pan discourages roaches and other crawling insects.

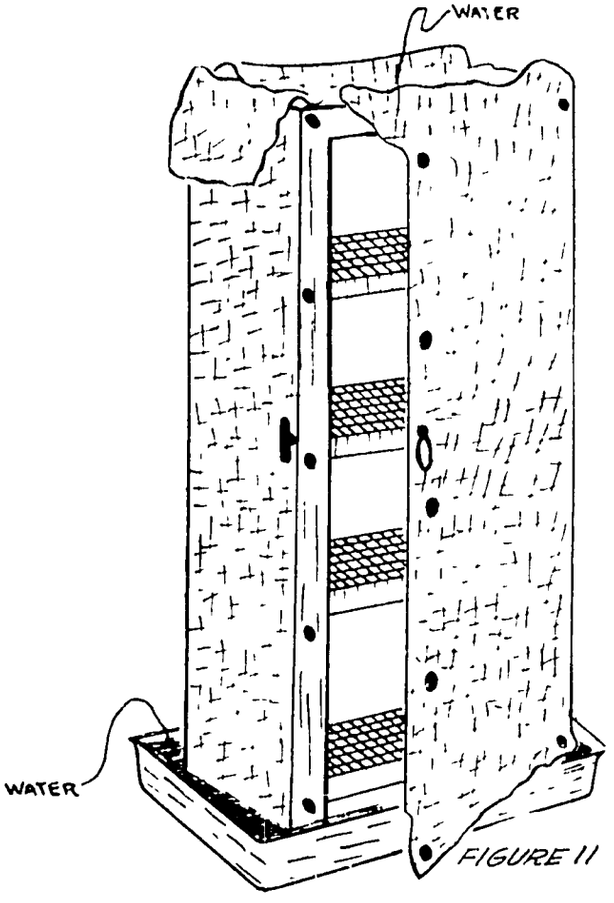


FIGURE 11

How to Make the Evaporative Food Cooler

Make the wooden frame to fit the upper pan (see Figure 12). This might be the bottom of a discarded 5-gallon oil can. The lip of the pan fits over the top of the frame to keep the pan from falling into the refrigerator. Hinge the door carefully so that it swings easily, and make a simple wooden or thong latch. Paint or oil all the wooden parts. The upper and lower pans should also be painted to prevent rust. Cover the shelves (see Figure 13) and frame with screening or hardware cloth and tack it in place.

The frame can be strengthened by putting the screen on diagonally, although this will take more material than applying it with the wires parallel to the frame. Make the shelves adjustable by providing several shelf supports. Flatten the pointed ends of the nails slightly to keep the wood from splitting when it is fastened.

Tools and Materials

Saw

Hammer

Nails, tacks

Burlap or other cloth: 2m x 2m (78 3/4" x 78 3/4")

Wood for frame: 3cm x 3cm x 13m (1 1/4" x 1 1/4" x 42.7')

Pan: 10cm (4") deep, 24cm x 30cm (9 7/16" x 11 13/16") for top

Screen, hardware cloth or galvanized iron: 2m x 2m (78 3/4" x 78 3/4") (non-rusting)

Hinges: 2 pair

Pan larger than 30cm x 36cm (11 13/16" x 14 3/16") for legs to stand in

Paint for wooden and metal parts

Buttons or lacing material for cover

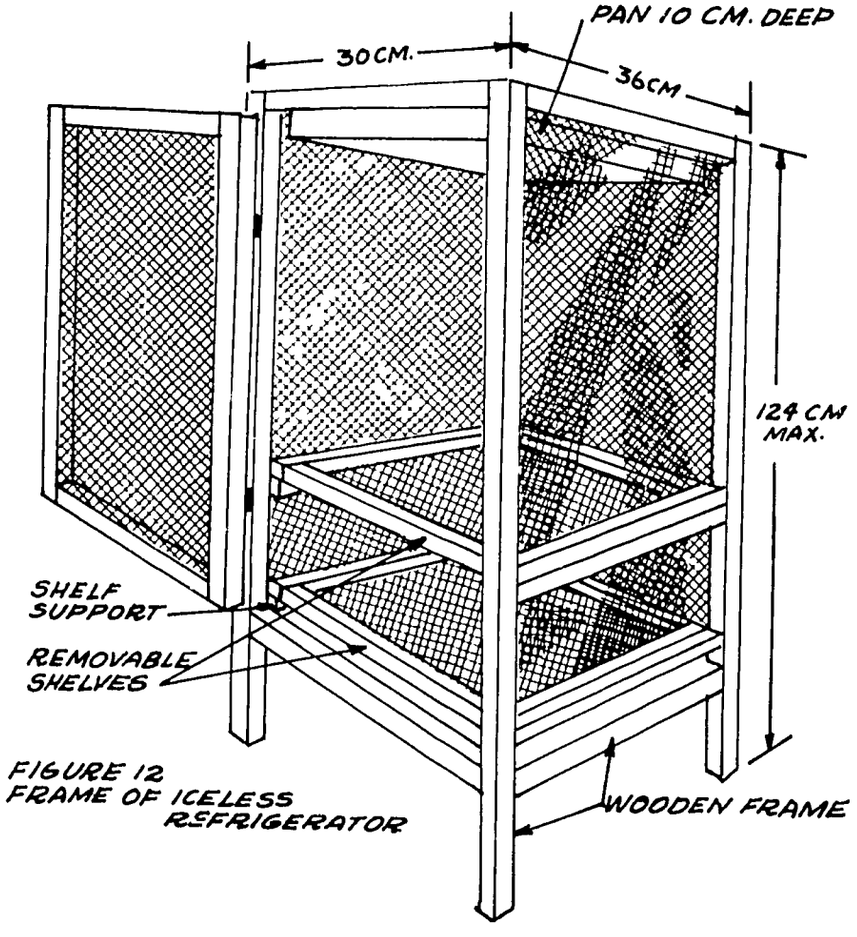


FIGURE 12
FRAME OF ICELESS REFRIGERATOR

Make two covers of canton flannel, jute burlap (not sisal or henequin burlap) or heavy-grade absorbent coarse cloth to fit the frame. Wash and sun one cover while using the other. On the front, fasten the cover to the door instead of the frame. Allow a wide hem to overlap the door closing. To form wicks which will carry water from the pans, into the cover, the top and bottom of the frame and door covers should extend into the upper and lower pans. If the cloth cover does not stay moist, extra pieces of cloth can be placed at the top of the frame to serve as additional wicks.

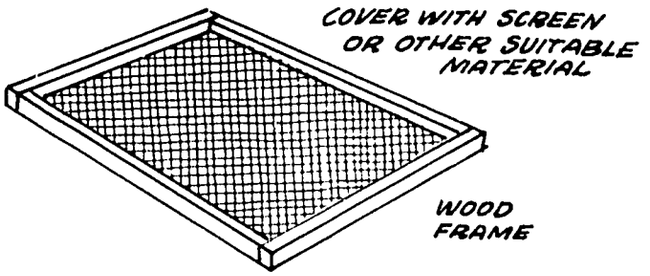


FIGURE 13 SHELF

ICELESS COOLER

Materials

A basket with loose fitting cover. May be made of bamboo or other slender wood with open weave. The size depends upon the family's needs.

A container to set the basket in. This may be square or round, of earthenware or metal. A clean oil drum could be used. This container should be about 30cm (12") high and wider than the basket

Bricks or stones

Burlap of the soft jute type.

Building the Cooler (see Figure 14)

1. Select a cool place in the kitchen away from the stove for your cooler.
2. Place the outer container here.
3. Arrange the bricks or stones in the container so the basket will balance evenly on them.
4. Sew burlap around the rim of the basket. Let it hang loose around the bottom and extend into the earthenware or metal container.
5. Sew burlap loosely over the cover of the basket.
6. Set the basket on the bricks.
7 Place food in the basket and cover.
8. Put water in the bottom of the container. Wet the cover of the basket the first time the basket is used. Later do this just occasionally.
9. The basket should not be in water. The burlap cover should hang down into the water.

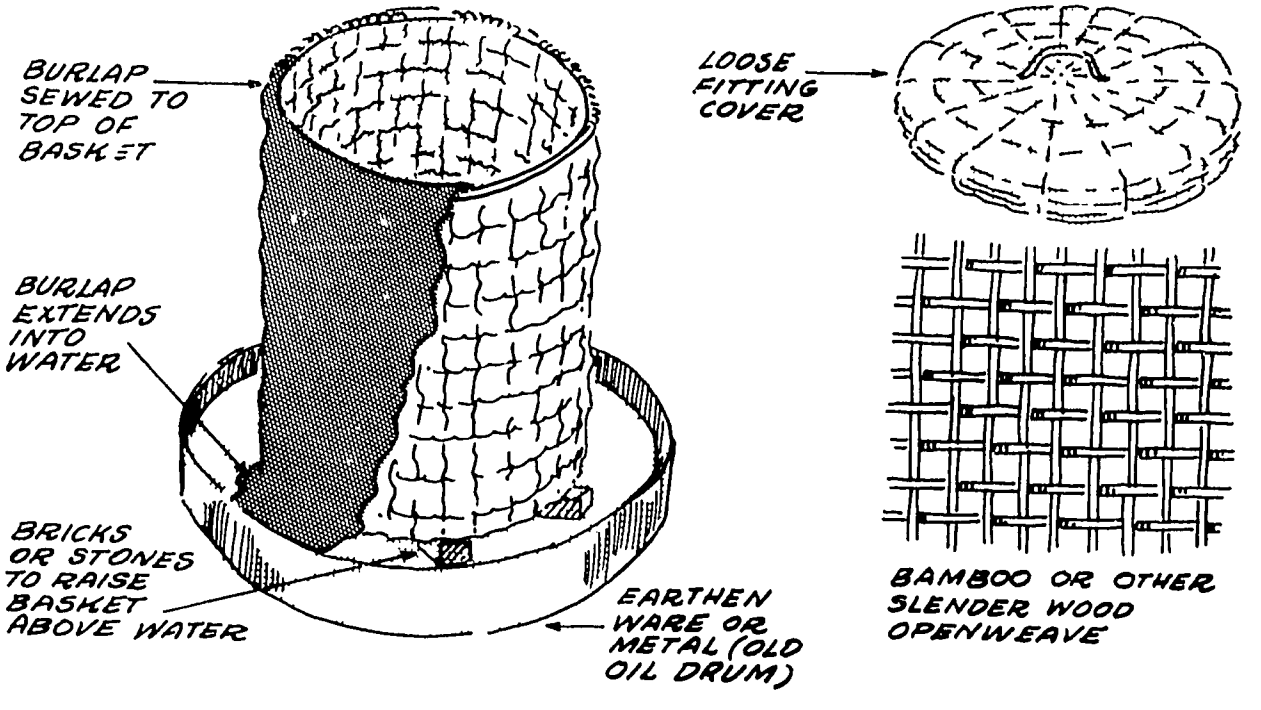


FIGURE 14

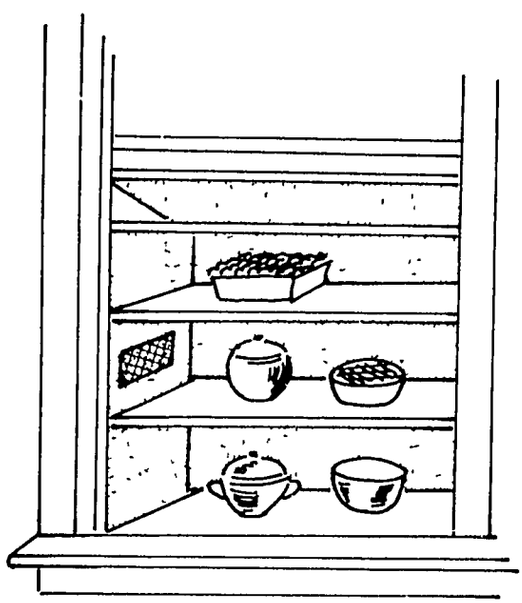
WINDOW BOX

In some countries window boxes are used to store foods during the cool months of the year. They must have good ventilation and tight covers to keep out rain or snow. An ordinary light wooden box may be used or you can make one.

Installing A Window Box

1. Fit the box to the outside of the window. The window is the door. Select the window that is in the shade longest during the day.
2. Put a shelf on the window sill. Support the shelf with wooden braces.
3. Set the box on the shelf.
4. Fasten the box to the window case with screws or nails.
5. Fit a sloping top over the box to shed the rain.
6. Make holes in the end of the box so air can circulate. Screen them.
7. Shelves may be made of heavy screening, poultry wire, or wood.
8. Rest the shelves on cleats fastened to the sides of the box.
9. Paint the box inside and out. It will be easier to keep clean. Wash the inside with soap and water from time to time.
10. Food placed in the box should be in clean covered containers.

A food storage closet may also be built on the outside of the house. You can make it open into a room by a special door through the wall.



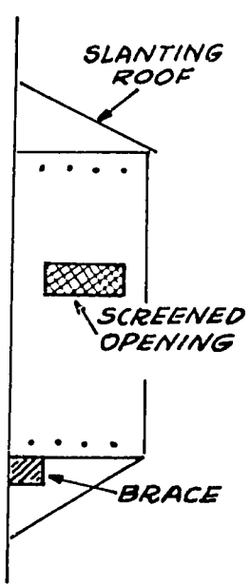


FIGURE 15

OTHER WAYS TO KEEP FOOD COOL

A mechanical refrigerator is ideal for storing perishable foods. However, refrigerators are not available in all parts of the world. Where a refrigerator is used, it needs special care.

Clean and defrost it regularly. To do this, turn it off. Allow the ice to melt. Wash inside the refrigerator thoroughly, using warm water and soap. Pay special attention to the corners.

An ice chest can be made at home. Line a wooden packing case with galvanized iron. You will need to put insulation between the wooden box and iron to keep out heat. Use sawdust, cork or similar material. Make a hole at the bottom for water to drain out as the ice melts. Keep the ice chest clean. Wash it with soap and water often.

A wooden keg lined with cement makes a good food cooler. You may store leafy vegetables such as spinach and lettuce here. The vegetables can be kept in a strong, paper or plastic bag. Hang the bags on a hook screwed into the cover of the keg. Fill the bottom with water.

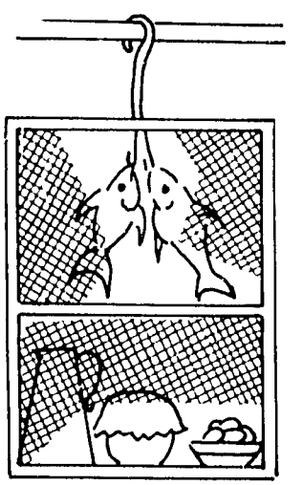


FIGURE 16

On some farms cold water pumped from deep wells for livestock may first be used to cool foods, by running it through a suitable storage box. Also a house or box may be built over a spring or brook to keep foods cool.

Special wells or caves are sometimes built for cool storage of foods.

FIGURE 17. THIS IS A SIMPLE COUNTRY ICELESS COOLER USED IN INDIA. YOU CAN MAKE IT EASILY WITH TWO DIFFERENT SIZED POTTERY JARS. PUT WATER BETWEEN THE JARS. COVER THE TOP WITH PALM, BANANA OR OTHER LARGE LEAVES.

Storing Vegetables and Fruits for Winter Use

In some countries the climate is too cold to grow foods the year around. Farmers and gardeners in many parts of the world have found good ways to store some vegetables and fruits.

Some of their methods may be ones you will want to study and tell others about. An agricultural advisor can help you decide which type of storage is best for your climate and the foods grown in your area. Storage methods described here are practical only in areas where outdoor winter temperatures average -1C (30F) or lower.

Some vegetables, like tomatoes, can be planted late in the season so that they can be picked just before frost. If picked when white or turning red, tomatoes will ripen in a warm room. To store them for longer periods, they can be packed in boxes of sawdust; when they are to be used, the boxes are opened and the tomatoes are put in a warm room to ripen.

Beans can be kept for winter use by picking the pods as soon as they are mature and spreading them in a warm, dry place until dry. The beans are then shelled, stored in bags and hung in a cool, dry, ventilated place until needed. Cellars are usually too damp for storing dry beans. Dry lima beans, soybeans and peas can be stored this way.

Root crops such as beets, carrots, celery, kohlrabi, turnips, winter radish and horse radish are not stored until late fall. When the soil is dry, the roots are pulled and the tops are removed. Cone-shaped pits make good storage places for root crops in areas where they can be kept from freezing. Turnips may be left in the garden until later than most crops but are hurt by alternate thawing and freezing. Parsnips may be left in the ground until needed as freezing does not hurt them. But, put a few in underground storage for use when the ground is frozen.

Sweet potatoes store best in a warm, moderately dry place. A small supply can be placed near a cooking stove or a warm chimney or some other place where the temperature will stay around 12C to 15C (55F to 60F).

Late maturing pumpkin and squash can be kept in rows out of doors until late winter. They can also be kept on shelves in an area with a temperature ranging from 12C to 15C (55F to 60F).

Some helpful pointers on storing fruits and vegetables:

- Different vegetables and fruits need different storage conditions and methods
- Anything showing decay or injury should not be stored.
- Vegetables and fruits will dry out unless the storage place is damp and the temperature low but not freezing.
- Ventilation not only changes air and removes odors. It also helps maintain desirable temperature and humidity.
- Windows and ventilators should be kept open when temperature is not freezing.
- Walls and ceilings should be insulated so moisture will not condense and drop on stored foods.

More detailed instructions on storing fruits and vegetables are given in:

"Storing Vegetables and Fruits in Basements, Cellars, Outbuildings, and

Pits," Home and Garden Bulletin No. 119, U.S. Department of Agriculture. For sale by the Superintendent of Documents U.S. Government Printing Office, Washington, D.C. 20402. Price 15 cents.

Fruits and vegetables can be stored in pits, trenches, outdoor cellars or caves to keep them through the winter if the average temperature is -1C (30F) or less.

Here are some kinds of storage you can build.

* *

Post-Plank Cellar

This type of storage cellar is low in cost, but does not last long as the wood will decay. (See Figure 18). If creosote or other waterproofing material is available, paint the wood with it to slow down decay.

1. Dig a hole big enough to hold the foods to be stored and 120cm (4') deep.
2. Keep the soil piled nearby and use it to cover the roof and bank the sides.
3. Set two rows of posts of the same height in the bottom of the pit near the side walls.
4. Set a middle row of posts about 150cm (5') higher than the outside posts. Put a ridge pole on the center row. Lay planks on the two outside rows.
5. Next place a roof of planks.
6. Close the ends and cover the whole cellar except the door with soil. The door may be made of planks or other durable material. The thickness of the cover depends upon the climate.
7. Be sure that water drains away from the cellar and that a pipe extends from the storage area up through the dirt for ventilation.

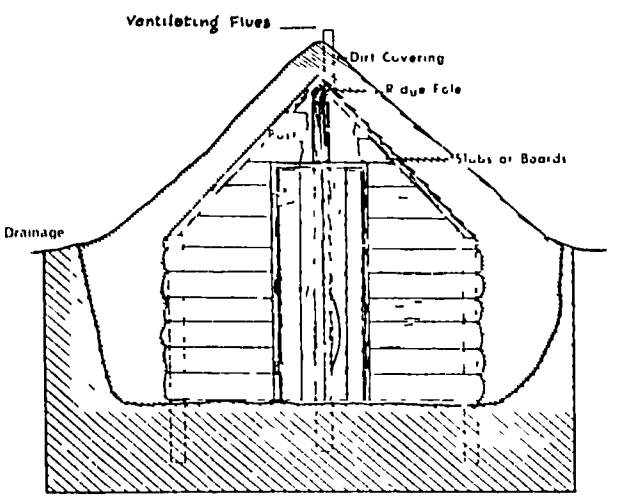


FIGURE 18

Cabbage Pits

A good way to store cabbage, collards and other greens is in a pit made of stakes and poles covered with straw (see Figure 19).

1. Dig a trench long enough to hold

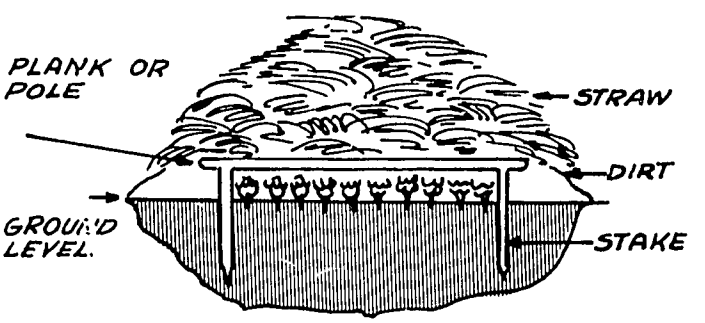


FIGURE 19

the number of cabbages to be stored.

2. Pull the plants by the roots and set them side by side in the trench.

3. Pack soil around the roots.

4. Build a frame about 60cm (2') high around the bed. This may be of boards, poles or stakes driven into the ground.

5. Bank the soil around the frame.

6. Place poles across the top to hold the covering of straw, hay, leaves or corn fodder.

Cabbages can also be stored above ground in an area protected by drains from excess moisture (see Figure 20). Cabbage plants are pulled out by the roots, placed head down in the storage area and covered with soil. The advantage of this method of storage is that you can remove a few heads of cabbage without disturbing the rest of the pit.

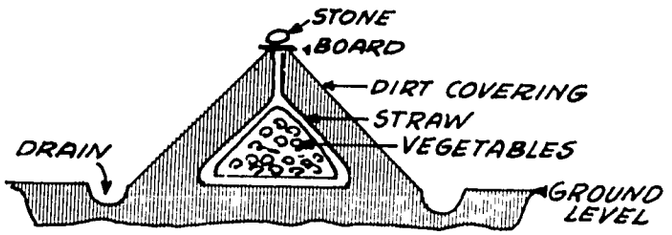


FIGURE 21

Cone-Shaped Outdoor Pits

1. Build the pit either on the surface of the ground, or in a hole 15cm to 20cm (8" to 10") deep in a well-drained location.

2. Spread a layer of straw, leaves or similar material on the ground.

3. Stack the food to be stored on the litter in a cone-shaped pile.

4. Cover the food with more straw, leaves or similar material.

5. Cover the entire pile with 7cm to 10cm (3" to 4") of soil.

6. Firm the soil with the back of a shovel to make it waterproof. More soil may be needed in very cold weather.

7. Dig a shallow drainage ditch around the pit to carry away water.

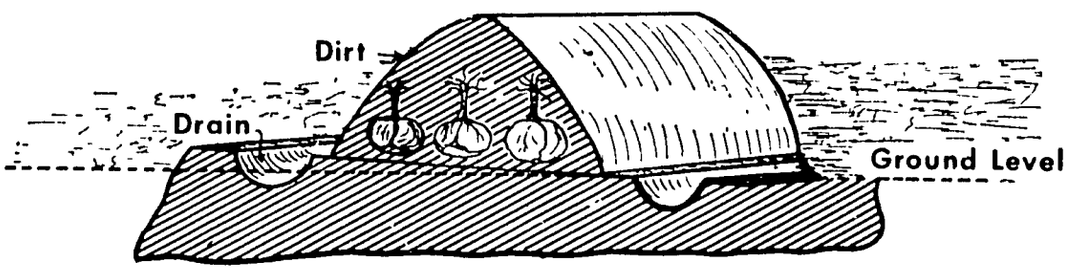


FIGURE 20

8. Ventilation or air circulation is necessary.

Small pits with 100 to 150 liters (a few bushels) of vegetables will get enough air if the straw between the vegetables and soil extends through the soil at the top opening. To keep out rain, cover the top with a board or piece of sheet metal held with a stone.

Large pits - Place two or three rough boards or stakes up through the center of the pile of vegetables to form a flue. Cap the flue with two boards nailed together at right angles.

9. Opening the pit - Once the pit is opened it is best to remove all the food at once. It is better to make several small pits rather than one large one, and place small amounts of vegetables in each pit. When several kinds of vegetables are stored in the same pit, separate them with straw or leaves.

10. Pits should be made in a different place every year to avoid decay from spoiled food left in an old pit.

FIGURE 22. A CONE-SHAPED PIT USED FOR STORING POTATOES.

How to Salt Fish

Salting, one of the oldest methods of preserving food, is an art as well as a science. The process of salting fish is influenced by weather, size and species of fish and the quality of salt used. Therefore, experience is needed to adapt the process outlined here to your situation. Start by salting small lots of different varieties of the available fish. By salting small amounts of fish at first, you will learn how much time is required for each step. Salted fish, if properly packed to protect it from excessive moisture, will not spoil.

Quality and Cleanliness. Of special importance are:

1. The quality of the fish to be salted--the fish must be top quality; salting will not help poor quality, old or rotten fish; and

2. Cleanliness in all operations - all water used must be unpolluted; all waste must be removed from working and drying areas; whatever comes in contact with the fish, including all the equipment, must be kept clean.

Caution. One word of caution: Start by salting non-fatty, white-meated varieties of fish. The salting of fatty fish brings up problems of rancidity, rusting and spoilage which can be handled better after you have experience in salting.

Tools and Materials

A clean sharp knife

Salt: the amount varies with local conditions, but figure about 1 part salt (by weight) to 5 parts of raw, prepared fish

Clean containers for washing fish

Clean, flat working surfaces; e.g. tables

Clean containers for removing waste

Waterproof vats: one or more, depending on the amount of fish to be salted. The dimensions are not too important; a good size is 183cm x 152cm and 91cm deep (6' x 5' x 3'). But fish can be salted in a container as small as a wide-mouthed glass jar. Metals other than stainless steel should not be used. Wooden boards will work because moisture will swell the wood and seal it effectively.

Clean boards and weights (for pressing).

Clean slats or lines for hanging fish (see Figures 3 and 4).

Portable thatch-roof shelters or small roofed sheds (see Figure 5).

Salting the Fish

The process of salting fish has four operations:

A. Preparing the fish
B. Salting
C. Washing and drying to remove excess salt
D. Air drying

A. Preparing the Fish

1. Beheading and Gutting. Fish should be gutted and beheaded as soon as possible after catching.

2. Beheading. Remove the head by cutting it off on a slanted line following the gills. Sharks can be beheaded at the last line of gill slits. (Only the "wings" of rays or skates are usually considered edible). Fish which weigh 250gm (1/2 pound) do not have to be beheaded but they should generally be gutted. Local custom will determine whether or not they should be beheaded.

3. Gutting. In gutting a fish, cut from the gill cavity along the ventral fold to the anal vent (see

Figure 1). All the guts must be removed. It is also good commercial practice to remove the black

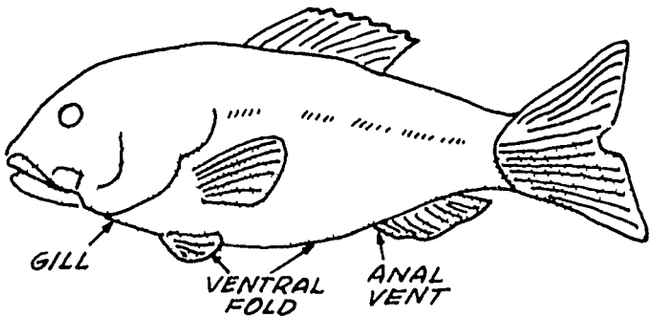


FIGURE 1

membrane located in the visceral cavity (the hollow in the body of the fish which contains the guts) of many species.

4. Bleeding. All species of fish must be thoroughly bled: if the head has not been removed, cut the throat; remove the gills and all blood vessels. Blood clots can cause discoloration, as well as bacterial infection which would make the fish unfit for eating.

5. Cutting. The shape into which the fish is cut depends on local custom. But, for a rule of thumb: under 0.5kg (1 pound), the fish may be left whole; from 0.5kg to 5kg (1 to 10 pounds) it should be split in half from head to tail (see Figure 2); over 5kg (10 pounds), split the fish in two again from head to tail. The collarbone behind the gills should be left intact when a fish is split in half.

B. Salting

1. Sprinkle a thin layer of salt, just enough to completely cover the bottom of a waterproof vat.

2. Place a layer of fish, flesh side up, with enough room for each fish to avoid overlapping. Try for a neat pattern, alternating head to tail and tail to head.

3. Cover the fish with salt - a thin layer, but with no open spaces.

4. Repeat Steps 2 and 3 up to two or three layers of fish from the top of the vat.

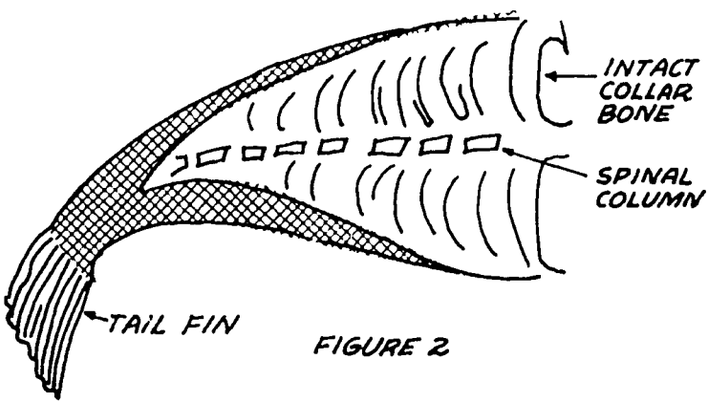


FIGURE 2

5. Reverse the fish, packing them SKIN side up to the top of the vat, alternating with layers of salt. The top layer must be salt.

6. The salt will extract moisture from the fish, forming a brine. Use boards and weights to keep all the fish under the salt.

7. The brine must be kept saturated (90 Salinometer- or when no more salt can be dissolved) at all times. As moisture is extracted, more salt must be added to keep the brine saturated. Too little salt will cause the fish to spoil. Too much will detract from the flavor and cause rehydration.

8. As moisture is extracted from the fish, the level of fish in the vat will fall. More fish can be added, skin side up - alternating a layer of fish with a layer of salt, the top layer always being salt. Continue to add salt to keep the brine saturated.

9. Length of Cure. The fish are "struck through," or thoroughly impregnated with salt, in 12 to 15 days in warm weather. In cold weather, the fish should stay in the brine for 21 days or more; in the tropics, 15 days may be a good limit. The higher the temperature, the quicker the fish will be struck through. When properly salted, the flesh of the fish is translucent. It is firm but yields to gentle pressure. It has a whitish salt cover. An odor of fish and brine should prevail. There should be no spoilage odors.

C. Washing and Drying to Remove Excess Salt.

1. When the fish are struck through, they are removed from the vat and washed in unpolluted sea water or fresh brine to remove excess salt.

2. Then place the fish on flat surfaces, using any arrangement of boards and weights to press them as flat as possible:

   a. to remove excess moisture;

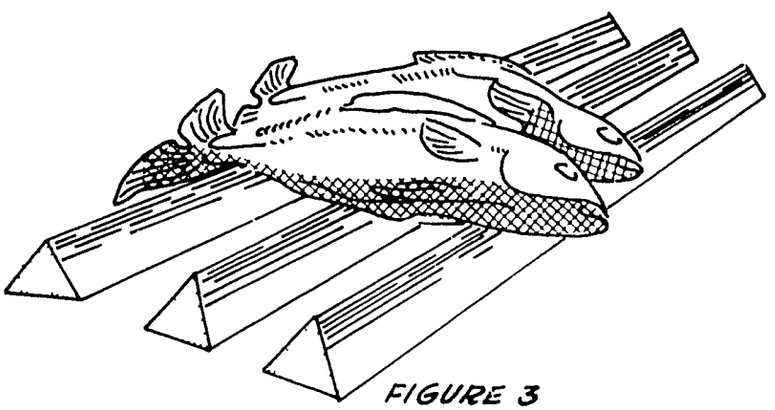


FIGURE 3

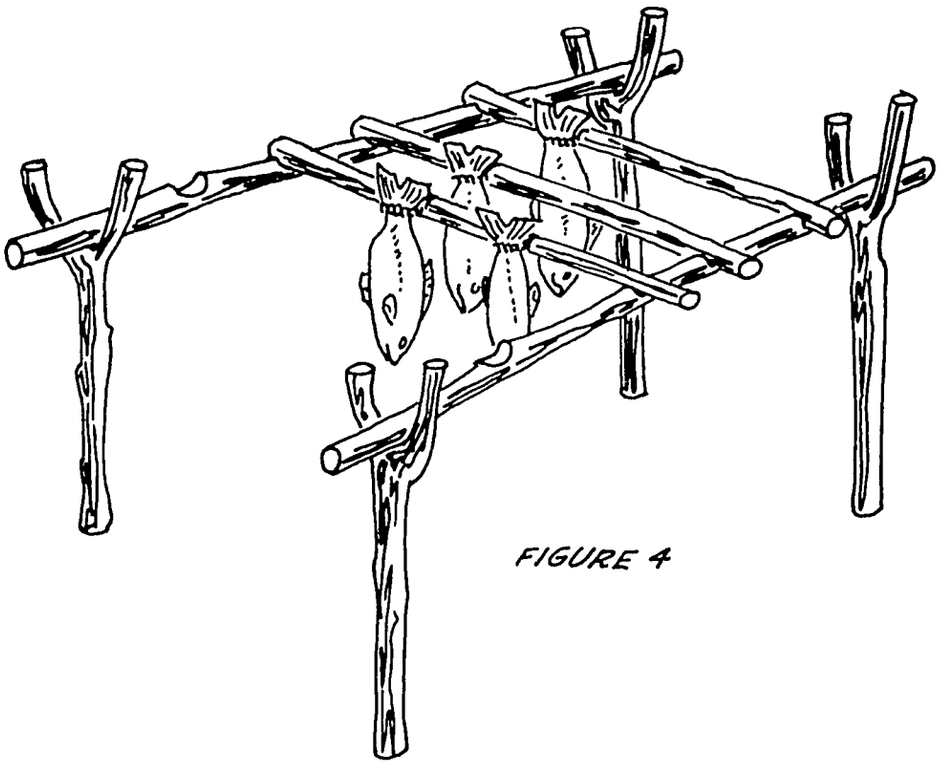


FIGURE 4

b. to make the fish thinner, which will reduce the length of the air-drying process and improve the appearance of the fish for marketing.

D. Air Drying.

1. The final drying can be done either by sunlight and natural air currents or by artificial heat and air currents generated by fans. In most areas, in the proper season, drying can be done outdoors in the sun and fresh air. Choose an open area to get the most sunlight and wind. Avoid swampy areas, locations near human or animal waste and, especially, fly-breeding areas.

2. When freshly salted fish is first brought out to dry, there is danger of sunburn. If fish is exposed at this stage to the direct rays of the sun, it may harden on the outside and turn yellow. This will keep the inside from drying properly. To avoid this, keep the fish under shade or semi-shade for the first day.

3. After the first day, expose the fish to as much sunlight and wind as possible. One method is to lay the fish on triangular slats - so that it rests on the least possible amount of surface - flesh side facing the sun (see Figure 3). Another method is to hang the fish by the tail (see Figure 4).

4. Protect the drying fish against dampness. The fish can be sheltered by portable thatch roofs (see Figure

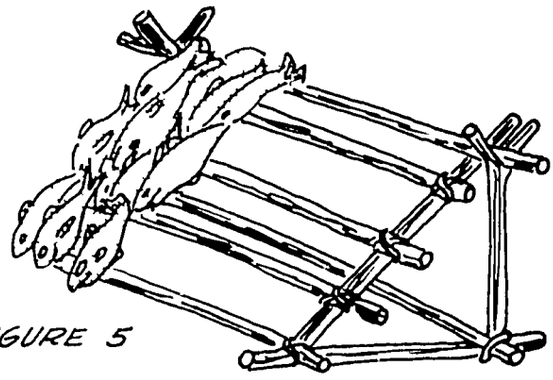


FIGURE 5

5) or moved into small roofed sheds built nearby for protection from rainfall and night-time dampness. The fish should be free of discoloration, mold or other defects. Split fish should not have ragged edges.

5. Length of Process. Generally, six warm days with winds of more than 5km (3 miles) per hour should dry the fish enough to prevent spoiling in storage or shipping, provided the fish is properly packed to protect it from excessive moisture.

IMPORTANT POINTS TO REMEMBER

1. Use only top quality fish
2. Work cleanly
3. Work fast
4. Keep the brine in the salting vats saturated - when in doubt, add more salt.
5. Try to follow local custom in style and length of cure.
6. All water used must be unpolluted.

Using Salted Fish

Salted fish is usually soaked overnight, with at least one change of water, to remove most of the salt before it is eaten. The longer it is soaked, the more salt is removed. Then it is used in the same way as fresh fish, except that it is not good for frying.

Source:

Daniel Casper, Product Manager,
Seabrook Farms, Co., Seabrook,
New Jersey

Useful Reference

Home Curing Fish, by Sue T. Murry. Covers catching and handling, cleaning and curing (salting, drying and smoking), and how to use cured fish. 18 pages. 1967. Available from:

Agriculture and Rural Development Service
Office of the War on Hunger
Agency for International Development
Washington, D.C. 20523 U.S.A.

APPENDIX

Simple methods are given here for converting English and metric units of measurement. Following these is a series of useful conversion tables for units of area, volume, weight, pressure and power.

LENGTH CONVERSION

The chart in Figure 3 is useful for quick conversion from meters and centimeters to feet and inches, or vice versa. For more accurate results and for distances greater than 3 meters, use either the tables in Figure 2 or the equations.

The chart in Figure 3 has metric divisions of one centimeter to three meters, and English units in inches and feet to ten feet. It is accurate to about plus or minus one centimeter.

Example:

An example will explain how to use the tables. Suppose you wish to find how many inches are equal to 66cm. On the "Centimeters into Inches" table look down the leftmost column to 60cm and then right to the column headed 6cm. This gives the result, 25.984 inches.

FIGURE 1

Equations:

1 inch = 2.54cm
1 foot = 30.48cm
= 0.3048m
1 yard = 91.44cm
= 0.9144m
1 mile = 1.607km
= 5280 feet
1cm = 0.3937 inches
1m = 39.37 inches
= 3.28 feet
1km = 0.62137 miles
= 1000 meters

FIGURE 2

INCHES INTO CENTIMETERS
(1 in. = 2.539977 cm.)

inches	0	1	2	3	4	5	6	7	8	9
0	cm	2 54	5 08	7 62	10 16	12 70	15 24	17 78	20 32	22 86
10	25 40	27 94	30 4°	33 02	35 56	38 10	40 64	43 18	45 72	48 26
20	50 80	53 34	55 88	58 42	60 96	63 50	66 04	68 58	71 12	73 66
30	76 20	78 74	81 28	83 82	86 36	88 90	91 44	93 98	96 52	99 06
40	101 60	104 14	106 68	109 22	111 76	114 30	116 84	119 38	121 92	124 46
50	127 00	129 54	132 08	134 62	137 16	139 70	142 24	144 78	147 32	149 86
60	152 40	154 94	157 48	160 02	162 56	165 10	167 64	170 18	172 72	175 26
70	177 80	180 34	182 88	185 42	187 96	190 50	193 04	195 58	198 12	200 66
80	203 20	205 74	208 28	210 82	213 36	215 90	218 44	220 98	223 52	226 06
90	228 60	231 14	233 68	236 22	238 76	241 30	243 84	246 38	248 92	251 46

CENTIMETERS INTO INCHES
(1 cm. = 0 3937 in)

cm.	0	1	2	3	4	5	6	7	8	9
0	inches	0 394	0 787	1 181	1 575	1 969	2 362	2 756	3 150	3 543
10	3 937	4 331	4.724	5 118	5 512	5 906	6 299	6 693	7 087	7 480
20	7 874	8 268	8 661	9 055	9 449	9 843	10 236	10 630	11 024	11 417
30	11 811	12 205	12 598	12 992	13 386	13.780	14 173	14 567	14 961	15 354
40	15.748	16 142	16 535	16 929	17 323	17 717	18 110	18 504	18 898	19 291
50	19 685	20 079	20 472	20 866	21 260	21 654	22 047	22 441	22 835	23 228
60	23 622	24 016	24 409	24 803	25 197	25 591	25 984	26 378	26 772	27 165
70	27 559	27 953	28 346	28 740	29 134	29 528	29 921	30 315	30 709	31.102
80	31 496	31 890	32 283	32 677	33 071	33 465	33 858	34 252	34 646	35 039
90	35 433	35 827	36 220	36 614	37 008	37 402	37 795	38 189	38 583	38 976

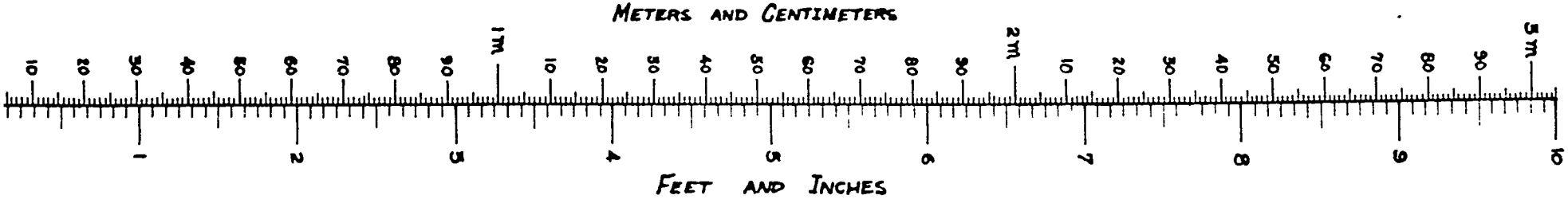

METERS AND CENTIMETERS
10
20
30
40
50
60
70
80
90
1M
10
20
30
40
50
60
70
80
90
2M
10
20
30
40
50
60
70
80
90
3M
1
2
3
4
5
6
7
8
9
10
FEET AND INCHES

FIGURE 3

WEIGHT CONVERSION

The chart in Figure 5 converts pounds and ounces to kilograms and grams or vice versa. For weights greater than ten pounds, or more accurate results, use the tables (Figure 4) or conversion equations. See "Length Conversion," Figure 2, for an example of the use of the tables.

On the chart, notice that there are sixteen divisions for each pound to represent ounces. There are 100 divisions only in the first kilogram, and each division represents ten grams. The chart is accurate to about plus or minus twenty grams.

Equations:

1 ounce = 28.35 grams
1 pound = 0.4536 kilograms
1 gram = 0.03527 ounce
1 gram = 2.205 pounds

FIGURE 4

KILOGRAMS INTO POUNDS
(1 kg = 2 20463 lb.)

kg	0	1	2	3	4	5	6	7	8	9
0	lb	2 20	4 41	6 61	8 82	11 02	13 23	15 43	17 64	19 84
10	22 05	24 25	26 46	28 66	30 86	33 07	35 27	37 48	39 68	41 89
20	44 09	46 30	48 50	50 71	52 91	55 12	57 32	59 53	61 73	63 93
30	66 14	68 34	70 55	72 75	74 96	77 16	79 37	81 57	83 78	85 98
40	88 19	90 39	92 59	94 80	97 00	99 21	101 41	103 62	105 82	108 03
50	110 23	112 44	114 64	116 85	119 05	121 25	123 46	125 66	127 87	130 07
60	132 28	134 48	136 69	138 89	141 10	143 30	145 51	147 71	149 91	152 12
70	154 32	156 53	158 73	160 94	163 14	165 35	167 55	169 76	171 96	174 17
80	176 37	178 58	180 78	182 98	185 19	187 39	189 60	191 80	194 01	196 21
90	198 42	200 62	202 83	205 03	207 24	209 44	211 64	213 85	216 05	218 26

POUNDS INTO KILOGRAMS
(1 lb. = 0 45359 kg)

lb.	0	1	2	3	4	5	6	7	8	9
0	kg	0 454	0 907	1 361	1 814	2 268	2 722	3 175	3 629	4 082
10	4 536	4 990	5 443	5 897	6 350	6 804	7 257	7 711	8 165	8 618
20	9 072	9 525	9 979	10 433	10 886	11 340	11 793	12 247	12 701	13 154
30	13 608	14 061	14 515	14 969	15 422	15 876	16 329	16 783	17 237	17 690
40	18 144	18 597	19 051	19 504	19 958	20 412	20 865	21 319	21 772	22 226
50	22 680	23 133	23 587	24 040	24 494	24 948	25 401	25 855	26 308	26 762
60	27 216	27 669	28 123	28 576	29 030	29 484	29 937	30 391	30 844	31 298
70	31 751	32 205	32 659	33 112	33 566	34 019	34 473	34 927	35 380	35 834
80	36 287	36 741	37 195	37 648	38 102	38 555	39 009	39 463	39 916	40 370
90	40 823	41 277	41 730	42 184	42 638	43 091	43 545	43 998	44 452	44 906

FIGURE 5

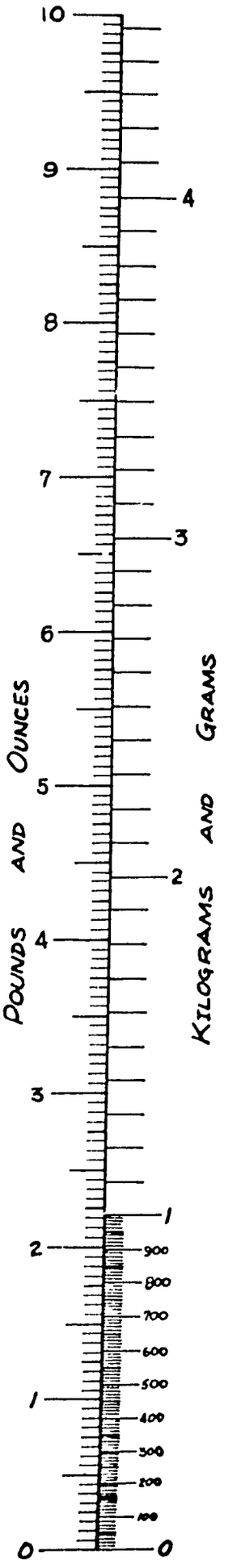
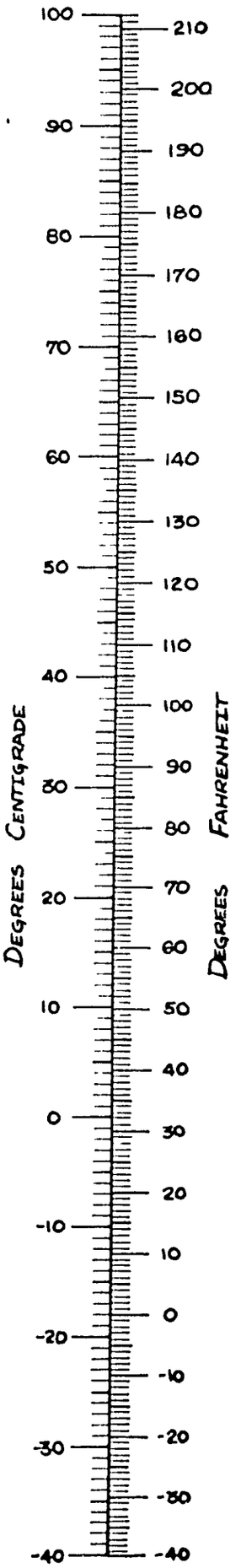


FIGURE 1



TEMPERATURE CONVERSION

The chart in Figure 1 is useful for quick conversion from degrees Celsius (Centigrade) to degrees Fahrenheit and vice versa. Although the chart is fast and handy, you must use the equations below if your answer must be accurate to within one degree.

Equations:

Degrees Celsius = 5/9 x (Degrees Fahrenheit -32)

Degrees Fahrenheit = 1.8 x (Degrees Celsius) +32

Example:

This example may help to clarify the use of the equations; 72F equals how many degrees Celsius?

72F = 5/9 (Degrees F -32)

72F = 5/9 (72 -32)

72F = 5/9 (40)

72F = 22.2C

Notice that the chart reads 22C, an error of about 0.2C.

Conversion Tables

Units of Area

1 Square Mile	= 640 Acres	= 2.5899 Square Kilomete
1 Square Kilometer	= 1,000,000 Square Meters	= 0.3861 Square Mile
1 Acre	= 43,560 Square Feet	
1 Square Foot	= 144 Square Inches	= 0.0929 Square Meter
1 Square Inch	= 6.452 Square Centimeters	
1 Square Meter	= 10.764 Square Feet	
1 Square Centimeter	= 0.155 Square Inch	

Units of Volume

1.0 Cubic Foot	= 1728 Cubic Inches	= 7.48 U.S. Gallons
1.0 British Imperial Gallon	= 1.2 U.S. Gallons	
1.0 Cubic Meter	= 35.314 Cubic Feet	= 264.2 U.S. Gallons
1.0 Liter	= 1000 Cubic Centimeters	= 0.2642 U.S. Gallons

Units of Weight

1.0 Metric Ton	= 1000 Kilograms	= 2204.6 Pounds
1.0 Kilogram	= 1000 Grams	= 2.2046 Pounds
1.0 Short Ton	= 2000 Pounds	

Conversion Tables

Units of Pressure

1.0 Pound per square inch	= 144 Pounds per square foot
1.0 Pound per square inch	= 27.7 Inches of Water*
1.0 Pound per square inch	= 2.31 Feet of Water*
1.0 Pound per square inch	= 2.042 Inches of Mercury*
1.0 Atmosphere	= 14.7 Pounds per square inch (PSI)
1.0 Atmosphere	= 33.95 Feet of Water
1.0 Foot of Water = 0.433 PSI	= 62.355 Pounds per square foot
1.0 Kilogram per square centimeter	= 14.223 Pounds per square inch
1.0 Pound per square inch	= 0.0703 Kilogram per square centimeter

* at 62 degrees Fahrenheit (16.6 degrees Celsius)

Units of Power

1.0 Horsepower (English)	= 746 Watts = 0.746 Kilowatt (KW)
1.0 Horsepower (English)	= 550 Foot Pounds per second
1.0 Horsepower (English)	= 33,000 Foot Pounds per minute
1.0 Kilowatt (KW) = 1000 Watts	= 1.34 Horsepower (HP) English
1.0 Horsepower (English)	= 1.0139 Metric Horsepower (cheval-vapeur)
1.0 Metric Horsepower	= 75 Meters X Kilogram/Second
1.0 Metric Horsepower	= 0.736 Kilowatt = 736 Watts