AN ABSTRACT OF THE THESIS OF

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for the M.A. in GENERAL STUDIES

Date Thesis presented  J ULY 17, 1946

Title Observations on Purchasing, Inspection, and Preparation of Vegetables for Group Feeding at Certain Army Air Bases.

Abstract Approved

Since vegetables are of such importance in the nutrition of human beings, it is natural that they should play a large part in Army feeding. They are high in food value. The different kinds vary widely in their energy values; some—like potatoes—are high in carbohydrates, others—like lettuce and cucumbers—are low. Fresh or canned they are high in minerals and vitamins, low in protein and fat, and are valuable for bulk and palatability.

When purchasing fresh produce it was necessary to know something of quality, appearance, and texture. Quality is made up of many characteristics—some external, internal, chemical, and physical. Appearance is concerned with shape, color, freedom from blemishes and dirt. Texture contrasts hard or soft, smooth or granular, stringy and fibrous or free from fiber, crisp or flabby, wilted or tough.

The flavor of vegetables is due to several constituents: sugar, organic acids, mineral salts, and aromatic compounds. A combination of these gives flavors that make vegetables palatable and attractive.

The nutritive value of a given vegetable depends on the part of the plant to be used, as well as the variety, climate, soil in which it is grown, conditions of storage, and preparation. The leaf, stem, flower, seed, and fruit
are all edible parts.

When purchasing vegetables for the Army it was well to know that the initial price was by no means the ultimate cost as there was a wide margin between the cost as purchased and edible-portion cost. Waste in preparation, storage, and losses in the cooking of highly perishable produce would cost six cents per pound as purchased and thirty cents per pound edible portion.

The condition of the vegetables when delivered has a great influence on the probable yield. When purchasing canned vegetables, grades were used as purchasing guides. Samples of each grade of produce were requested for testing to find out if the product was satisfactory. The highest grade was not purchased for general use; Grade B or Standard was acceptable for the Army mess.

Fresh and frozen vegetables were used largely in Army camps and fields in the United States. Canned and dehydrated products were to be used in combat areas overseas because they were easy to prepare, there was little or no waste, and the nutritive value was fairly well retained. The problem of storage was not difficult, and shipping space was saved when dehydrated food was shipped because of its lightness and lack of bulk.

The Army food purchasing officer needed to be familiar with the local vegetable supply and market center facilities. A knowledge of standardizing, grading, packaging, sorting, and transporting produce was necessary in order to purchase food economically and intelligently.

Because of uncertainty of crops due to curtailed planting and harvesting occasioned by labor shortages, it was difficult for producers and distributors to cooperate at all times. The Quartermaster's office arranged
with local marketing centers for information on prices, substitutions, and quantities of local produce available, several days in advance, so that suitable substitutions could be made on menus if sufficient fresh vegetables were not obtainable.

Inspection of all food on delivery was required, and if low grade or unsatisfactory produce was discovered it was returned to the dealers or an adjustment requested. This was done to determine whether or not supplies met the contract requirements for quality and conditions specified by the Army.
OBSERVATIONS ON THE PURCHASE, INSPECTION, AND PREPARATION OF VEGETABLES FOR GROUP FEEDING AT CERTAIN ARMY AIR BASES

by

ETHEL MAE MCINTYRE

A THESIS

submitted to the

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ACKNOWLEDGEMENT

The writer wishes to express her appreciation to Professor Ernest H. Wiegand, Head of the Department of Food Technology, for his assistance and interest in the development of this study. The writer also wishes to thank Professor Thomas Onsdorff, Associate Professor of Food Technology, for his interest and guidance.
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INTRODUCTION

As a food supervisor in the Army during World War II, it was necessary to learn as quickly as possible what vegetables were liked best and how to prepare and serve those that were acceptable to the majority of service people.

The purpose of the experiments was to discover how to prepare and to serve vegetables so that the color, flavor, palatability and appearance might be acceptable for consumption; and to learn why these qualities were important for cooked vegetable acceptance.

Regional food habits needed to be understood and considered for the benefit of those who preferred to have their food prepared as they had been accustomed to having it prepared in their homes.

This information was needed in order to determine what recipes would best satisfy the men and thus avoid needless waste of vegetable produce.

The study was carried on at nineteen Army Mess Halls at Pendleton Field, Oregon and at five Army Mess Halls at Kelly Field, Texas. Service men and women were army air corps personnel, nearly all white with the exception of one colored squadron. These service people served as the experimental group to test the vegetables used in the surveys.

Troops were classed in three groups according to their activities: 4500 calories per day per man were recommended for very active personnel; 3000 calories per day per man were recommended for moderately...
active men; and 2500 calories per day per man were recommended for men in sedentary positions.

The caloric recommendations for service women were 3000 calories per day per person for the very active; 2500 calories per day per person for those moderately active; and 2100 calories per day per person for those in sedentary positions.

The problem of knowing how to serve food economically was complicated by the fact that different kinds of foods were demanded at the different regional Air Bases. Therefore food surveys had to be made at each Air Base.

Experiments were limited because cooks were not always well trained or qualified to prepare food in large quantities for army personnel. They were not familiar with regional food preferences or methods of cooking outside of their own communities.

As it was the policy of the army to take men from their home locality and send them to distant parts of the county it was difficult to please all the service people at all times. It was decided to serve a variety of plain foods well prepared. Foods served plain retained their identity and flavor and were palatable and attractive. By avoiding highly seasoned sauces or mixtures we felt that we were not pleasing everyone but the majority, we felt certain, would accept and appreciate these foods.

Fresh and frozen vegetables were to be used in the United States so that dehydrated and canned foods might be sent overseas. Our food survey would also assist our cooks going overseas at a later date to become familiar with the correct methods of preparing and serving
processed vegetables to the troops abroad. Food preferences needed to be studied and recipes made for those preparing and serving food.

Vegetable consumption surveys would show vegetable preference and acceptability of different methods of preparation. The recipe books, bulletins and literature used came from both army and civilian sources. Recipes were used so that the cooks might know how to measure foods correctly and limit the cooking time. Experimental preparation of fresh, frozen, dehydrated, dried and canned vegetables were made.

Experimental foods, prepared in food experimental kitchens, were served in the mess halls as part of the regular meals. As the service men did not know that they were eating test foods it was felt that their comments on these foods were more reliable than if they had been informed in advance that the desirability of certain foods was being tested.

Army Produce Inspection

Inspection was necessary to determine quality of goods when purchasing. Specific requirements were made when orders were given and goods had to conform with the specification. Commodities vary greatly in food value because of variations in growth, preparation, handling methods, and sanitation. Army specifications established a minimum of condition and quality for produce which was desirable and necessary for human consumption.

Competent personnel were authorized to select and order delivery of necessary quantities of standard quality produce. Allowances were made for changes in production, refrigeration, handling, and market-
ing, but the purchaser must be familiar with the degree of deterioration acceptable when judging fitness of produce.

The condition of vegetables when delivered had a great deal of influence upon the yield. When vegetables were delivered to the Army mess kitchen, someone was there to inspect the produce when delivered. This person was well-informed concerning the good qualities or defects of produce.

Inferior quality, wilted, rusty, poorly washed, off-color, bruised, poorly packaged, or short weight produce was not accepted. Attention was called to the specifications listed when the order was given to the vegetable market.

Sometimes lower grade produce was accepted if the Army mess could use it immediately, but a refund was made to the Army mess for the difference in quality.

If poor quality produce was accepted, there would be a shortage of food at mealtime, and cost of the meals would be higher because of waste. One cannot be sure of a definite number of servings when poor quality produce is purchased as it will not be satisfactory when served.

A knowledge of quantity, quality, and prices of food was important when purchasing vegetables of any kind for Army mess use.

While stationed at Kelly Field, Texas, during World War II, it was the writer's duty to make and revise master menus for the forty-two mess halls and station hospital at Kelly Field and nearby air fields.
Vegetables were purchased from city produce markets of San Antonio and from the Army Commissary Stores. It was necessary to purchase local produce as much as possible to save transportation and delivery costs. All fresh produce listed on the master menu was to be changed if it was not obtainable from local markets, and vegetables of the same nutritive value were to be substituted. We used as much local produce in season as was possible and depended on what was available from outside market centers in emergencies.

Standard grades were used and specifications were definitely stated on all orders. Quantity, uniformity, freshness, cost, and quality were always considered important when ordering fresh produce.

The field food administrator and the writer of this thesis were asked to inspect all fresh produce before it was accepted for hospital use. Only on a few occasions did we find poor quality vegetables. One time lettuce was badly rusted -- it had been shipped in from distant production centers, and we were given a choice of accepting the produce as poor quality at a discount or cancelling the order. We accepted the lettuce. We purchased carrots in sacks and on inspection when delivered found a very small percentage unfit for serving. Celery and potatoes were rejected a few times because of damage done by insects and frost to celery and lack of uniformity in size of potatoes. About five percent tolerance was permitted for defects due to disease, insects, frost, lack of refrigeration, or improper harvesting.

All vegetables that required peeling by machines in preparation
for serving needed to have smooth surfaces and to be uniform in size; as a great deal of hand work was required to finish the peeling if the eyes of potatoes were deep, and the surface of carrots or potatoes were uneven. Small vegetables did not peel well and waste was excessive.

We felt sure that the close inspection on delivery and definite requirements made when ordering had a great deal to do with the good quality produce we received regularly in such large quantities.

The person buying vegetables for an Army mess had to be familiar with standards for vegetables. The variety and quality were determined by size, uniformity, shape, maturity, color, for variety, and freedom from defects. Definite specifications were made when ordering products, so that a clear understanding existed between buyer and seller regarding definite qualities required. Specifications covered weight and count wanted, for example, a crate of brussels sprouts should weigh twenty-five pounds. The type of vegetable as well as the quality was stated.

There is a wide margin between cost as purchased and edible portion cost. Some vegetables might cost seven cents a pound when purchased, and twenty-five cents a pound when served. Immediate and proper storage after delivery is very important and no vegetable should be removed from holding rooms or storage until ready for preparation or cooking.
The menus for Army Air Bases were planned at Washington, D.C. in the Quartermaster's Office and were sent to Air Base Headquarters at Patterson Field, Ohio, for distribution to Army Air Fields at least one month in advance to be checked for changes and substitutions. In planning menus for the garrison ration it was necessary to know the foods essential to good nutrition, to include all classes of food, and to have a knowledge of the availability of fresh produce in the locality.

The purpose of the master menu was to have meal uniformity for all service people. This menu could not be changed without approval of the Menu Board. Large supplies could be ordered a month in advance and delivery dates specified according to movement of troops or number to be served.

A list of available fresh produce accompanied each monthly menu book, so a choice could be made if local produce was not available on the market in sufficient quantities to supply all installations in that particular area.

Flight Feeding Manuals were distributed to air fields and those in charge of crews on long range flights. These manuals gave recipes for pre-flight and post-flight meals and conversion menus.

The Station Menu Board met monthly to discuss the need for changing the master menu and to determine what substitutions were to be made if fresh produce listed on the menu was not locally available. The Menu Board members were commissioned officers selected by the Commanding Officer of the Air Field. The dietitian, nutrition officer, food
administration officer, one or more mess officer from the field mess
halls, sanitation and food inspectors made up the Menu Board personnel.

Menus were checked for adequacy, balance, variety, caloric content, attractive appearance of meals, and ease of preparation. All
food emergency problems were discussed and decisions made. Menu Board
proceedings were reported to the Commanding Officer of the Field im-
mediately following Board meetings.

Monthly Nutrition Report

A monthly nutrition report was sent to Headquarters Army Air
Forces Office giving recommended dietary allowances listed below:

Number of calories (daily)
Quantity of protein
Quantity of calcium
Quantity of iron
I.U. of Vitamin A
Milligrams of thiamin
Milligrams of riboflavin
Milligrams of niacin
Milligrams of ascorbic acid

Blanks and data for this report were supplied by the Food and
Nutrition Board, National Research Council. If the menu was not ade-
quate the general of the field was notified, and a request made to
make menus nutritionally adequate in the future.

Because food is used by the human body to provide energy and
heat to build and repair the body, a large variety of food was neces-
sary as no single food was able to provide all the necessary elements.
When food was served in proper proportions, it was called a balanced
diet. Balance for an all-over period, such as for a day, was suffici-
ent.
The number of calories needed depended on the activity of the person fed. If moderately active 3,000 to 3,200 calories per day was sufficient. If the work was heavy the calories were increased to 4,500 to 5,000 per day.

Carbohydrates digest quickly and make energy easily available. They needed to form a large part (two-thirds) of the balanced diet.

Proteins are food substances that build and repair body tissues. These include legumes, bread, cereals, meat, eggs, and fish. About one-sixth of the diet consisted of proteins (about 75 grams per day).

Fats made up about one-sixth of the Army diet. They were used for palatability and to furnish some vitamins.

Minerals are necessary for balance and maintenance of health. Calcium and phosphorus are furnished by some leafy vegetables. Quantities of 0.5 grams of calcium and 0.8 of phosphorus were required daily. Iron and copper requirements were 12 milligrams per day. Some vegetables furnish these minerals. Iodine daily requirements for adults were 0.15 and 0.30 milligrams.

The daily intake of Vitamin A recommended was 5,000 I.U. Green and yellow vegetables are good sources of this vitamin.

Thiamin aids in the utilization of carbohydrates. The daily intake recommended was 2 to 5 milligrams. Legumes, green peas, green corn, asparagus, and brussels sprouts are good sources.

Riboflavin is found in some green vegetables. The daily requirement was 2 to 3 milligrams.

Niacin daily requirements were 20 milligrams.
Vitamin C (ascorbic acid) daily requirements were 60 to 75 milligrams. Fresh vegetables are a good source of Vitamin C. (13)

There was no danger of insufficient food in the daily diet of the Army under normal conditions and arrangements. In combat there were not always balanced meals. When there was lack of trained kitchen personnel, food was not always cooked well or properly handled.

Food selection habits are formed early in the life of the individual and are often a matter of training, environment, and custom. If some one did not like a vegetable it was usually because he disliked its appearance or the way it was prepared. Many times vegetables in mess kitchens were cooked too long, had darkened in appearance, and lost flavor. Correct cooking has helped many soldiers overcome prejudice for certain foods.

Food preference was more noticeable in the selection of processed vegetables: More in dehydrated and canned, less in frozen, scarcely any in fresh raw vegetables.

Dehydrated vegetables were used in flight rations because there was little bulk when stored, they were easily prepared, and because of their low moisture content kept well.

Menus for in-flight and pre-flight meals were made so that fresh and processed vegetables were varied to give a variety to meals and furnish necessary nutrients.

All vegetables for in-flight meals were packed cold with the exception of dehydrated vegetables. Canned vegetables were opened and
emptied into suitable containers. These were covered until heated and served. Food was placed on trays and put into temperature controlled, electric heat warmers. When food was hot it was served from trays containing portions suitable for the individual.
PURCHASING VEGETABLES FOR SOME ARMY AIR BASES

Standards for grades of fresh vegetables have been established by the U. S. Government. The differentiation made among the different grades of perishable produce is based on variety, quality, size, color, uniformity of shape, maturity, and lack of blemishes. Wise selections could be made easier if a statement of the product to be purchased was definitely specified and descriptions of the article clearly given, so that both buyer and seller understood what was wanted.

The weight and count were covered in specifications. Because of the wide variety of structural form included in the edible parts of vegetables, they were more difficult for the inexperienced person to purchase than other produce. The part or parts of the plant to be used vary. It may be the stem, leaves, seed, root, or flower. It was necessary for the buyer to know the value of these structural differences and parts.

The nutritive value depends upon the part of the plant used, as well as variety, climate, soil in which it is grown, the conditions of storage, and preparation.

Vegetables were usually purchased for the Army from large wholesale markets. See Table I for "Guides for the Purchasing of Fresh Vegetables" (15).
<table>
<thead>
<tr>
<th>Product</th>
<th>Purchasing Guide</th>
<th>Usual type of container</th>
<th>Contents of container</th>
<th>Average weight or size</th>
<th>Quantity for each 100 portions-A.P.Wt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artichokes</td>
<td>Leaves should be fresh, bright green, ( \frac{3}{4} ) fleshy. Solid compact head, uniform in size, yield slightly to pressure.</td>
<td>Box Artichoke lug</td>
<td>Weight - 40 lb. Count - 48, 60, 72, 84</td>
<td>1 globe - 4 to 12 oz.</td>
<td>100</td>
</tr>
<tr>
<td>Asparagus</td>
<td>All varieties may be green or white. Stalks should be brittle, tender, fresh. Tips compact. Thin stalks usually tough and stringy. Stalk length varies with producing districts.</td>
<td>Crates of various sizes (dependent upon producing districts) pyramid in form.</td>
<td>Weight - 24 to 36 lbs. Count - 1 and 2 dos. bunches</td>
<td>1 lb. - 3 to 4 servings</td>
<td>30 to 36 lbs.</td>
</tr>
<tr>
<td>Beans, Lima</td>
<td>Pods should be dark green in color, well filled and fresh. Shelled Lima beans should be greenish white, plump, firm but not dry. Shelled Lima beans are highly perishable.</td>
<td>Pod - hamper Shelled basket</td>
<td>Weight - approx. 45 lb. approx. ( \frac{1}{2} ) lb.</td>
<td>1 lb. in pods in pod</td>
<td>48 to 60 lbs. 16 to 20 lb. shelled</td>
</tr>
<tr>
<td>Beans, Snap</td>
<td>Order according to preference of color and shape. Should be fresh, young, tender, stringless, and should snap readily when broken, free from damage due to insects, disease, or mechanical handling. Should not be wilted or rusty.</td>
<td>Hamper Basket (bushel)</td>
<td>Vary with producing district Western - 30 lb. Southern - 24, 32, or 40 qt.</td>
<td>24 lb.</td>
<td></td>
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<table>
<thead>
<tr>
<th>Product</th>
<th>Purchasing Guide</th>
<th>Usual type of container</th>
<th>Contents of container</th>
<th>Average weight (lb.) or size</th>
<th>Quantity for each 100 portions: A.P. Wt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beets</td>
<td>Young beets usually sold with tops. Beets should be smooth, firm, tender. Medium size most desirable (2 to 3 in. in diameter). Tops green and fresh; small beets without tops usually old and dry. Topped beets usually late crop; desirable characteristics same as beets with tops; may be larger.</td>
<td>With tops - crate</td>
<td>Weight - 85 lb</td>
<td>1 bunch - 4 medium</td>
<td>28 lb.</td>
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<td></td>
<td></td>
<td>Topped - basket or hamper</td>
<td>Count - 4,5 doz. bunches, 1 to 1½ bu.</td>
<td>1 lb. - 5 medium</td>
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<td></td>
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<td></td>
<td>Weight - 52 lb.</td>
<td>1 lb. cooked</td>
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<td></td>
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<td></td>
<td>diced - 2½ o.</td>
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<tr>
<td>Broccoli</td>
<td>Should have firm, crisp, tender, well-trimmed stems. Compact heads, bright green color. Avoid wilted, tough, discolored heads</td>
<td>Crate - (Western)</td>
<td>Weight - 48 to 50 lb.</td>
<td>32 to 40 lbs</td>
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<td></td>
<td></td>
<td></td>
<td>Count - 2 doz. bunches</td>
<td></td>
<td></td>
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<tr>
<td>Brussels Sprouts</td>
<td>Should be fresh, green in color, hard compact heads of uniform size. Free from insects and decay.</td>
<td>Berry crate or qt.</td>
<td>Weight - appr. 30 lbs.</td>
<td></td>
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<tr>
<td>Cabbage</td>
<td>Kinds are Danish, white, red, and Savoy. Heads should be solid, firm, and heavy for size. Free from discoloration, decay, and spray residue.</td>
<td>Bag, barrel or half crate of varying sizes.</td>
<td>Weight - 80 lb.</td>
<td>Head - 2½ to 3 lb.</td>
<td>Raw - 16 lb.</td>
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<td></td>
<td></td>
<td>Crate (bushel)</td>
<td>Weight - 40 lb.</td>
<td>Each bunch - 1 doz. stalks</td>
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</tr>
<tr>
<td>Celtsuce</td>
<td>Cool season crop. Grows in spring &amp; fall, matures in 10-12 wk. Top cluster of leaves used as salads or cooked as greens. Stalk peeled &amp; served like asparagus.</td>
<td>Wooden drum</td>
<td></td>
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<tr>
<td>Product</td>
<td>Purchasing Guide</td>
<td>Usual type of</td>
<td>Contents of</td>
<td>Average Weight</td>
<td>Quantity for each 100 portions-A.F.Wt.</td>
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<tr>
<td>Carrots</td>
<td>Should be firm, fairly smooth, uniform size. Fresh green tops. (Average bunch contains 6 uniform medium-sized carrots.) The tops should be full length but not more than 20 inches.</td>
<td>Crate</td>
<td>Weight-85 lb.</td>
<td>1 lb.-3 medium</td>
<td>Raw - 18 lb. Cooked - 25 to 30 lb.</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Count=4,5, or 6 doz. bunch Topped-1½ bu.</td>
<td>1 lb. diced=3½ o.</td>
<td></td>
</tr>
<tr>
<td>Carrots-topped</td>
<td></td>
<td>Basket (bushel)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cabbage</td>
<td></td>
<td></td>
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<tr>
<td>Cauliflower</td>
<td>The flowerets of the head should be white, compact, and free from insect injury. Large percentage of waste results if flowers are rusty &amp; loose &amp; leaves tough and untrimmed.</td>
<td>Crate</td>
<td>Weight-56 lb.</td>
<td>Head - 1 to 3 lb.</td>
<td>56 to 60 lb.</td>
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<td></td>
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<td></td>
<td>Count=8 to 16 heads Av. 12 Trimmed-av.20 to 25 lb.</td>
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<tr>
<td>Cauliflower trimmed</td>
<td>Same as above</td>
<td></td>
<td>Wt. as desired</td>
<td></td>
<td>32 lb.</td>
</tr>
<tr>
<td>Celery</td>
<td>Should be tender, crisp, brittle, &amp; free from cracks. Size varies with variety &amp; is not necessarily an indication of quality. Stalks should be white or light green in color &amp; free from black rot and decay.</td>
<td>Crate</td>
<td>Count - 2½ to 10 doz. stalks</td>
<td>1 lb. - 3 o. chopped</td>
<td>Raw - 8 stalks Cooked - 16 to 20 stalks</td>
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<tr>
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<tr>
<td>Celery Cabbage</td>
<td>Should be firm, well-bleached, crisp, sweet, tender. Head 18 to 20 in. long.</td>
<td>Crate</td>
<td>Weight- 60 to 85 lb.</td>
<td></td>
<td>Raw- 12 heads Cooked - 20 heads</td>
</tr>
<tr>
<td>Corn, green</td>
<td>Ears should be well formed, free from disease, insects, &amp; insect injury. Husks fresh</td>
<td>Crate</td>
<td>Count- 5, 6, &amp; 12 doz.</td>
<td>100 ears</td>
<td></td>
</tr>
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<td>Product</td>
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<tr>
<td>Corn, green cont.</td>
<td>and bright green in color. Cobs well filled with plump &amp; milky kernels. Corn loses flavor rapidly after being picked.</td>
<td>Bag</td>
<td>Weight - 35 lb.</td>
<td>Count - 36 ears</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basket (bushel)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumbers</td>
<td>Should be firm, smooth, regular in shape &amp; green for slicing. 6-9 in. long. Avoid those conical in shape.</td>
<td>Basket (bushel)</td>
<td>Weight - 48 lb.</td>
<td>1 1 lb. - 26 slices</td>
<td>10 to 12 cucumbers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Carton</td>
<td>Count - 50 to 60</td>
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<tr>
<td>Eggplant</td>
<td>Should be heavy for size, firm, glossy surface. Deep purple color usually preferred. Desirable size not less than 4 in. in diameter.</td>
<td>Crate</td>
<td>Count - 24 to 30</td>
<td></td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Crate or hamp-er (bushel)</td>
<td>Weight - 50 lb.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Barrel</td>
<td>33, 150 lb.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endive</td>
<td>Leaves should be narrow, curled, leathery, crisp with centers blanched to delicate white. Escarole leaves large, broad with thick white midrib.</td>
<td>Hamper</td>
<td>Weight - 20 lb.</td>
<td>Count - 4 doz.</td>
<td>Salad - 16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Crate</td>
<td>Weight - 65 lb.</td>
<td>Count - 5 doz.</td>
<td>Garnish - 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Crate</td>
<td>Weight - 65 lb.</td>
<td>Count - 5 doz.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basket</td>
<td>Weight - 35 lb.</td>
<td>Count - 35 heads</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE I CONTINUED:

**GUIDES FOR THE PURCHASING OF FRESH VEGETABLES**

<table>
<thead>
<tr>
<th>Product</th>
<th>Purchasing Guide</th>
<th>Usual type of container</th>
<th>Contents of container</th>
<th>Average weight or size</th>
<th>Quantity for each 100 portions - A.P. Wt.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lettuce cont.</strong></td>
<td>Leaf: Curled or smooth leaf, usually highly colored.</td>
<td>Bulk-pound</td>
<td>Weight: 5, 10, 15 lb.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mushrooms</strong></td>
<td>Stems should not be more than 1 in. long. Should be free from disease injury. Shape, size, and color vary with variety &amp; are not indicative of quality.</td>
<td>Climax basket, Paper carton</td>
<td>Measure: 4 qt., Weight: 3 lb., Wt.: 1 lb., 2 lb.</td>
<td>1 lb., 2 lb., 3 lb., 4 lb.</td>
<td>Sauce to 1 gal., Meat: 10 lb.</td>
</tr>
<tr>
<td><strong>Okra</strong></td>
<td>Pod should be brittle, fresh, tender, &amp; bright green in color. Average length 2 to 4 in.</td>
<td>Small basket, Bushel basket</td>
<td>Weight: 4 to 5 lb., Wt.: 20 to 25 lb.</td>
<td>2 lb. to 3 lb.</td>
<td>1 gal.</td>
</tr>
<tr>
<td><strong>Onions</strong></td>
<td>Dry: Mature, uniform size, one variety only in each container. Shape &amp; color characteristic of variety. Free from soft rot, doubles, seed stems, &amp; damage caused by dirt, disease, or mechanical means. Green: Tops fresh, green, free from damage. Bulbs smooth, firm, crisp, well-blanch'd. Desirable size, max. 1 inch in diameter.</td>
<td>Sack, Crate</td>
<td>Weight: 50, 100 lb., 1 bu.</td>
<td>1 lb., 4 to 5 lb., 6 lb.</td>
<td>25 lb.</td>
</tr>
<tr>
<td><strong>Parsnips</strong></td>
<td>Should be firm, regular in shape &amp; smooth. Medium size preferable as large roots are usually fibrous with woody cores. Winter vegetable, best flavor after exposure to low temperature. Freezing does not injure.</td>
<td>Basket, hamper (bushel), Sack</td>
<td>Weight: 50 lb., 100 lb., 1 lb., 3 to 5 lb.</td>
<td></td>
<td>30 lb.</td>
</tr>
<tr>
<td>Product</td>
<td>Purchasing Guide</td>
<td>Usual type of container</td>
<td>Contents of container</td>
<td>Average weight or size</td>
<td>Quantity for each 100 portions-A.P.Wt.</td>
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<tr>
<td>Peas</td>
<td>Should be fresh, tender, with firm pods, well filled. Bright green color. Free from decay, mildew, and excessive moisture. Shelled peas should crush easily.</td>
<td>Hamper, basket (bushel) Crate</td>
<td>Weight- 28 to 32 lb. 45 lb.</td>
<td>1 bu.-7 to 8\frac{1}{2} qt. shelled 1 bu.-1 c. shelled</td>
<td>50 lb. In pods</td>
</tr>
<tr>
<td>Peppers</td>
<td>Should be smooth, glassy, firm, and crisp with thick fleshy walls, free from insect &amp; disease injury.</td>
<td>Hamper (bushel) Crate</td>
<td>Weight- 25 lb. Wt.-40 lb. approx. 160 pep.</td>
<td>1 bu.-approx. 125 peppers</td>
<td></td>
</tr>
<tr>
<td>Potatoes</td>
<td>Should be fresh, smooth, free from blemish &amp; sunburn as indicated by green color on surface. Medium uniform size. Shallow eyes, no sprouts.</td>
<td>Bag Box Basket (bushel) Barrel</td>
<td>Weight-100 lb. Count-60,70,80 Weight-60 lb. Wt.-180,165, 180 lb.</td>
<td></td>
<td>30 lb.</td>
</tr>
<tr>
<td>Radishes</td>
<td>Should be well formed, firm, tender, fresh, and free from damage caused by growth cracks, dirt, and insects. Tops should be free from dirt and damage caused from decay, insects, or mechanical means.</td>
<td>Barrel Basket (bushel) Crate</td>
<td>Count- 500 bunches 90-100 bunches 100 bunches</td>
<td>2 bunches-12 to 24 bunches</td>
<td>20 bunches</td>
</tr>
<tr>
<td>Spinach</td>
<td>All varieties, whether crinkly or flat-leaf, should be fresh, crisp, &amp; rich green in color. Short tender stems. Both leaves &amp; stems free from disease, insects, &amp; soil.</td>
<td>Round-stave basket Basket (bushel) Barrel Crate</td>
<td>Weight-8 to 10 lb. -18 lb. -40 lb. Count- 3 to 5 doz.</td>
<td></td>
<td>36 lb.</td>
</tr>
</tbody>
</table>
| Product     | Purchasing Guide                                                                 | Usual type of container | Contents of container | Average weight or size | Quantity for each 100 portions or size-
A.P.Wt. |
<table>
<thead>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Squash</td>
<td>Many varieties classified as summer &amp; winter squashes. Winter squashes generally large, firm, yellow-fleshed &amp; of various shapes &amp; sizes. Summer squashes usually small; soft, firm, texture; light yellow-and white-fleshed.</td>
<td>Barrel (Hubbard)</td>
<td>Weight- 100 lb.</td>
<td></td>
<td>20 to 24 lb.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hamper (summer)</td>
<td>37 lb.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet potatoes</td>
<td>* Dry Flesh: Big Stem, -Jersey Little Stem - Jersey Yellow Jersey Moist Flesh or &quot;yams&quot;: Nancy Hall, Puerto Rico U.S. Grades No. 1, No. 2, &amp; Jumbo should have clean roots, free from decay, growth cracks, frost, insects or disease injury. Dry varieties usually small, chunky, &amp; uniform in size. Flesh yellow. Moist varieties irregular in size &amp; shape, usually large. Flesh dark yellow to orange.</td>
<td>Hamper (bushel)</td>
<td>Weight- 55 lb.</td>
<td>1 lb. -2 to 4</td>
<td>30 lb.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Crate (Southern) (bu. to 5 peck) Round-crate basket (bushel)</td>
<td>- 50 lb.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Barrel</td>
<td>- 150 lb.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tomatoes</td>
<td>Mature, not overripe, smooth, firm, thick-meated with minimum number of seeds. Free from decay or other disease or injury.</td>
<td>6-basket carrier (6-4 qt. tills)</td>
<td>Count-72,84,96, 108,120,144, 162,180</td>
<td>1 lb.- 3 to 4</td>
<td>Whole-36 lb.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-basket flat (4-3 qt. tills)</td>
<td>Count-36,40, 48,56,60,72, 80,84,98,96</td>
<td></td>
<td>Sliced- 25 lb.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lug (Cal.&amp; Mex.) Weight-28-30 lb. 6x6,6x6,6x7 3 layers</td>
<td>Count-90,108, 126-Wt.-63 lb.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basket (bushel)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product</td>
<td>Purchasing Guide</td>
<td>Usual type of container</td>
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</tr>
<tr>
<td>Turnips</td>
<td>Should be firm, fairly smooth, free from damage caused by decay, insects, or growth cracks. The tops should be fresh and full sized or cut back to not less than 6 inches in length. Winter turnips are always topped.</td>
<td>Basket (bushel)</td>
<td>Weight - 50 lb.</td>
<td>30 lb.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Sack</td>
<td>100 lb.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Crate</td>
<td>76 lb.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Count - 4, 6 doz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Cress</td>
<td>Perennial water plant. Bright green leaves and crisp stems of piquant flavor. Highly perishable.</td>
<td>Doz. bunches</td>
<td></td>
<td>Garnish - 12 bunches</td>
<td></td>
</tr>
</tbody>
</table>
Trucks and trains delivered the produce to the wholesale market district. There the produce was stored in wholesale market houses, and a display was set up of the produce of representative cases.

The buyer from the Army Commissary Quartermaster Corps came into the wholesale market getting bids for the produce he planned to order. They discussed prices and after getting their prices he went to other dealers—to get comparative bids. After the buyer made his decision he returned to the wholesale market and left his order with the market where he planned to buy produce. There might be eight or ten different dealers who would be delivering purchased produce.

The buyer went to the warehouse whose owner had the Army transportation contract. The transportation facilities were large, refrigerator, trailer trucks. The federal inspector was also there. All produce must pass inspection according to U.S.D.A. standards. Usually Grade A was purchased.

The inspector "spot" inspected. This was a method of inspecting produce at random to prevent unscrupulous dealers from putting out (for display) their best produce, keeping inferior quality in the background and which might be used later to fill orders where higher quality produce was purchased. For example in the case of celery, he inspected a representative number of cases. All produce not passing this inspection is rejected and must be taken back to wholesale markets to be resold.

If the produce was passed, it was loaded on trucks and sealed and sent on its way to Army commissaries. In case of transfer, it was also
inspected again at the place of transfer or where unloaded. This inspector was an Army Quartermaster Commissary Officer.

Transportation trucks delivered produce at the station by 10:00 A.M. After delivery to the commissary, each mess hall sent a truck to pick up its produce; and the produce was again inspected after reaching the mess kitchens.

Dried and canned produce was ordered by bid method from wholesale stores and manufacturers. Samples were sent for approval and after specifications were satisfied the orders were given according to the lowest bid.

Frozen food was purchased by the bid system. It was inspected when purchased and again on delivery at the commissary stores. Sometimes it was purchased directly from local refrigerator locker sales stores and was inspected when delivered. Prices, grades, and quantity of produce were discussed and specified when purchases were made. If food was not as represented it was returned to dealers.

Special attention was given to packaging produce to be shipped overseas to tropical climates, such as air tight and moisture proof packages to protect perishable food.

Air conditioning constantly kept low temperatures to protect produce from heat and humidity. Palatizing was used to permit better air circulation in most commissary store houses. Air circulation kept perishable produce in good condition.
PREFERENCE FOR VEGETABLES SERVED IN ARMY HOSPITALS AND MESS HALLS

While stationed at Pendleton Field, Oregon, the writer made a survey to learn what preferences patients and service men had for fresh vegetables cooked or served raw in salads or relish plates. The food survey was made to learn something about preferred foods, and to prepare meals in such a way as to satisfy the service men and prevent waste.

Raw onions and raw green peppers were not very popular in salads unless served in very small quantities. If raw vegetables were attractively arranged, clean (well washed), fresh, and crisp, there was little or no preference for any particular vegetable. Mixed vegetable salads were eaten well, and carrot strips served with celery was one of the most popular relish plates.

Some of the service men explained that they preferred raw to cooked vegetables in that "the colors were retained, there were no bad flavors, the nutritive value had not been lost to any great extent, and the taste was better."

A hundred or more trays were checked each time the survey was made. Sometimes the nurses' dining room, when there were guests enough to make up the required number, was used for a survey. The results were similar.

Preference for frozen vegetables was as follows:

1. Peas
2. Corn
3. Asparagus
4. Lima beans

Other frozen vegetables were eaten and liked, but not as well as
the four listed. Zucchini, some greens, spinach, broccoli, and string beans were next on the preferred list.

The reasons for preferring the four listed were that "they had the appearance and taste of fresh vegetables and possessed most of the original elements."

When frozen peas and asparagus were cooked and served in salads, they were very acceptable.

Canned vegetable preference included:

1. Peas
2. Tomatoes (Served iced were well liked and eaten better than stewed hot tomatoes.)
3. Beets and corn
4. Asparagus
5. Carrots and peas
6. Lima beans
7. Spinach

When raw vegetables were served in salads with canned vegetables, the preference was changed. String beans, shredded beets, and peas added to a raw vegetable salad of lettuce, celery, and a small quantity of shredded green pepper was a popular salad. A salad made entirely of canned vegetables was not popular.

Fresh vegetable preference:

1. Lettuce - Peas
2. Celery
3. Tomatoes - Cabbage
4. Corn
5. Radishes
6. Asparagus
7. Carrots
8. String beans
9. Green onions
10. Yellow turnips
11. Cauliflower
12. White turnips
Comments on fresh vegetable preference: "Turnips darkened when cooked and flavor was strong." They might "like cabbage and cauliflower better if cooked just a short time." They objected "to strong flavors, odors, lack of freshness, over-cooking of some vegetables, having to wait in line while meal was served to others as the cooking lost its flavor and attractiveness."

Further causes for their prejudice regarding some vegetables were "not having had a variety of vegetables at home, not having learned to appreciate a variety, and having eaten badly prepared or poorly seasoned food."

Dehydrated vegetable preference:

1. Sweet potatoes
2. Creamed cabbage
3. Harvard or pickled beets
4. Dehydrated carrots with frozen or fresh peas
5. Buttered onions

Dehydrated vegetables were used for feeding troops overseas because the shipping weight was far below that of the original food. They were trimmed and otherwise cleaned, saving time and labor in preparation for the table, which was very important to the army overseas. Knowing that all personnel concerned with the preparation and serving of food in Army mess halls and hospitals needed to be familiar with techniques of cooking these foods in the most attractive, nutritious, tasty, and efficient way, a survey was made to find out the preferences for dehydrated vegetables.

The Medical Officer in charge of the Station Hospital at Pendleton Field, Oregon, secured from the Quartermaster's Commissary several
five-pound containers of carrots, potatoes, beets, onions, cabbage, and sweet potatoes for experimental use.

Carrots were served with fresh and frozen peas with fairly good results -- first using one-third carrots to two-thirds peas, later serving them one-half and one-half. Carrots were added to beef and chicken broth with fresh and canned vegetables. The results were satisfying.

Cabbage was served as slaw, creamed, and buttered. Its consumption was about 72%.

Irish potatoes were served with fresh vegetables in soup, mashed, and served escalloped using grated cheese and bread crumbs for topping. Cream of potato soup was also quite satisfactory.

Beets were more popular when served pickled or Harvard. Buttered beets were not very popular because of their flavor.

Sweet potatoes were fairly well received if served with butter, raisins, and brown sugar.

Onions were added to soups, dressing, escalloped dishes, creamed, and buttered, and were eaten well by those who liked fresh cooked onions.

It was not necessary to serve dehydrated vegetables regularly in the United States, as there were large supplies of frozen and fresh vegetables obtainable in most camps and fields. Dehydrated and canned foods were sent overseas where they were urgently needed as fresh, frozen, or canned vegetables were hard to obtain because of transportation and the lack of facilities to care for those that were perishable.
FRESH VEGETABLES

Fresh vegetables were of great importance in the Army diet because of their health protective value. Most fresh vegetables are best in appearance and flavor and richest in vitamin value when freshly gathered. Celery, cauliflower, cucumbers, sweet corn, lettuce, lima beans, radishes, string beans, and tomatoes are included in this group. Vegetables which were kept on hand for longer periods of time without harm were cabbage, carrots, onions, potatoes, and turnips.

Raw vegetables were considered a better source of vitamins than cooked ones, but cooked vegetables could be protected from heavy losses if they were not over-cooked.

Fresh vegetables frequently served in the Army mess were: Asparagus (both white and green--medium and small stalks were used as the large thick stalks were woody and tough), lima beans (in pods or hulled), string beans, beets, broccoli, cabbage (red and green), carrots, cauliflower, celery, corn (sweet corn and young tender field corn), cucumbers, egg plant, endive, lettuce (leaf and head), okra, onions (young green and mature), parsley, parsnips, peas, peppers, potatoes, sweet potatoes, pumpkin, radishes, spinach, squash, tomatoes, and turnips (white and yellow).

The methods of cooking vegetables have a decided effect, either good or bad, on color, odor, flavor, and nutritive value. In some vegetables one method would preserve all these qualities, by cooking as short a time as possible. Vegetables were usually prepared by one of
four methods—boiling, baking, frying, and pickling. Seasoning added variety. Sometimes butter was used; but bacon, vinegar, sugar, or salt and pepper were regularly used. (5)

Garnishing is one of the best ways of making foods attractive. Green pepper, pimento, parsley, celery, and radishes have been used for garnish.

Some Army rules for vegetable cookery:

(1) Use fresh vegetables as soon after delivery as possible.

(2) Handle very carefully for bruising causes rapid loss of vitamins.

(3) Keep vegetables crisp and cool until time to cook.

(4) Shred or chop just before they are to be cooked.

The following methods of preparation were used by Army cooks at Kelly Field, Texas, and Pendleton Field, Oregon.

All raw vegetables must be cleaned well, should be tender, crisp, and cool before preparing for cooking or for serving raw.

Cabbage should be shredded, cauliflower should be separated into flowerets and quartered, and onions or brussels sprouts—if old—should be slit crosswise at the bud end. In spite of the fact that cut ends means greater loss in nutritive value, we shorten the time of cooking and prevent the development of bad taste and odor. In cutting turnips, parsnips, carrots, and sweet potatoes into convenient pieces for cooking, we cut lengthwise rather than crosswise of the fibers since by this method less nutrients are lost. Do not let cooked vegetables stand in
water because it destroys vitamins.

There is a loss of weight in preparation of vegetables and allowances should be made for this loss when purchasing produce.

The preparation of vegetables, including preliminary procedure and cooking processes, have a great deal to do with nutritive value, attractiveness, palatability, and color of the cooked product. Vegetables may be of the best quality when purchased but prolonged over-cooking, water soaking, or slow cooking in cold water cause the loss of food values, flavor, color, and beauty. The product becomes tasteless or develops a strong unpleasant taste and odor.

The green pigment is very readily destroyed by cooking conditions. Heat and acid are its enemies. Long cooking, pressure cooking, covered vessels, and small amounts of water all bring about the destruction of color. To preserve color of green vegetables we should drop them into rapidly boiling water and cook uncovered for a very short time. There should be considerably more water used than is usually required to cook them.

The cooking time may be shortened by having water boiling rapidly when the vegetables are added to the water and by keeping it boiling rapidly during the cooking process.

One to one and one-half teaspoons of salt should be added to every quart of cooking water. Cooking with salt helps to retain the color of the green vegetables and improves the flavor.

Spinach can be cooked in four to five minutes, using only the water on the leaves left from washing. There is no advantage in cooking spin-
ach in a pressure cooker, as it does not require long cooking. Removing the stems from spinach cuts the cooking time in half. (There is little food value loss in removing stems.)

String beans require longer cooking than spinach, and there is a loss of color when they are cooked.

Asparagus is usually cooked longer than necessary, because the butts of the stalk require longer cooking to be tender. The way to prevent over-cooking of this vegetable is to stand the stalks in bunches with butt ends down in the water, tips above the water line, a lid put on, and cooked. When the butts are quite tender, then the stalks may be laid flat to finish cooking. Five or ten minutes of additional cooking will cook the tips well.

Cabbage can be cooked to retain its delicate, pleasing flavor and light green color if the vegetable is dropped into rapidly boiling water and kept boiling rapidly until tender. Long cooking causes strong flavor, loss of color, and a disagreeable odor which penetrates to the furthermost corners of the house and lingers for some time. It has become unpopular as a vegetable to serve in restaurants or public eating places. It is not the fault of the vegetable, but the way in which it has been cooked.

Brussels sprouts is a member of the cabbage family, and its cooking processes have been similar to cabbage with similar results. In the raw state the tissues may be thought of as being made up of tiny compartments—the acid being in one, and the chlorophyll, along with certain salts, in another set. When the vegetables are cooked the acid and
chlorophyll tend to run out of their tiny compartments and come to-
gether. If we do not find means of diluting or neutralizing the acid
the chlorophyll will be destroyed.

The coloring matter of bright yellow vegetables, such as car-
rots, squash, and sweet potatoes, belong to a class of pigments
called "carotinoids." These carotinoids are invariably present along
with chlorophyll in green vegetables on the average proportion of 3.5
parts chlorophyll to 1 part carotinoids. It is only when the green
disappears that the yellow shows up. The bronze-green color remains
when a large part of chlorophyll is destroyed.

Yellow vegetables can be cooked in a steamer in a small amount
of water or in a pressure cooker without damaging the color.

Red vegetables are rare and include radishes, beets, and red
cabbage. (The last should be classed as purple rather than red.)
The coloring matter of these vegetables belongs to a group of pigments
called "anthocyanins", which are also responsible for most of the col-
or of red, purple, and blue flowers and fruits. Their distribution
in nature is so wide that they deserve more attention than their lim-
it vegetable occurrence would warrant.

In cooking beets, we find, as we might expect from the behavior
of their water extract, that the acidity of their own juice is enough
to maintain the color. As long as we do not pare beets or cut them
up, we can cook them in water without adding extra acid and still
have a good color. They can be steamed or cooked in pressure cookers
without danger of loss of color and with assurance of preservation of
both flavor and nutrients. The cooking method for red vegetables is just the opposite to those for green.

A tart apple may be added to red cabbage to add acid. The apple should be pared and sliced. Four or five tablespoons of vinegar could be added to the cooking water.

**White vegetables:** Irish potatoes and white onions do not have color. A little alkali in tap water may cause a pronounced yellowing color to yellow-skinned onions. Usually the vegetable and cooking water turn yellow in cooking. White turnips and cauliflower darken by over-cooking and develop a strong taste and odor.

It is possible that in long cooking the iron and sulphur of the vegetable have a chance to get together and form a dark compound. White vegetables do not darken unless they are over-cooked. By cooking these vegetables only until they are tender can the unpleasant color and taste be avoided.

**(5)**

**Serving fresh vegetables:** Most vegetables, if well prepared and seasoned, may be served raw. These include salad greens, lettuce, cabbage, spinach, celery, endive, tomatoes, cucumbers, peppers, cauliflower, carrots, radishes, and turnips.

Cooked (well chilled) vegetables, such as, asparagus, artichokes, string beans, peas, lima beans, potatoes, carrots, beets, and cauliflower, may be served in combination with raw vegetables or alone.

Buttering, creaming, and candying are popular ways of serving vegetables. Browning is a method of seasoning parsnips.
The following tables pertain to the percentage of waste in vegetables as purchased and cooking losses.

**TABLE II**

PERCENTAGE OF WASTE IN VEGETABLES AS PURCHASED*  

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Average Percentage Waste</th>
<th>Range in Percentage Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beans, string</td>
<td>10.48</td>
<td>6.00 - 24.81</td>
</tr>
<tr>
<td>Cabbage</td>
<td>28.08</td>
<td>12.79 - 45.55</td>
</tr>
<tr>
<td>Carrots</td>
<td>21.42</td>
<td>11.00 - 34.90</td>
</tr>
<tr>
<td>Cauliflower, untrimmed</td>
<td>72.89</td>
<td>52.76 - 86.86</td>
</tr>
<tr>
<td>Cauliflower, trimmed</td>
<td>53.58</td>
<td>38.00 - 68.41</td>
</tr>
<tr>
<td>Celery</td>
<td>38.55</td>
<td>28.75 - 44.44</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>25.54</td>
<td>20.54 - 31.25</td>
</tr>
<tr>
<td>Onions</td>
<td>6.85</td>
<td>1.95 - 12.25</td>
</tr>
<tr>
<td>Peppers</td>
<td>28.11</td>
<td>12.50 - 41.46</td>
</tr>
<tr>
<td>Potatoes</td>
<td>27.67</td>
<td>9.46 - 45.15</td>
</tr>
<tr>
<td>Spinach</td>
<td>37.78</td>
<td>13.49 - 73.91</td>
</tr>
<tr>
<td>Sweet Potatoes</td>
<td>26.15</td>
<td>9.98 - 33.73</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>14.46</td>
<td>5.86 - 50.21</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Vegetable and Method</th>
<th>Loss of Total Nitrogenous Matter</th>
<th>Loss of Total Mineral</th>
<th>Loss of Total Sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potatoes peeled and soaked several hours before cooking</td>
<td>52</td>
<td>38</td>
<td>--</td>
</tr>
<tr>
<td>Potato started to cook in cold water</td>
<td>16</td>
<td>19</td>
<td>--</td>
</tr>
<tr>
<td>Potato, cooking started in boiling water</td>
<td>8</td>
<td>About 19</td>
<td>--</td>
</tr>
<tr>
<td>Potato, cooked in skin</td>
<td>Trifling</td>
<td>Trifling</td>
<td>--</td>
</tr>
<tr>
<td>Carrots cut in small pieces</td>
<td>42</td>
<td>47</td>
<td>26</td>
</tr>
<tr>
<td>Carrots cut in medium pieces</td>
<td>Less than 42</td>
<td>Less than 47</td>
<td>26</td>
</tr>
<tr>
<td>Carrots, large pieces</td>
<td>20</td>
<td>25 plus</td>
<td>16</td>
</tr>
<tr>
<td>Cabbage, started in hot water</td>
<td>About 33</td>
<td>About 33</td>
<td>--</td>
</tr>
<tr>
<td>Cabbage, started in cold water</td>
<td>About 50</td>
<td>About 50</td>
<td>--</td>
</tr>
</tbody>
</table>

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### TABLE IV

**COMPARISON OF COOKING LOSSES IN PARED AND UNPARED POTATOES (10)**

<table>
<thead>
<tr>
<th></th>
<th>Dry Matter</th>
<th>Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potatoes pared</td>
<td>4.2</td>
<td>18.5</td>
</tr>
<tr>
<td>Potatoes unpared</td>
<td>0.2</td>
<td>2.2</td>
</tr>
</tbody>
</table>

### TABLE V

**SIZE OF PIECES OF CARROTS AND LOSSES IN COOKING WATER (10)**

<table>
<thead>
<tr>
<th>Size of Pieces</th>
<th>Dry Matter</th>
<th>Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small pieces</td>
<td>30.5</td>
<td>49.4</td>
</tr>
<tr>
<td>Medium sized pieces</td>
<td>21.7</td>
<td>45.3</td>
</tr>
<tr>
<td>Large pieces (started in cold water)</td>
<td>20.2</td>
<td>29.3</td>
</tr>
</tbody>
</table>

### TABLE VI

**LOSSES IN IRON IN COOKING (10)**

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Percentage Loss of Iron</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinach</td>
<td>43</td>
</tr>
<tr>
<td>String Beans</td>
<td>39</td>
</tr>
<tr>
<td>Navy Beans</td>
<td>32</td>
</tr>
<tr>
<td>Peas</td>
<td>36</td>
</tr>
<tr>
<td>Potatoes</td>
<td>15</td>
</tr>
<tr>
<td>Vegetable</td>
<td>Method of Cookery</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>String beans</td>
<td>Boiled - moderate am't water</td>
</tr>
<tr>
<td></td>
<td>Boiled - large amount water</td>
</tr>
<tr>
<td></td>
<td>Steamed</td>
</tr>
<tr>
<td></td>
<td>Pressure cooked</td>
</tr>
<tr>
<td>Cabbage</td>
<td>Boiled - moderate am't water</td>
</tr>
<tr>
<td></td>
<td>Boiled - large amount water</td>
</tr>
<tr>
<td></td>
<td>Steamed</td>
</tr>
<tr>
<td></td>
<td>Pressure cooked</td>
</tr>
<tr>
<td>Carrots (unscreaped)</td>
<td>Boiled</td>
</tr>
<tr>
<td></td>
<td>Steamed</td>
</tr>
<tr>
<td></td>
<td>Pressure cooked</td>
</tr>
<tr>
<td>Potatoes (pared)</td>
<td>Boiled</td>
</tr>
<tr>
<td></td>
<td>Steamed</td>
</tr>
<tr>
<td>Approximate average of 16 vegetables</td>
<td>Boiled - moderate am't water</td>
</tr>
<tr>
<td></td>
<td>Boiled - large amount water</td>
</tr>
<tr>
<td></td>
<td>Steamed</td>
</tr>
<tr>
<td></td>
<td>Pressure cooked</td>
</tr>
</tbody>
</table>
The marketing centers were in a position to purchase frozen vegetables which were currently available in large quantities, and therefore, quick frozen vegetables constituted an important part of our vegetable supply. Full use was made of quick frozen vegetables at camps, fields, and hospitals when fresh vegetables were not available in the large quantities needed. Canned vegetables were kept at a minimum for home use.

The quartermaster arranged with the market centers in the locality of the camp or field to obtain information on prices and amounts available, so that substitutions could be made without increased cost.

Some advantages of frozen vegetables:

1. They had the appearance and taste of fresh vegetables.
2. They possessed most of their original vitamins and minerals. (Fresh vegetables held too long in storage, too, may lose much of their vitamin content.)
3. Only edible portions were purchased, so they were economical.
4. The conveniently sized package was easy to handle.
5. They were easy to prepare.
6. They were uniform in size and quality affording control of size of serving.

The frozen foods most commonly used in the Army were:

1. Peas
2. Asparagus
(3) Broccoli
(4) Corn
(5) Green beans
(6) Lima beans
(7) Spinach
(8) Brussels Sprouts
(9) Wax beans
(10) Cauliflower

For the purpose of assisting less experienced cooks, the following information is given concerning storage, cooking, and serving frozen vegetables.

Frozen vegetables are subject to dehydration unless very well packaged. Moisture proof wrappings, a film of ice, or oil will protect against dehydration.

The following are some suggestions when buying packaged frozen foods:

(1) Packaging must protect food from dehydration, oxidation, loss of flavor and odor, acquisition of off-flavors and odors, leakage, and loss of vitamins.

(2) It must be moisture proof, juice proof, and stain proof.

(3) It must permit an economical use of storage space.

Because of the ease in preparing vegetables for quick freezing, there will be more interest taken in saving small quantity garden produce. Frozen food is a time-saver in most homes and institutions.

Two or more compartments are desirable in the home freezing cabinet--freezing and storage compartments. Cold controls indicate the temperature required for storage or freezing.

Methods of Handling for Frozen Foods for Army Use

Frozen vegetables may be kept frozen until the cooking commences
or they may be allowed to thaw partially immediately before they are cooked. In no case should they be allowed to warm slowly, because undesirable changes to flavor and texture occur. Completely defrosted vegetables show greater shrinkage when cooked and are less attractive than are those cooked when partly frozen.

The changes that occur in frozen food are not unlike those which may be expected in fresh food from the standpoint of spoilage. When thawed or defrosted they will spoil as readily as fresh food and possibly even faster. Consumers must be educated in this respect as many think thawed food will keep a long time if container is not opened.

If such vegetables as broccoli and asparagus are partially thawed, they can be broken apart sufficiently to avoid having the outside of the block over-done while the center is cold. Peas and lima beans soon separate into units after starting to cook, so it is not necessary to defrost them. Spinach may be cut into 2 or 3 inch squares before it is put on to cook. The cob, as well as the kernels, of corn on the cob should be thawed before the cooking is started. If the whole ear is thawed before cooking, the cob will be warm without the kernels being over-cooked. Otherwise the cob may be icy when the corn is served.

Cookery of Frozen Food

Frozen vegetables should be cooked for the shortest time required to secure a desirable product. Frozen vegetables have been softened by blanching and cooking and it is very easy to over-cook them. They require from one-half to two-thirds the cooking time for fresh vegetables;
but like fresh vegetables the cooking time varies for the same kind of vegetable, depending on such factors as maturity, size, variety, and the length of time it stood between the garden and the blanching and freezing processes.

The color of frozen green vegetables is stabilized and they can be cooked successfully in ways that fresh green vegetables cannot. Fresh broccoli, for instance, is not well liked when cooked in a pressure sauce pan; frozen broccoli is acceptable.

Since flavors may go into the cooking water and some off in steam, some people prefer the milder flavors of Brussels sprouts, broccoli, and cauliflower by cooking them in from one to two quarts of water for every pound of vegetable, with the lid off, and for a short time. Long cooking of strong-juiced vegetables may give unpleasant flavors and digestive upsets.

To keep bright colors:

1. Frozen green vegetables, because the pigment has been stabilized, may be cooked in a minimum amount of water with the cover on or they may be cooked in a pressure sauce pan. The color of many green fresh vegetables, however, is better retained when they are cooked in more water and with the cover off. Short-time cooking is the better way.

2. Red vegetables should be cooked with the cover on. A little acid, such as vinegar, may be added to red beets. This helps to keep the red color and adds to the flavor.

3. In yellow vegetables the color is stable and requires no attention.
White vegetables should not be cooked in water in which soda has been added. Strong alkali turns white vegetables yellow; very hard water has the same effect.

The following is a summary on how to cook frozen foods:

1. Cook for as short a time as possible.
2. Use as little water as possible. Do not have more than one to two tablespoons left when vegetables are done. The frost in some frozen vegetables may form sufficient liquid.
3. Have the water boiling when the vegetable is added. Add the vegetable to the water, not the water to the vegetable.
4. A tightly fitting cover is necessary when a small amount of water is used or the vegetable will not be uniformly cooked and is likely to burn.
5. Bring the water back to the boiling point as quickly as possible after the vegetable is added—within two minutes if the vegetable is thawed, and within three to six minutes if it is frozen.
6. Do not add soda.
7. Never allow a vegetable to boil violently.
8. Do not stir since air may be stirred in, and it is destructive to some vitamins.
9. Cook in a pressure sauce pan or steam to decrease losses in water.
10. Serve the vegetable as soon as it is done.
Vitamin Retention in Frozen Foods

Quick freezing tends to protect the vitamin content of foods. While frozen and in a solid condition, foods are not subject to serious changes due to enzyme inactivation and to micro-organisms if the storage temperature is 0°F or below.

Ascorbic acid: Extensive researches have been carried out to determine the ascorbic acid (Vitamin C) content of the frosted vegetables which are packed on a large scale commercially. This work indicated that although the processes of preparing vegetables for freezing and cold storage cause some loss of this vitamin, there is less loss during the cooking of frozen than fresh vegetables. Frozen vegetables when served may be as rich in ascorbic acid as fresh vegetables.

Fellers and Stepat (1935) found that commercially frozen peas contained about 20% less ascorbic acid than the freshly harvested vegetable. Fresh peas lose Vitamin C during transportation and marketing; frozen peas were superior to many of those sold in retail markets.

Fenton, Tressler, and King (1936) found that freezing in itself did not cause any destruction of this vitamin.

Jenkins, Tressler, and Fitzgerald (1938) studying the changes in ascorbic acid content of peas during commercial operations incidental to the preparation for freezing and the freezing of peas observed a loss of 30% of the total amount present. A loss of 10% occurred during
blanching. Cooling and washing operations cause a rapid loss of Vitamin C.

Jenkins, Tressler, and Fitzgerald (1938) also studied the rate of loss of ascorbic acid from peas and other vegetables during long continued storage at various temperatures. No loss was observed in 9.5 months' storage at -40°F. At -18°F, a very slight loss was noted at the end of this period. At the two higher temperatures studied (±10°F. and ±16°F.), a rapid loss occurred.

Vitamin A potency of frozen vegetables and the effect of washing, blanching, cooling, and other treatments given vegetables preparatory to freezing on their Vitamin A content have been investigated several times. Using the bioassay method, Fellers, Young, Isham, and Clague (1943) found that frozen asparagus contains as much Vitamin A as the fresh product.

Fitzgerald and Fellers determined the carotene content of fifteen frozen vegetables and compared the results with the Vitamin A values for the fresh vegetables reported in the literature. They conclude: "It is apparent that freezing causes no measurable loss of Vitamin A if they are kept in the solidly frozen condition."

Experiments on spinach by DeFelice and Fellers observed that spinach after freezing contained only three-fourths as much carotene as the fresh vegetable.

Stimson, Tressler, and Maynard employed both chemical and bioassay methods and reported a loss of approximately 18% during preparation for freezing and storage of peas.
Zimmerman, Tressler, and Maynard noted no appreciable loss of carotene from green snap beans during blanching and other operations in preparation for freezing and during four months' storage at 0°F.

In 1941 Zimmerman, Tressler, and Maynard found that asparagus, broccoli, spinach, and green lima beans lost little or no carotene during preparation for freezing or freezing. Asparagus lost 40% of its carotene in six months, and green lima beans lost a similar amount in eleven months.

**Vitamin B₁:** Moyer (1942) found no loss of Vitamin B₁ either during the actual freezing itself or in the storage of peas and asparagus.

**Vitamin C:** Rose and Phipard compared quick frozen peas and lima beans with the same season's crop and found no difference in Vitamin C content, either in the raw or cooked state.

Fellers, Esselen, and Fitzgerald observed no loss of this vitamin on freezing peas, but reported 16% loss during the freezing and storage of lima beans. Frozen broccoli contained slightly more riboflavin than fresh broccoli, according to Conner and Staut (1941).

### When Vegetables are Frozen and Available

- **May** - Asparagus, Spinach
- **June** - Asparagus, Spinach, Turnip Greens, Peas
- **July** - Carrots, Kohlrabi, Peas
- **August** - Green Shell Beans, Snap Beans, Beets, Chard, Eggplant, Turnips
- **September** - Lima Beans, Carrots, Chard, Sweet Corn, Peppers, Winter Squash
October  -  Broccoli, Brussels Sprouts, Cauliflower, Kale, Squash, Beets, Greens

November  -  Broccoli, Brussels Sprouts, Kale, Beets

Preparing Vegetables for Freezing

1. Select a suitable fresh variety, correct maturity.

2. Speed of preparation and freezing.

3. Steam blanch, or in a few cases, water blanch at 212°F for 2-5 minutes. If the steam blanch is to be used, wash the vegetables thoroughly before blanching. Test for enzyme inactivation.

4. Chill in cold water, and if required, also in a blast of cold air.

5. Pack in suitable vapor proof, correct size containers.

6. Weigh and seal.

7. Freeze rapidly at sub-zero temperature.

8. Store at uniform temperature not higher than 0°F.

Packaged Frozen Food

Cartons, of 1-3 and 5 pound capacity, were of fiberboard, and lined with various transparent vapor proofed material. Treated paper cups were used for some frozen vegetables. They are less durable because of waste space.

Methods of Purchasing

Frozen food was purchased from the Quartermaster Commissary in large quantities, or local stores when supplies were low, so there would
be enough for all mess halls when they were served at the station or field.

Grades and standards were used in purchasing frozen food at the same level as fresh or other processed food. Market centers sold to the Commissaries and distribution was made from there to Mess Hall holding rooms. Transportation was made by covered trucks from market centers to commissaries, where the frozen produce was kept in locker rooms until distribution to the hospital or mess kitchens was requested.

**Experiments of Interest in the Preparation of Some Frozen Vegetables.** *(17)*

Methods of cooking frozen cut corn, corn on the cob, peas, green beans, asparagus, lima beans, spinach, broccoli, and cauliflower. Cooking and Scoring Methods.

Each vegetable was cooked by two methods: boiling and steaming.

In the boiling method the contents of one package (approximately 12 ounces) of the solidly frozen vegetables were put into sufficient boiling water to just cover the vegetables and were boiled slowly in an uncovered utensil for the number of minutes indicated in the discussion given later. The boiling period started when the water boiled the second time. The period from the time of entering the vegetable into the water until the boiling time was started was recorded as pre-cooking time.

The vegetables were drained immediately after cooking. The quantity of water used to cover the vegetables varied from 1 to 1 3/4 cups under conditions of study.
Steaming methods: The contents of one package of the solidly frozen vegetable were put into sufficient boiling water to supply steam throughout the entire cooking period. These vegetables were cooked in a tightly covered utensil.

Bogg's Experiments:

Cut corn was boiled 3, 5, 8, and 12 minutes, and it was steamed for the same period. The pre-cooking period for steaming was three minutes. All of the scorers preferred the steamed corn because it was sweeter. The scores indicated little difference in quality due to different periods of cooking. Five minutes was considered standard practice in the laboratory.

Corn on the cob was boiled 3, 5, 8, 12, and 15 minutes, and was steamed for the same period. The pre-cooking for steaming was six minutes. The corn on the cob was allowed to stand at room temperature for one hour in the package before cooking, otherwise the center of the cob was cold after cooking. Thawing was necessary in this study, because the vegetables were held at 0°F. Corn held in a home refrigeration for a few hours before cooking would be sufficiently thawed, and the holding room temperature could be omitted. The corn on the cob which was steamed for five minutes received the highest score. Steaming was preferred to all cooking periods, because the corn was sweeter. Cobs of the corn cooked for three minutes were cool, and when cooked for longer than five minutes were water-soaked.

Peas were cooked 4, 6, 8, 10, 12, and 15 minutes. The pre-cooking period for cooking was four minutes. In addition to steaming and the
standard boiling method, peas were boiled in the usual way; but at the end of the cooking period they were removed from the heat and allowed to stand in the cooking liquid for two minutes before drained. Six minutes was the preferred period of cooking, but scorers did not agree as to the best method of cooking. All who preferred boiling plus standing agreed that this method showed more plumpness, less wrinkling, and better color of peas; but the flavor was weak, the peas were not sweet, and were somewhat water-soaked. Steaming was preferred because the peas were sweeter, had better flavor, but were less attractive in appearance.

Green beans were boiled 8, 10, 12, 15, and 18 minutes, and they were steamed for the same periods. The pre-cooking period for steaming was four minutes. The high scores were about equally divided between the 12 and 15 minute periods, and no preference for steaming or boiling could be interpreted from the scores. The steamed beans received higher scores for flavor, but lower scores for sloughing and color than did the samples which were boiled. It might be best to cook by the boiling method in order to obtain the most attractive product possible, and to supplement the flavor with ham, bacon, or other suitable flavoring.

Lima beans were steamed 4, 6, 9, 12, 15, 20, and 25 minutes, and they were boiled for the same periods. The pre-cooking time for steaming was four minutes. All beans were Henderson Bush variety. The samples which were boiled for 20 to 25 minutes received the highest score. Shorter cooking periods were discarded because the Cotyledon texture was not acceptable. The flavor did not change a great deal with variation in cooking time, but the color was impaired with longer cooking
periods.

Asparagus was boiled 3, 5, 7, 9, and 11 minutes, and it was steamed for the same periods. The pre-cooking time for steaming was five minutes. The stalks were generally small, a few were medium; there were no large stalks included in this study. The scorers preferred 5 minutes of boiling for all sizes; with 7 minutes of cooking stalks became limp-looking, sloughed badly, and the color became yellowish.

Spinach was steamed 3, 5, 8, and 10 minutes, and it was boiled for the same periods. The pre-cooking period for steaming was six minutes. The spinach was thawed in the room temperature for one hour before it was cooked. Otherwise the outside leaves would have been boiled for several minutes before the center leaves thawed enough to break apart. The five-minute cooking sample received the highest score. Boiling was preferred to steaming, because the flavor was milder.

Broccoli was boiled 5, 7, and 9 minutes, and it was steamed for the same periods. The pre-cooking period for steaming was five minutes. The preference shown was for the five-minute boiling period. Flavor, appearance, surface, and color of steamed samples received lower scores than did those of boiled samples. Increased cooking period of from five to seven minutes lowered the score from very good to poor. Additional cooking caused a wilted appearance, grey color, and weak flavor.

Cauliflower was boiled 3, 5, 7, and 9 minutes, and it was steamed for the same periods. The pre-cooking period for steaming was for four minutes. The preference for the sample boiled five minutes was unanimous, although the samples steamed five minutes had better flavor. The boiled samples were less wilted and whiter than the steamed ones.
The appearance, color, and flavor of frozen vegetables change appreciably when the cooking period is extended only for a few minutes. The preference for any period of cooking vegetables is to some extent a personal choice of the taster, and cooking directions are limited by this factor. However, it is useful to have a guide. The shortest cooking period yielding an acceptable texture should be employed for frozen vegetables. This is necessary to retain excellent quality which can be obtained when vegetables are frozen.
CANNED VEGETABLES

Great improvements have been made in the methods of commercially canned vegetables. Larger varieties were available and nutritional values had been receiving more attention. From a standpoint of value, standard brands closely resembled the fresh product in color, food value, shape, and flavor. Canned products were an important part of the Army ration because they were nearly always available and did not require special storage attention as other types of processed foods. They provided a wide variety and were easily and quickly prepared because they had been previously cooked. Canned vegetables were considered splendid substitutes for fresh or frozen produce.

Commercially canned goods are generally graded for quality as follows:

**Grade A - Fancy:** Usually as nearly perfect as nature and canning processes will permit. Products of this grade would be tender, succulent, of good form, free from blemishes, and have a clear color.

**Grade B - Extra Standard:** This grade is nearly as good as Fancy. It may be the second grade packed, a lot that was packed for Fancy and because of some defect could not be graded as such. It may have two or three, but not all, of the following defects:

1. Lack of form symmetry.
2. Lack of color uniformity.
3. Lack of color depth found in Fancy.
4. Slight blemishes or spots.
(5) Larger pieces than Fancy.
(6) Not so tender or succulent as Fancy.
(7) Not quite so well trimmed as Fancy.
(8) Not quite so well flavored as Fancy.

**Standard:** This grade is good edible food, wholesome in every respect; but includes vegetables not considered fit for Fancy or Extra Standard grades because of (1) off-color, (2) excessive defects such as spots, blemishes, hard portions, lack of size uniformity, (3) lack of symmetry of pieces, (4) not well-trimmed, cored, or peeled. Peas of standard grade lack tenderness; corn may have the same defects; and tomatoes may lack color uniformity.

**Substandard:** This grade is usually an "off pack" -- an item intended for standard of higher grade and having been found inferior in quality after canning. It is usually flavorless, flat, tough, off-flavor, and unattractive in appearance. This grade represents a comparatively small proportion of commercially canned food.

(11)

When Army inspectors were considering an order of canned vegetables, the factors listed below were kept in mind.

(1) Availability
(2) Suitability
(3) Cost
(4) Climatic conditions
(5) Human and mechanical elements involved.

Inspection was made to determine whether or not supplies met contract requirements for quality, quantity, and condition.
After canned goods were purchased, it was necessary to provide suitable storage.

Canned vegetables were used extensively in Army messes, and it was important to select the grade most appropriate to the use.

The quality of foods put into cans is often better than that of fresh foods available during out-of-season months; the nutritive value was comparable with that of the fresh vegetable; the waste was negligible; and the degree of certainty of cost per serving was much less. The use of canned vegetables relieved the pressure of food preparation and provided a variety.

Close inspection of purchases were made to keep sellers rigidly mindful of the quality of goods ordered, and to maintain high standards of quality in the Army mess. Samples of canned vegetables were examined before purchasing, so that the buyer knew what certain trade names and standards indicated.

It was always necessary to buy U.S. Grade A or U.S. Grade B goods for the Army, except when U.S. Grade C or Substandard grades could be used to advantage. Whatever grade of goods was purchased, the product was to be delivered according to specifications given at the time of the purchase.

The Vitamin Value of Some Canned Vegetables (7) (23)

**Vitamin A**

Green asparagus -- excellent source

Green beans -- excellent source

Strained carrots -- excellent source
Pimento -- excellent source
Spinach -- excellent source
Turnip greens -- excellent source

**Vitamin B₁**
- Green beans -- good source
- Lima beans -- good source
- Turnip greens -- fair source

**Vitamin C**
- Tomato -- excellent source
- Turnip greens -- excellent source

**Vitamin F**
- Kale -- good source
- Tomato -- good source

**Vitamin K**
- Green leafy vegetables (especially spinach and kale) -- good source

### Canned Vegetables Rich in Iron
- Beans (kidney)
- Beans (lima)
- Beet greens
- Broccoli leaves
- Chard
- Kale
- Dandelion greens
- Lentils (dry)
- Soy beans
- Spinach
- Turnip greens
- Water cress
- Mustard greens

### Vegetables Rich in Protein
- Dried beans
- Dried peas
Canned Vegetables Rich in Calcium

Broccoli
Cabbage - Savoy
Cabbage - Chinese
Chard
Collards
Garden cress

Dandelion greens
Kale
Mustard greens
Tendergreens
Turnip tops
Water cress

Care should be taken in the heating of canned vegetables that the fully cooked food is not over-cooked.

Food Contamination

In canned goods no "swell", "springer", "flipper", or "leaker" should be accepted. If food is packed in glass, the cover and seam should be examined. Contents should be inspected for signs of spoilage; no spoiled product should be served. No reprocessed canned goods should be tolerated.

When buying canned goods in tin:

(1) Both ends of can should be flat or curved slightly inward. Neither end should bulge, snap back when pressed, or feel loose.

(2) All seams should be tight and clean with no trace of leaks.

(3) Punctured swells: remove label and note whether the can has been punctured (for removed gas) and then resoldared. Refuse punctured cans.
When buying canned goods in glass:

1. The cover should be firm, flat or concave with seam, collar band, and label clean and free from all signs of leak.

2. The contents should appear free from mold, disintegration, cloudiness, or other abnormality, and show no discoloration.

Causes of Spoilage

1. Acid of some vegetables reacts with metal of the can, causing pinholes.

2. Improper handling.

3. Incomplete exhaust (the oxygen present favors chemical action which increases fading and also favors micro-organisms of most types, causing breaking down of fats.

4. Rusted or dented cans or those having nail holes punched in them in sealing the case.

5. Improper sealing (Even a good seal may breathe a little air).

6. Imperfect sterilization (Bacteria may continue to exist).

7. Increased chemical action through warmth and heat.

8. Freezing (Can seams may burst).

Loss may be prevented by observing the following suggestions:

1. Avoid storing in damp place. Avoid sweating caused by sudden changes in temperature. Provide ventilation. This may prevent rusting.

2. Avoid high temperatures. Do not store near radiator or
near the ceiling.

(3) Store cases on their sides on dunnage. If leaks develop they will be noticed more readily.

(4) Avoid freezing temperatures (few items will freeze unless left at temperatures below 28°F for several hours.

(5) Use oldest lot first. (Constant inspection in store-room is necessary.)
DEHYDRATED AND DRIED VEGETABLES

Dehydrated vegetables were not served regularly at any of the hospitals or fields where the writer was stationed. It was necessary that all personnel concerned with the preparation of food know how to cook and serve these vegetables in a palatable way.

The following discussion includes information and methods of preparation used in experimental cookery when surveys were made at Pendleton Field Station Hospital, Pendleton, Oregon.

The dehydrated foods are fresh foods from which water and inedible portions, such as peels, cores, seeds, and stems have been removed. Such foods are carefully cleaned and then dried by scientifically controlled processes designed to retain much of the original food value, flavor, and natural texture.

Through dehydration weight and bulkiness are reduced. For instance, when potatoes are dehydrated, over 80% of the weight is removed. The following table further illustrates this point:

<table>
<thead>
<tr>
<th>Quantity-100 lbs.</th>
<th>Amount of Water</th>
<th>Weight of Dehydrated Vegetable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh potatoes</td>
<td>Peel-20 lbs.</td>
<td>D. potato-17 lbs.</td>
</tr>
<tr>
<td></td>
<td>Trimmings</td>
<td></td>
</tr>
<tr>
<td>Fresh cabbage</td>
<td>lost-28 lbs.</td>
<td>D. cabbage-6 lbs.</td>
</tr>
<tr>
<td>Fresh carrots</td>
<td>Peel-23 lbs.</td>
<td>D. carrots-8 lbs.</td>
</tr>
<tr>
<td>Onions</td>
<td>Peel-10 lbs.</td>
<td>D. onions-7 lbs.</td>
</tr>
</tbody>
</table>

Dehydration is a process of preservation used in emergency, as in war or times when bulky food cannot be transported conveniently. This type of preservation is convenient as it uses little space in shipping.
and if kept at moderate temperatures in air-tight, insect-proof containers will keep for indefinite periods of time. Low moisture content is the reason why the state of preservation may continue on indefinitely.

The vegetables in preparation for this kind of preservation are trimmed and cleaned, making them very easy to prepare at mealtime.

Reconstitution is carried on by soaking vegetables in enough cold water to cover for 20 to 25 minutes. They may be simmered in the water in which they were soaked or steamed for 15 to 20 minutes. Vegetables are not to be soaked over night, as this would result in spoilage and loss of flavor. Spoilage would be the result of organisms (yeast, molds, and bacteria) present in food but unable to carry on their activities because of the low moisture content in dehydrated food; for after water is added their activities are renewed.

Vegetables were dehydrated in various sizes or forms--sliced, shredded, cubed, julienne, and powdered, depending on the characteristics of each vegetable and its intended use.

Pea and navy bean powders were used for soups. Beets (cubed and julienne), cabbage, carrots (cubed and julienne), onion (chips), Irish potatoes (cubed, julienne, and shreds), sweet potatoes (cubed, julienne, and sliced), and turnips (cubed) were used.

Irish potatoes were served most extensively. The potato shreds were used mainly for soup and mashed potatoes, but they were also used for potato cakes and potato puffs (using dried eggs and dried milk). Hashed brown, creamed, au gratin, salad, and fried were other ways recommended for serving.
Four methods of preparation may be used. Dehydrated vegetables may be boiled, baked, fried, or pickled.

Cabbage may be boiled and the following recipe may be used as an example:

- Dehydrated cabbage: 3 1/2 lbs.
- Cold water: 32 lbs.
- Salt (to taste)
- Diced bacon: 3 lbs.
- Pepper: 1/3 oz.

Soak cabbage 10 to 20 minutes in cold water. Slowly bring to boil. Cook 25 to 30 minutes; add salt, cook 5 to 10 minutes more. Drain (leave about 1/3 liquid on cabbage). Fry diced bacon until brown; add pepper, bacon, and the grease from bacon, and serve.

This amount will serve 100 people.

Pickled beets (100 servings):

- Dehydrated beets: 3 1/2 lbs. (4 dippers)
- Cold water: 24 lbs. (12 dippers)
- Dehydrated onions: 5 oz. (2 dippers)
- Water: 2 lbs. (1 diper)
- Vinegar: 3 lbs. (1 1/2 dippers)
- Sugar: 8 oz.
- Salt: 1 1/2 oz.
- Pepper: 3/4 oz.

Soak beets and onions separately 20 to 25 minutes. Bring beets to boil and cook 15 to 20 minutes. Bring vinegar to boil and pour over reconstituted onions; add sugar, salt, and pepper. Drain the beets and add to the onion-vinegar mixture. Cool for 4 hours. Serve very cold.

Baked sweet potatoes with sugar and raisins:

- Dehydrated sweet potatoes: 7 1/2 lbs. (10 dippers)
- Cold Water: 30 lbs. (15 dippers)
- Salt: 1 oz.
- Butter: 2 lbs.
- Brown sugar: 4 lbs. (2 dippers)
- Raisins: 5 lbs. (3 dippers)
Soak potato slices 20 to 35 minutes. Bring slowly to boil. Simmer 30 to 35 minutes. Potatoes should be moist and tender. Drain off surplus water, add \( \frac{1}{2} \) of butter, and mash. Place in large pan, add brown sugar and raisins, dot with remaining \( \frac{1}{2} \) of butter. Bake 20 to 30 minutes. This quantity will serve 100 people.

**Smothered (fried) onions for steaks, liver, and other meats:**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehydrated onions</td>
<td>2 lbs. (3 ( \frac{3}{4} ) dippers)</td>
</tr>
<tr>
<td>Cold Water</td>
<td>14 lbs. (7 dippers)</td>
</tr>
<tr>
<td>Lard or bacon fat</td>
<td>1 lb. (( \frac{3}{4} ) dipper)</td>
</tr>
<tr>
<td>Salt</td>
<td>1 ( \frac{1}{2} ) oz.</td>
</tr>
</tbody>
</table>

Stir onions into cold water and allow to soak 20 minutes. Bring to boil and simmer 15 to 20 minutes until tender. Heat the fat to frying temperature, add the onions (with surplus water), and allow to steam until brown and very tender. Add salt and serve over meat.

**Onion Soup (100 servings):**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehydrated onions</td>
<td>1 lb., 2 oz. (1 ( \frac{3}{4} ) dipper)</td>
</tr>
<tr>
<td>Water</td>
<td>8 lbs. (4 dippers)</td>
</tr>
<tr>
<td>Bacon fat or butter</td>
<td>2 lbs. (1 dipper)</td>
</tr>
<tr>
<td>Flour</td>
<td>2 lbs. (1 ( \frac{3}{4} ) dipper)</td>
</tr>
<tr>
<td>Bouillon cubes</td>
<td>70 cubes</td>
</tr>
<tr>
<td>Hot water</td>
<td>40 lbs. (20 dippers)</td>
</tr>
<tr>
<td>Salt</td>
<td>3 oz.</td>
</tr>
</tbody>
</table>

Soak dehydrated onions in cold water for 20 minutes. Bring to boil; simmer 15 minutes or more. Put fat in pan, add simmered onions (with surplus water), allow to fry until they are brown, add flour to fried onions, and stir well. Dissolve bouillon cubes in hot water. Add some of the stock to thin out onion and flour mixture, then combine with remainder of stock. Add salt and simmer for one hour before serving.

**Nutritive value**

Dehydrated foods retain most of their nutritive value with the exception of the variable vitamins, particularly Vitamin C, Vitamin A, and some of the members of the Vitamin B complex. While large quantities of these vitamins are retained in some processes of dehydration, the losses
in storage, preparation, and cooking are such that under conditions existent in the Army the dehydrated vegetables are not to be depended upon as the only sources of Vitamin C and to a lesser extent Vitamin A and Vitamin B.

Storage

After the drying and dehydration operations were completed, it was necessary to store the products in large quantities in bulk so that equalization of moisture would take place. After this period the products were boxed, packaged, or shipped. Dried foods needed to be packaged carefully to protect against insects and moisture. It was decidedly important to protect this food from air. The moisture content should not be over eight percent.

During World War II dehydrated vegetables assumed great importance in meeting the needs of troops overseas. Potatoes, carrots, cabbage, onions, and beets were some of the dehydrated vegetables commonly used.

Standards

These were needed for the purchase, quality, and control of these products in order to have healthy, nutritious, and palatable products. All vegetables used for dehydration were of good quality, free from disease, sun scald, frost, or other injury making them unsuitable for processing. They were thoroughly washed and given other treatment, such as, peeling, trimming, and hot and cold dipping, that was necessary to secure the best quality of product. This processing should be performed with the same care as that used in the preparation of vegetables for table
use or canning. (12)

Friction top cans were found to be reasonably resistant to moisture absorption, and were reasonably inexpensive and convenient. For use by the Army vegetables were sealed by solder in five-gallon cans. Cans sealed by double seaming were satisfactory, but more expensive than cartons and less expensive than friction top cans. Vacuum packing was found to improve the keeping quality of dehydrated vegetables.

In regard to dried vegetables there were a number of types of dried beans used in Army messes. The following types were purchased in large quantities: white beans, kidney beans, lima beans, colored or pinto beans, and black-eyed beans.

White beans were best for baking; while colored, lima, and black-eyed beans were usually simmered. White beans were sometimes simmered, but were more popular if baked and served as a main dish. Colored beans were served as a vegetable, except when kidney beans were served in a chili dish.

All beans were seasoned with ham scraps, bacon, or salt pork. Lima beans were baked occasionally with beef stock or milk added. White and lima beans were also used in soup making. This food was sometimes cooked a few hours ahead of time and re-heated for meals when emergency food was needed quickly.

All beans listed are high in protein and were sometimes used in place of meat, as they were lower in cost. Dry beans are a good source of Vitamin B. They have very little roughage and when properly prepared were appetizing, nutritious, and popular.
When purchasing beans it was important to have them as uniform in size as possible so that they cooked evenly. Inspection was necessary when purchasing to avoid buying insect infested beans. The kidney and colored ones are usually the beans more liable to insect attack.

Split peas were purchased and used for soup making. They were soaked in water and simmered until they made a puree. The purée was combined with canned or fresh tomatoes in making soup. Dried peas and white beans were sometimes seasoned with ham or bacon scraps, when used for soups.
SUMMARY

This study is based on an experiment in vegetable preparation carried on at two Army Air Bases, during World War II, to discover what vegetables were liked best and the reasons for their acceptance.

The following general findings were made:

Raw vegetables were liked best because of their crispness, flavor, color, higher vitamin content, appearance, and aroma. Nearly all raw vegetables could be eaten raw or in salads without anything added to improve their flavor. Frozen vegetables were next in popularity because of their close similarity to fresh ones. Canned vegetables were acceptable because they were palatable, kept their color, flavor and vitamin value without much loss. Dehydrated vegetables were the least popular because of their "off flavor" on some occasions and the limited ways in which they could be served palatably. They were less like fresh produce than other types of preserved vegetables.

Cooks were trained to prepare vegetables so as to retain their flavor, color, texture, and vitamin values. Plain foods served well were found more pleasing to all and less difficult to prepare.

The value of appearance, palatability, color, flavor, and methods of serving could not be overestimated. Vegetables that had been cooked too long had lost their color and attractive appearance.

Food habits were regional and were related to crops, climate, religious beliefs, economic conditions and food availability. Regional dishes were added to the menu frequently with pleasing results. It
was, however, often necessary for the soldier to learn to adjust himself to various foods and to appreciate them even though they were not prepared in a manner to which he was accustomed.

Foods that continued to prove unpopular after several experiments were made with different methods of preparation and serving, were discontinued as the waste was too great and cost too high to continue serving them.

Air Corps personnel included in the survey were enlisted white men and women, one colored squadron, and white men and women officers.

Sample experimental food was prepared in portions of six by the writer. This quantity was sufficient for our culinary staff to examine and comment on as to taste, color, and flavor. After many recipes were tried for each kind of processed vegetable, portions of one hundred were prepared and taken to different mess halls to be served with the meals. The persons served were of many nationalities and races. This gave us a better opportunity to learn of preferences and reasons why various foods were or were not acceptable.

Frequently it was found necessary for the writer to prepare larger quantities of food than the cooks had prepared for experimental purposes in order to compare differences in flavor, appearance and color.

Master menu publications were not distributed early in the war and our recipes for quantity cookery were limited. We therefore followed directions for preparation of dehydrated vegetables as they appeared on the packages.
Purchasing and Inspection Guides were obtained from the U. S. Department of Agriculture and were used at stations where the writer served.

To avoid publicity and prevent consumers from knowing that a survey was carried on, the test food was served with other food at mealtime. The writer felt that most informative data could be gathered from the plate inspection method following the meal. The comments heard in the mess hall by writer were interesting and informative concerning food preferences.
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18. Branch and Service Command, Patterson Field, Ohio. Food handling and public health, 1942.


June 25, 1946

Miss Ethel M. McIntyre
P. O. Box 673
Corvallis, Oregon

Dear Miss McIntyre:

Mrs. West and Miss Wood have written us granting you permission to use tables 13, 23, 24, and 25 in your graduate thesis.

We are glad to concur in this permission, and our only stipulation is that credit be given to the source. Our form of acknowledgment is as follows:

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Very truly yours,

/S/ Rudolph M. Triest
Vice-President

RMT:st

[Signature]

NOTARY PUBLIC FOR OREGON
My Commission expires June 24, 1949
Miss Ethel M. McIntyre  
Veteran Hospital  
Walla Walla, Washington  

Dear Miss McIntyre:

Your letter of 20 September 1916 has been referred by the Adjutant General's Office to this office for reply.

There is no objection on the part of the War Department to your writing a thesis on your service as a dietitian in the Army. As a civilian, any former member of the Army of the United States may write freely on his experiences during the war with the exception of intelligence operations.

On behalf of the War Department, I wish to thank you for your inquiry.

Sincerely yours,

/S/ N. C. Ruddell

N. C. RUDDELL  
Major, CAC  
Review Section