

UNITED STATES DEPARTMENT OF AGRICULTURE

MISCELLANEOUS PUBLICATION No. 361

WASHINGTON, D. C.

MAY 1940

DESCRIPTIONS OF TYPES OF  
PRINCIPAL AMERICAN VARIETIES OF  
ORANGE-FLESHED CARROTS

Prepared jointly by specialists of the United States  
Department of Agriculture, Cornell University, and  
the Experiment Stations of California, Louisiana,  
Minnesota, Texas, and Virginia



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**DESCRIPTIONS OF TYPES OF PRINCIPAL AMERICAN VARIETIES OF ORANGE-FLESHED CARROTS**

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**INTRODUCTION**

This publication is the fifth of a series dealing with descriptions of types of the principal varieties of vegetables grown in the United States. It is published in response to the needs of seedsmen, produce merchants, vegetable canners, and growers for an adequate, accurate, and generally accepted description of varietal characteristics. The sustained interest, generous co-

operation, and constructive criticisms of these groups have immeasurably helped the Department and the cooperating State experiment stations in initiating and carrying forward this work. The authors gratefully acknowledge the assistance given them by the above-mentioned agencies and by their colleagues and associates.

**OBJECT AND RESULTS OF TYPE STUDIES**

As the title suggests, the object of this publication is to describe as accurately and definitely as possible the general form or plan of structure of the most important varieties of orange-fleshed carrots (*Daucus carota* L. var. *sativa* DC.) grown in the United States at the time this study was made (1931-35). Insofar as possible, information is also given on the relative importance of varieties for specific purposes and geographical regions,

their resistance to diseases and insects, and their reaction to different environments.

Since the better plants were selected for description and illustration, these descriptions are somewhat idealistic and in that sense a standard of perfection to be sought after, rather than a description of the better stocks as they existed at the time this work was done. Illustrations of random samples from the most uniform

<sup>1</sup> The names of the joint authors who collaborated in the several States are listed according to the alphabetical order of the names of the cooperating institutions as a matter of convenience, since it is not possible to list them in any order of rank or seniority. This publication represents the joint efforts of all the authors, aided by the criticisms and suggestions of the various agencies referred to herein.

stock of each variety available are presented to indicate the nature and degree of variation between it and the type or standard description.

It is hoped that these descriptions may serve as a standard for varietal identification, classification, and nomenclature. Such a catalog of characteristics of the principal or standard varieties should prove of value in many ways to all persons interested in the crop, from the seed producer to the vegetable consumer.

Provided with a knowledge of the salient features of each variety, the ultimate user, seedsman, canner, grower, or shipper will be able to intelligently determine the best variety for his particular needs. This intelligent selection should tend to concentrate demand on the most valuable varieties and to reduce the demand for inferior ones, resulting in the gradual elimination of the latter. The local seed merchant could soon reduce his list of varieties to those best suited to his locality and thereby eliminate a number of unprofitable items from his catalog and his store. Reduction in number of varieties would also enable the seed producer to devote more time and attention to the comparatively few important varieties, with consequent improvement in the quality of commercial stocks.

### SUPPLEMENTAL VARIETAL DESCRIPTIONS CONTEMPLATED

Since the initiation of this work, a number of new and distinct strains, varieties, or types have been introduced to the trade but have not been sufficiently tested to warrant their acceptance as principal varieties at this time. If, in the future, a number of these new introductions are sufficiently different and important to warrant principal status, it is planned that a separate publication describing the new standard types will be issued.

To warrant a new varietal name, the plant introduced should be different in one or more easily recognized or easily determined characters and preferably should contain some characteristic of superiority over existing varieties. Mere difference in a minor character should not be considered sufficient reason for a new name or for perpetuating the new stock or strain.

On the other hand, a new and distinct improvement should be recognized as such by giving the introduction a new name rather than by gradually substituting it

By making it possible to identify or classify varieties by reference to a standard variety or type, the practice of renaming standard varieties or substituting other varieties with incorrect labeling will be discouraged. If all stocks of a given variety name conform to the standard or type herein described, the buyer can order by name with confidence that the desired type will be secured. It is highly desirable to establish such confidence. The introduction, acceptance, and use of valuable new varieties and strains may be facilitated by indicating their points of difference from or superiority over the standard variety that they resemble most closely. Plant breeders will also be interested in the ensemble of characters which constitute the principal varieties and may have direction given to their efforts by a study of the importance of different characteristics.

Acceptance of these descriptions as type standards and attainment of the desirable objectives outlined above is entirely dependent upon the voluntary action of everyone concerned. The intense interest exhibited in the work and the splendid spirit of cooperation evidenced on all sides augur well for speedy consummation of the informal cooperation necessary to achieve these objectives.

under the name of a standard variety, a practice which invariably leads to confusion and distrust. Red Core Chantenay is an example of a strain sufficiently different in an important commercial character to warrant the new name, although it is being sold in a great many instances under the old name of Chantenay. In this case the informative feature of the name is more important than brevity.

It should not be inferred that this list of principal varieties meets perfectly all the possible requirements of the trade. A careful study of the descriptions will reveal the desirability of many improvements in the present varieties that can and will probably be made in future varieties. Rather than impede progress in the development of new varieties, an unbiased catalog of characters should stimulate the production of better varieties by establishing the standards with which they may be compared and by pointing out the strong and weak points of the present varieties.

### METHOD OF PROCEDURE

The following descriptions are based upon the results obtained from one crop (summer, 1931) grown at St. Paul, Minn.; two crops (winter) grown at Weslaco, Tex., during 1931-32 and 1932-33; five crops (three spring and two fall) grown at Davis, Calif., during 1931-33; five crops (three spring and two fall) grown

at Norfolk, Va., during 1931-33; five crops (three spring and two fall) grown at Baton Rouge, La.; and eight crops (five spring and three fall) grown at Arlington Experiment Farm, Arlington, Va., and at the United States Horticultural Station, Beltsville, Md., during 1931-35.

The manuscript and figures were critically reviewed by all collaborators and also by most of the major American carrot breeders and seed producers. Since the descriptions are based on actual stocks in existence at the time this work was done, the acceptance by this group most qualified to judge should be sufficient authority for establishing these as standards or type descriptions for the principal varieties. While it is true that all of the plants of any stock of any variety did not meet the standard herein described, the percentage that did attain the standard was sufficiently high in the better stocks to be commercially acceptable, as shown in the illustrations of random samples. The task of determining the intended type was, therefore, relatively easy.

The list of varieties in this report, French Forcing, Scarlet Horn, Nantes, Red Core Chantenay, Danvers, Imperator, Long Orange, and Oxheart, includes those constituting between 85 and 95 percent of all the orange-fleshed carrots sown in the United States, according to reports submitted by seed growers and dealers when this work was started in 1931.

Seed of the best available stocks of these varieties was requested from American and European seed growers through the vegetable research committee of the American Seed Trade Association. The same seed was used by all collaborators throughout the 3-year period (1931-33), and after the first year the observations and measurements were made on the same strain of each variety according to a uniform system previously agreed upon by the workers in the various locations.

The choice of a name has been influenced by priority, descriptiveness, brevity, and popularity or use. In all cases brevity has dictated the omission of descriptive adjectives from the older varieties. Imperator is the name selected by the introducer. In cases where names for these varieties now used in seedsmen's catalogs differ from these standard names, it is suggested that the old name be enclosed in parentheses following the standard name, in order to acquaint the purchasers with the change in name. After a few years' use, listing of the old name may be discontinued.

Synonyms were obtained from Morse (13),<sup>2</sup> Ritchie (14), Tracy (15), unpublished records of the Bureau of Plant Industry for 1921, and from the catalogs and trial-ground records of American seedsmen. Some of these synonyms may be incorrect. Unless it was an integral part of the varietal name, the seedsmen's name was omitted in the list of synonyms.

Every effort was made to provide optimum growth

conditions at the different locations by the use of proper fertilization, irrigation, and cultural methods. Plants were spaced 3 inches apart in the rows with ample space between rows for uncrowded development of the foliage.

It is felt that the range in environmental conditions was sufficiently wide, considering the different locations and seasons in which the crops were grown, to provide a fair sample of the weather conditions under which carrots are grown in the United States.

Detailed notes, measurements, and color readings were made at prime marketable stage of maturity as a bunching carrot. The diameter varied according to variety as pointed out in the descriptions, but exterior color meeting the minimum market requirements was attained before the roots were considered to be prime marketable. A sample of 20 to 50 plants within the marketable range of diameter and color and typical of the variety was selected from which the detailed data were secured.

Plant height and spread were measured when the plants were turgid, usually in the morning. The greatest distance between the tips of leaves on opposite sides of the plant was measured as the spread, and height was measured from the soil surface in the row between the plants to the highest point reached by the foliage.

Leaf (petiole and blade) measurements, ratings, and color readings were made on one of the longest normally developed leaves from each selected plant. The leaves were cut off level with the top of the root. Petiole length was measured as the distance from the cut end to the point of juncture of the first pinna to the base; blade length was the distance from the juncture of the first pinna to the distal end of the central axis. Blade width was the distance between the ends of the first pair of pinnae (at the base) when the axis of each pinna was pulled back to form a right angle with the central axis. Petiole depth was the distance between the dorsal and ventral sides (top to bottom) of the petiole; diameter (width) was at right angles to depth; both measurements were taken midway of the petiole length. Leaf number includes all leaves 2 inches or more in length.

Color readings were made on the leaves that give the mass color effect in the field. These were usually the largest leaves or those that made up the greatest visible surface of the plant. The selected leaves were immediately taken to the laboratory and readings made from A Dictionary of Color (11) under light from a north window, before the leaves wilted. Root color readings were made on washed roots while the surface was still wet or damp. Specimens representing the average were selected for color readings, although notes were also made on the color of the extremes.

<sup>2</sup> Italic numbers in parentheses refer to Literature Cited, p. 46.

## IMPORTANT CONSIDERATIONS IN COMPARING CARROT VARIETIES OR STRAINS WITH TYPE DESCRIPTIONS OR STANDARDS

Since the greatest value of these descriptions will probably be as a standard by which to judge or compare new or commercial varieties or strains of carrot, great care should be taken to provide proper conditions for valid comparisons. Cognizance should be taken of the variations to be expected, as pointed out in the section on Influence of Environment on Plant and Varietal Characteristics. Two or more strains of several standard varieties should be included in the test plots to serve as a measure of the variation produced by the particular set of growth conditions encountered.

All strains to be compared should be planted on the same day and given identical cultural practices most likely to lead to the production of a good commercial crop. The plot or field selected should be as uniform in soil type and fertility as possible, and sufficient fertility should be provided for normal growth.

Two or three rows, each 20 to 30 feet long, located in various sections of the plot are likely to give more reliable comparisons than a single longer row. Where a critical comparison of yield is desired, plots of sufficient size and number should be so arranged that the results may be analyzed statistically.

The rows should be far enough apart that the leaves do not overlap in the space between rows. Thinning to 3 or 4 inches apart in the row should be done while the plants are still small.

### INFLUENCE OF ENVIRONMENT ON PLANT AND VARIETAL CHARACTERISTICS

Owing to fluctuations in the different components comprising the environment, it is extremely difficult, if not impossible, to accurately determine the value or influence of any given factor of the environment in experiments conducted under field conditions. For that reason the following discussion is based largely upon the results of experiments conducted under controlled conditions by other workers where the effect of a given factor could be carefully studied. Only a brief summary is given, as readers interested in the details may consult the original articles cited.

#### INFLUENCE OF ENVIRONMENT ON GERMINATION

No varietal differences in germination were noted during the course of these trials, but environmental factors such as soil type; amount, character, and date of rainfall (soil moisture); and temperature are of importance in determining the rate and final percentage of germination. Soil type in itself is probably not so important, but when planting is followed by heavy or dashing rainfall and drying winds just prior to seedling emergence, a hard crust is formed on the soils of the silt or clay types, which greatly impedes and sometimes prevents the emergence of the small tender seedlings.

A part of each row or rows should be pulled for comparison as soon as the roots reach prime marketable stage of maturity for bunching purposes, and the remainder of the plants should be allowed to remain for another month or until they reach their maximum or mature size. At least 25 normally developed plants should be available for each comparison and, wherever possible, measurements and color readings should be the basis of comparison. Counts of the number of misshapen or offtype plants (not typical of the variety in which they occur) and a brief description of the type of the offtype or unusual plants should also be included in the report or characterization of the strain or variety being tested.

Color comparisons should be made with clean roots or foliage, preferably under cover and with light from a north window. Root sections should be kept moist when comparing them with the color plate in this publication or with A Dictionary of Color (11). The designations of color values used in this publication refer to A Dictionary of Color and care should be used to follow the directions given therein in matching specimens with the color plates.

Obviously, all characteristics of the plant should be carefully studied and considered before attempting identification or characterization. Carrot varieties usually differ in more than one character.

Sandy or loamy soils in good tilth are preferred. Kottowski (9) found that with ample moisture in fine sand at constant temperatures the promptness of germination was increased as the temperatures were increased from 46.4° F. to 51.8°, to 64.4°, to 77.0°, and to 86.0°. Carrot seed did not germinate at 39.2°, and the temperature at which it did germinate seemed to have no effect on the final percentage of germination.

Alternating temperatures (low at night and high during the day, or vice versa) gave no better results than favorable constant temperatures (8, 10). Daily or frequent watering delays germination, according to Bailey (1).

#### INFLUENCE OF ENVIRONMENT ON FOLIAGE COLOR

Color as well as size of carrot foliage is influenced by the conditions under which the plants are grown. Carolus and Brown (5) reported that a deficiency of nitrogen or magnesium results in a yellowing of the leaves. An excess of nitrogen, especially during dry weather, produces a very dark green color, and it has also been observed that temperatures near 32° F. or above 85° tend to darken the foliage color if sufficient nitrogen is present.

### INFLUENCE OF ENVIRONMENT ON FOLIAGE SIZE

Conditions affecting the size or amount of the foliage are of primary interest to the carrot grower since the development of the root, a storage organ, depends on the materials elaborated in the foliage. Garner and Allard (7) showed that the length of the leaf is greatly reduced by limiting the plant to 7 hours of daylight compared with approximately 14 hours, and Barnes (2) found that increasing the daily lighted period from 9 to 10.5 and 14 hours resulted in successive increased length of leaf but no significant increase in weight.

The addition of any nutritional element that might become sufficiently deficient during the season to limit total growth would be expected to increase foliage growth. Nitrogen is most commonly deficient and the addition of nitrogenous fertilizers on most soils usually results in increased top or foliage growth. Soils more acid than pH 5.5 generally cause reduced size of the foliage as compared with less acid soils. Bremer (4) in Norway states that the amount of water in the soil is more closely associated with the weight of foliage produced than is temperature, whereas temperature was more effective in increasing the length of the leaves than was soil moisture.

Temperature is a very important factor in the production of carrot leaves. Germination will not take place at 39.2° F. and Bremer (4) states that foliage growth below 50° is very slow. The length and weight of leaves increase with increase in temperature up to 82.4° for the Nantes variety, but is less at 75.8° than at 66.1° for the Red Core Chantenay variety, provided optimum moisture and fertility are available. An average temperature of 65° resulted in much larger foliage than a temperature of 65° during the day and 45° during the night. If the temperature drops to 50° or below for 60 days or longer after root enlargement has started, the plants will produce seedstalks when higher temperatures prevail instead of completing root development.

Foliage growth of carrots at temperatures beyond this range have not been studied critically, but it is doubtful if much growth takes place when the air temperatures are maintained in the neighborhood of 100° F. for any extended length of time.

### INFLUENCE OF ENVIRONMENT ON ROOT WEIGHT

The size or weight of the carrot root is dependent upon the ability of the foliage to elaborate storage materials in excess of the amount required for maintenance. Any factor affecting leaf size or efficiency might be expected to have some effect on root weight, although the factors affecting leaf size do not always have a corresponding effect on root size. Thus, Bremer's work with the Nantes variety showed that while the leaf length and weight increased as the temperature increased to 82.4° F., the weight of the root did not

increase at temperatures above 68°. Larger roots of the Red Core Chantenay variety were produced at an average temperature of 66.1° than at 75.8°. The optimum temperature for root growth in carrot is probably between 65° and 70°, which is lower than the optimum for foliage growth.

Optimum nutritional conditions also seem to be somewhat different for root growth than for foliage growth, although any deficiency or unfavorable growth condition that greatly reduces the amount of leaves might be expected to reduce the amount of root. However, under specific conditions certain elements such as phosphorus, potassium, magnesium, and copper have increased root yields without materially affecting the size of the tops. Changes in the moisture content of a composted garden soil from 18 to 26 and 34 percent of saturation resulted in large increases in fresh root weight, but still larger increases in leaf weight (2).

At optimum conditions of temperature and moisture increases in day length from 9 to 10.5 and 14 hours had no effect on root weight, but when carrots were grown at low temperatures and with low soil-moisture content, increasing the length of day increased the root weight and top size (2).

Differences in final weight of roots grown at different temperature levels imply a differential rate of growth throughout, or at some period during the growth cycle of the plant. Experiments in electrically heated hotbeds (4) show that roots of the Nantes variety reached the minimum marketable size (15 gm.) from 4 to 9 days earlier when grown at soil temperatures of 68° F. than at 60.8°, and 14 to 22 days earlier at 68° than at 53.6°. Increasing the temperature above 68° resulted in no increase in date of first marketable size.

### INFLUENCE OF ENVIRONMENT ON PLANT SIZE

Obviously, differences in one or more factors of distinct environments that result in a larger foliage or root size without an accompanying retardation in the other plant part result in an increased total size or weight of plant. Even though the average size of root of the Nantes and Red Core Chantenay varieties does not increase at the higher temperatures, the foliage does increase enough to produce larger plants at the higher temperatures (82.4° and 75.8° F.) than at lower temperatures (4).

The space available for growth is also a factor in determining the optimum temperature for large plant size. With the Nantes variety, increasing the distance between plants made it possible for the largest plants to be produced at lower temperatures (4).

### INFLUENCE OF ENVIRONMENT ON ROOT SHAPE

In addition to hereditary factors that may cause branched or forked roots, there are a number of environmental factors that have a marked influence on the

shape of carrot roots. The presence of undecayed manure or plant refuse in the soil results in branching or divided roots, and soils of heavy texture produce more misshapen roots than those of lighter or more open texture. Branched or forked roots may also be caused by an injury to the young taproot or to any impediment to its downward growth. Any nutritional factor that affects the size or weight might also be expected to influence the shape, since the developmental history of shape shows that roots increase in diameter more rapidly than in length and that the increase in diameter progresses from the top of the root downward.

In the case of Red Core Chantenay, low soil moisture and low soil phosphorus resulted in more pointed roots than where optimum amounts were supplied (2). Unpublished experimental work conducted by the California Agricultural Experiment Station at Davis, Calif., during the spring and summer with a uniform line of Danvers carrot showed that carrots from relatively dry soil (sparingly or infrequently irrigated) were significantly longer than those grown on relatively moist soil (heavily or frequently irrigated).

In the present studies California carrots were usually longer than those grown from the same seed at Norfolk and Arlington, Va., probably because of the combined effect of lower soil temperatures and less rainfall or soil moisture.

The root shape of carrots is also affected to a remarkable degree by temperature. The typical shape of the Red Core Chantenay variety (plate 2) is most readily produced when the roots are grown at constant temperatures of approximately 65° F. When grown at a mean temperature of approximately 55° F. the roots were longer and more slender, and when grown at approximately 75° they were shorter and less slender (4). Growing plants at a mean temperature of about 45° at night and about 65° during the day resulted in longer, more slender roots than when they were grown continuously at 65°. Growth at 65° until root enlargement had begun and then continuously at a mean temperature of about 45° resulted in poorly shaped roots, the upper part being enlarged as usual, but the lower part tapering off rapidly to a long, thickened taproot. Although Nantes is a longer, more slender, and nearly cylindrically shaped variety, temperature had essentially the same effects as on Chantenay. When grown at temperatures above 68°, many of the roots were misshapen and their surfaces were rougher than at lower temperatures. The results of these type trials indicate that high as well as low temperatures may prevent the normal rounding of the base of such varieties as French Forcing, Scarlet Horn, Nantes, and Chantenay, resulting in roots with tapered bases (pls. 4, 7, 8, 9, 10, and 12).

Smoothness of root surface is influenced greatly by environmental conditions. High temperatures and irregular water supply result in deep horizontal depressions in the root surface, i. e., rough surface. Roots

grown in Virginia and Louisiana in the spring and summer are not as smooth as those grown in California or Texas during the winter or as smooth as a fall crop in the Northern States, as shown in plates 9, 10, 11, and 12. Excessive moisture following a period of water shortage frequently results in white, corky outgrowth at the points of side-root emergence.

Marked differences in the shape of the top of the carrot root were observed in the spring or summer and late-fall crops grown in Virginia and Maryland (pl. 8). The spring or summer crops encountered much higher temperatures and usually less abundant rainfall than the fall crop, with the result that the shoulders of the fall crop were more nearly square or more sharply rounded than those of the spring or summer-matured crop. Narrow crowns or sloping shoulders were quite common in summer-matured Nantes.

This variety also failed during late spring or early summer to develop normally that portion of the root which might project above the soil due to washing away of soil. Under these conditions the root became definitely necked. The same tendency appears if the partially grown plants are covered with 3 or 4 inches of soil.

#### INFLUENCE OF ENVIRONMENT ON ROOT COLOR

With the development of rapid chemical methods for determining the amount of carotene, the principal pigment in yellow or orange carrots, it has been possible to accurately determine the effect of different growth conditions on carrot root color (2). Total color as measured by the carotene content is, in general, decreased by continuous temperatures above 70° F. and below 60°. Roots grown at a mean temperature of 55° had less total color than those grown at 65° and the exterior color of the roots was much lighter, owing to the reduction in the amount of pigment in the surface layers. Growing the plants at a mean temperature of about 45° after the roots had started to enlarge resulted in still poorer total color as a result of the greater amount of the bleached or whitened cells at the surface of the root. Cool nights (45°) and warm days (65°) resulted in fewer bleached cells, hence better color, than did continuous growth at 45°.

Increasing the soil moisture from a low to a high percentage decreased the total amount of color, but in soil of moderate fertility an increase in the amount of the different plant-food elements failed to increase appreciably the color of the roots. However, a marked deficiency of plant-food materials resulted in smaller size and reduced color.

Miller et al. (12), working in Louisiana, found that carrots that matured during the spring were of better color than those that matured during the fall and winter. Carrots grown on sandy soils or soils high in organic matter were also of better color than those grown on silt loam soil. The poor color of carrots

grown in the water furrow as contrasted with the good color of carrots grown on the adjacent beds 10 inches high is thought to be due to the excess moisture in the water-furrow locations. All varieties reacted in the same way in the experiments, but there were always a few roots of superior color in each variety. Varying amounts of a 4-12-4 fertilizer had no material influence on color, nor did the addition of a mixture composed of boric acid, manganese sulfate, copper sulfate,

barium chloride, potassium iodide, and zinc sulfate, nor 800 pounds per acre of fertilizers varying widely in percentages of nitrogen, phosphoric acid, and potassium.

Increasing the length of day from 9 to 14 hours did not affect the color of carrot roots, but reducing the daylight period to 7 hours resulted in much smaller size and lighter color than with 14 hours of light daily (2, 7).

### DEVELOPMENTAL HISTORY OF SHAPE AND COLOR OF CARROT ROOTS

In spite of the rather wide range in general shape of carrot varieties and of smaller differences in range of visible color discussed in the following sections, there are rather consistent changes in shape and color with increased age and size. The carrot root, as it increases in age and size, changes in color from a yellowish white when very young to whitish yellow, light yellow, dark yellow, orange, or purple, according to the variety. These changes in color are due to the accumulation of carotene, which appears in varying intensities of yellow until crystals form, which produce the orange or orange-red color.

In fairly uniform strains the larger roots usually have a higher concentration of carotene than the smaller roots of the same age, while in mixed stocks the larger roots are liable to be lighter colored, especially if the seed was grown near larger lighter-colored varieties with which the female parent could cross. In uniform strains the smaller old roots usually have more carotene than younger roots which are larger.

Carotene is laid down first in the oldest cells of the cortex or phloem and then in the oldest cells of the core or xylem (fig. 1 and pl. 1). Since a carrot root grows from the cambium (junction of the core and cortex), the oldest cells are those immediately adjacent to the epidermis and in the center of the core. As the root grows older, more carotene is deposited in these oldest cells as well as in the cells nearer the cambium thereby establishing color gradients, which radiate from the center of the root outward and from the epidermis inward, leaving a light-colored ring at the cambium. In old or slow growing carrots this region may become fairly well colored. The vertical development of color is from the top of the root to the tip, for the same reason (6).

The rate of increase in color depends to some extent on moisture and temperature but usually increases most rapidly during the early part of the plant's growth. It is not known how long the increase in carotene will continue under optimum conditions, but records show that it increased up to 142 days of age in the Red Core Chantenay variety when grown during the summer in the garden at Ithaca, N. Y. (2).

Varieties and individuals within a variety differ in the rate of carotene formation. Color formation reaches its visible maximum in a smaller number of days in the earlier maturing varieties than it does in the later varieties. From the market standpoint a variety is said to be mature when it attains the desired size and its typical shape and color, with the color practically uniform from top to bottom. Uniformity and

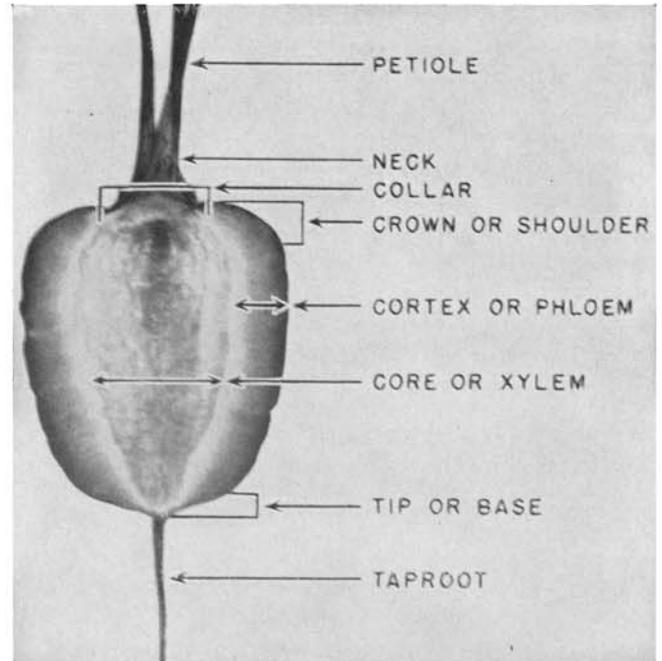


FIGURE 1.—Cross section of a carrot illustrating the terms used in the text for the various parts.

degree of color are the most important factors in market standards, with size and shape usually required to be typical of the variety. Chemical analyses (3) indicate a varietal difference in carotene content at 23 weeks of age, but no data are available to show whether at ages greater than this the same relative content would be maintained.

Measurements on carrot roots showed increase in length and diameter (width) of Red Core Chantenay up to 142 days of age, at which time the experiment

was concluded (2). It was found that this variety increased faster in diameter than in length after three-fourths of an inch in diameter had been attained, so that as the roots became older they became relatively thicker or broader. Observations indicate that the other varieties described in this publication develop in the same manner.

The increase in diameter is most rapid at the top or crown of the root and, as the plant becomes older, the lower portions of the root increase in diameter in varieties where this change is characteristic. In French Forcing the lower half of the root gradually fills out

under favorable conditions until it is characteristically rounded or stump-rooted (pls. 2 and 3). In Scarlet Horn and Red Core Chantenay and to some extent in Danvers the same rounding off at the tip of the enlarged root takes place, but the increase in diameter near the tip or base is not as rapid as near the crown and results in a slightly tapering root (pls. 4, 10, 11, 13, and 14). In the Nantes variety the mature roots become straight-sided, resulting in a cylindrical stump-rooted shape under the proper conditions (pls. 2, 5, and 6). When young, all these varieties have roots with a tapered or pointed base.

### DISTINGUISHING VARIETAL CHARACTERISTICS

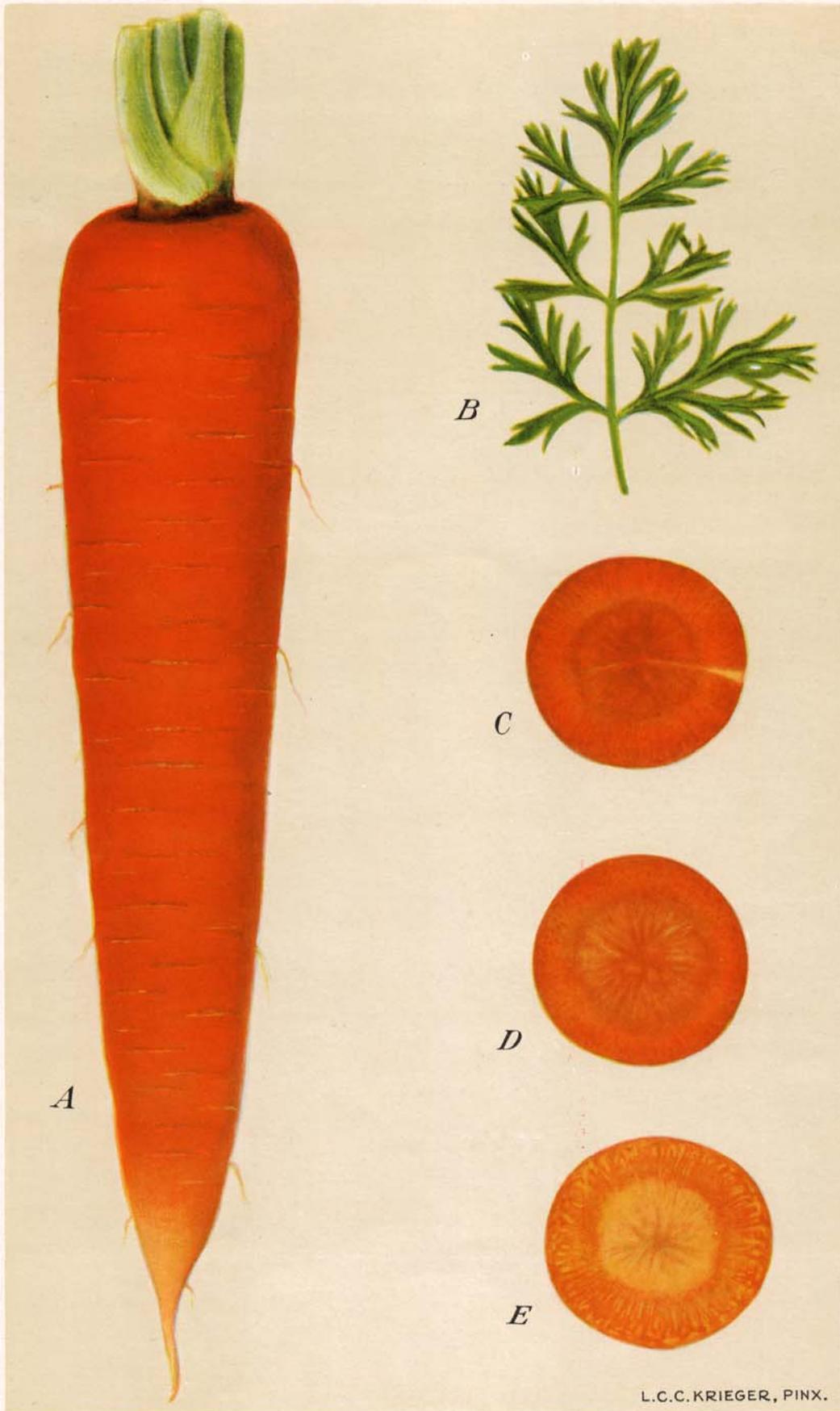
The principal characteristics of the varieties of carrots described in this publication are given in table 1.

TABLE 1.—Use and distinguishing characteristics of the principal varieties of orange-fleshed carrots

Varieties	Chief use	Season	Leaf number	Foliage size	Neck and collar size	Average root length
French Forcing	Forcing, home garden	Very early	Few	Small	Small	1¼-1¾
Scarlet Horn	do.	Early	do	do	do	3-4
Nantes	Home and market garden	do	do	do	Very small	4¾-5¾
Red Core Chantenay	Cut off for storage and manufacturing	Midseason	Many	Large	Medium to large	4½-5¼
Danvers	Bunching for market	do	do	do	do	5½-5¾
Imperator	do.	Midseason to late	Medium	do	Medium	6-7
Long Orange	Stock feed and market garden	Late	Many	do	Medium to large	7-8½
Oxheart	Stock feed	Midseason	do	do	do	2¾-3½

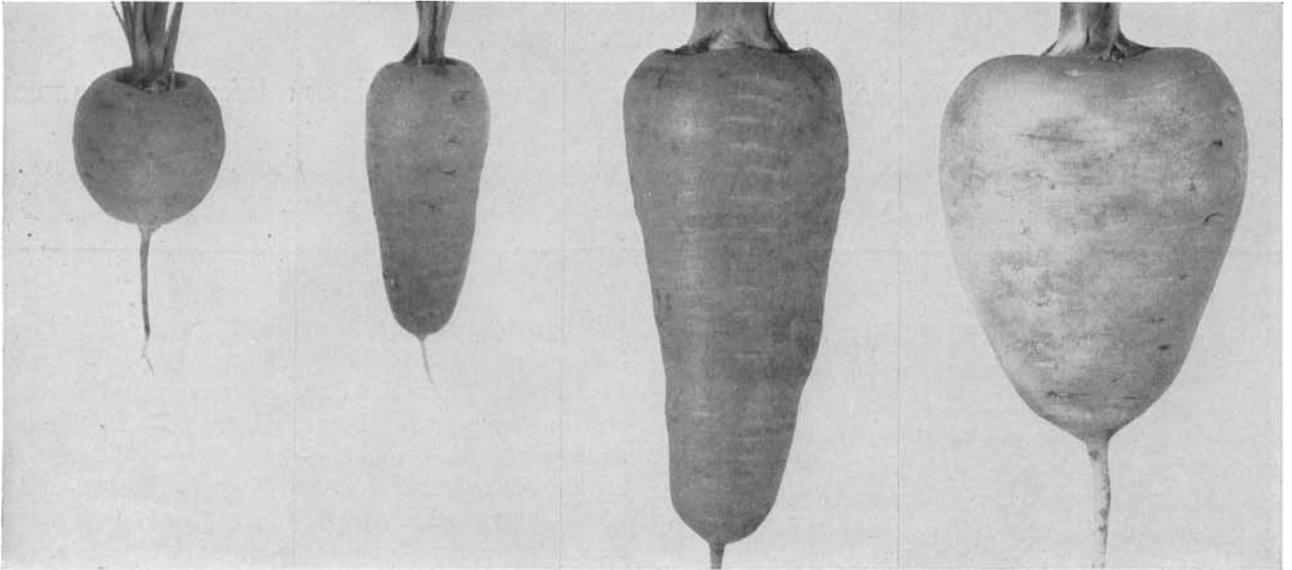
  

Varieties	Root shape			Core size	Skin color above ground	Skin color below ground	Core color
	General	Shoulders	Base				
French Forcing	Short conic to round, slightly oval.	Round	Short tapered to round.	Large	Green	Medium orange	Yellowish orange.
Scarlet Horn	Medium conic to nearly cylindrical.	Square to round	do.	Small	do	Deep orange	Deep orange.
Nantes	Slightly tapered to cylindrical.	Round to sloping	do.	do	Red	do	Do.
Red Core Chantenay	Medium conic to truncate.	Square to round	do.	Large	Green	do	Do.
Danvers	Long conic to slightly truncate.	Round	Medium tapered to slightly rounded.	Medium to large	do	do	Yellowish to deep orange.
Imperator	Long with slight taper	Square to slightly tapered.	Short medium tapered.	do	do	do	Deep orange.
Long Orange	Very long conic	Square to round	Long tapered	Very large	do	do	Yellowish to deep orange.
Oxheart	Medium conic to heart-shaped.	Square	Short tapered to round.	Large	do	Medium orange	Do.



Color of prime marketable root (A) and foliage (B) of the Emperor variety of carrot. Cross sections of roots (C to E) show stages in the development of interior color from poor (E) to fair (D) to good (C). Color designations (11) as follows: Local color on A, root 10 F 10, petiole base 21 L 5, and lighter; B, foliage 23 L 6; C, phloem 10 C 10, xylem 10 I 9; D, phloem 9 K 10, xylem 9 K 8; E, phloem 9 J 7, xylem 9 K 5.

### TYPICAL CARROT ROOTS

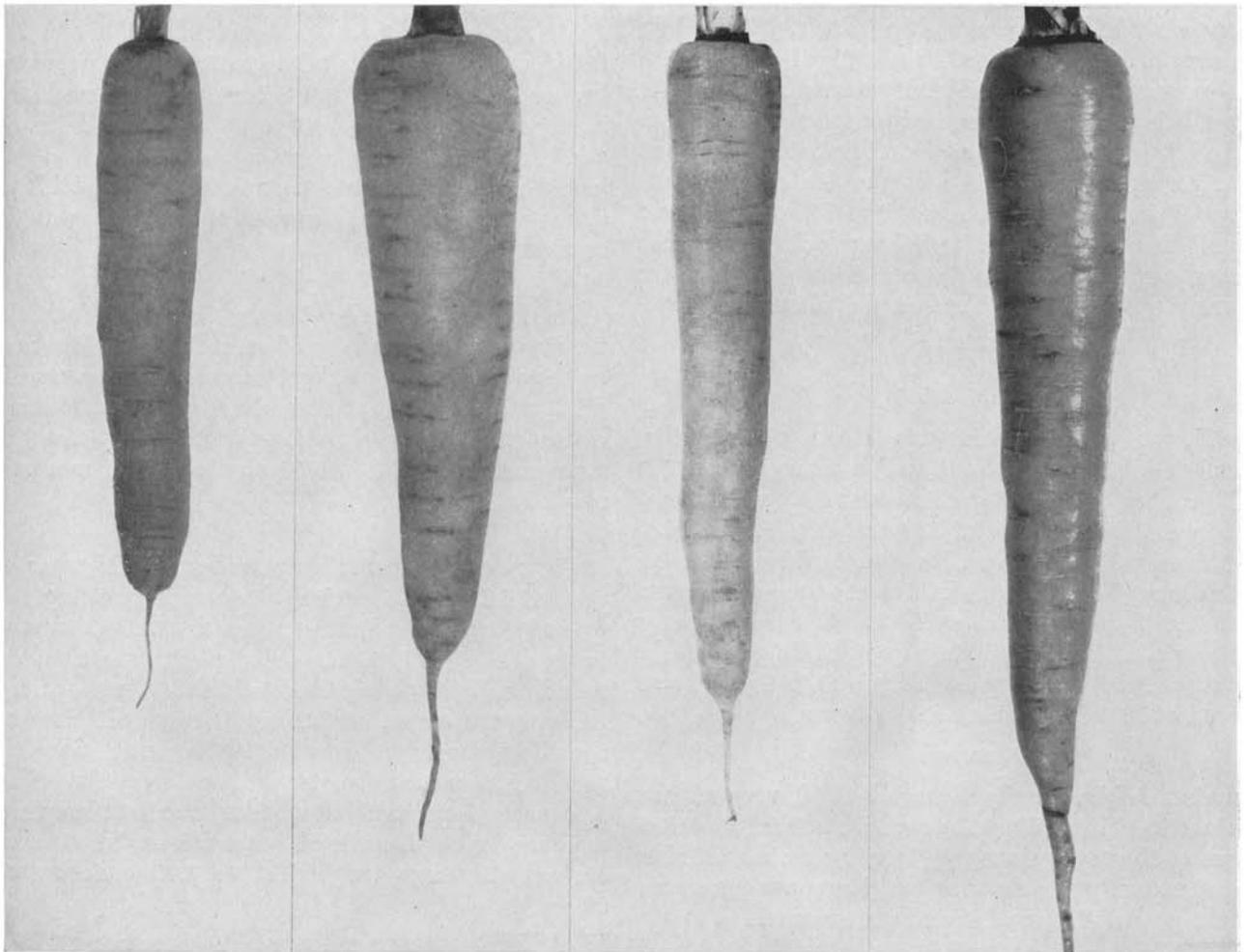


FRENCH FORCING

SCARLET HORN

RED CORE CHANTENAY

OXHEART



NANTES

DANVERS

IMPERATOR

LONG ORANGE

*An approximation of the ideal type, showing relative size and shape of mature roots,  $\times \frac{1}{2}$ .*

## FRENCH FORCING

### BRIEF CHARACTERIZATION

Little used except in the home garden and for forcing in hotbeds or coldframes. Its small foliage and early maturity are its chief advantages for forcing use.

Very early maturing with sparse, small foliage and small, round or short top-shaped roots of medium orange color. Cracks easily after reaching 1 inch in diameter.

### ADAPTABILITY AND USE

The French Forcing carrot is of very little importance in the United States at present, as year-around shipments of carrots from California or Texas have practically eliminated the frame or greenhouse culture of carrots, a purpose for which this variety was originated. Nantes has largely supplanted it for home and market-garden purposes. Cracks badly during rainy periods after it has attained 1 inch in diameter.

### SEASON

Very early maturing, reaching 1 inch (2.5 cm.) in diameter in 55 to 65 days from date of germination when grown as a spring and summer crop but requiring 75 to 85 days under cooler temperatures encountered by the late fall crops in the Northern States and the winter-grown crops in the Southern States and California. Prime marketable size,  $1\frac{1}{4}$  to  $1\frac{3}{4}$  inches (3.2 to 4.5 cm.), is attained in 60 to 75 days as a spring and summer crop but requires 85 to 100 days as a winter and early spring crop in Texas and California.

### PLANT

(Pls. 2 and 3)

Small, at prime marketable stage of maturity typically about 2.3 ounces (65 gm.) but ranges from 1.9 to 3.2 ounces (55 to 90 gm.) in average<sup>3</sup> weight, depending on the amount of foliage present. Usually 8 to 10 inches (20 to 25 cm.) in average height and 10 to 14 inches (25 to 35 cm.) in average spread, or from 1.0 to 1.6 times as wide as high. Under especially favorable conditions for foliage growth, it may attain an average height of 12 to 16 inches (30 to 40 cm.) and a spread of 16 to 19½ inches (40 to 50 cm.).

### LEAVES

Few in number, usually average 7 to 10, very seldom less than 6 or more than 15; constitute from 20 to 30 percent of the total plant weight at prime marketable stage of maturity for the spring and summer crops and 15 to 20 percent for the fall and winter crops.

<sup>3</sup> The figures given in this and subsequent descriptions are averages for the number of specimens measured. The range of averages is obtained from the crops grown in different years, locations, and seasons.

### BLADE

Young growth typically light green, ranging from Cerro Green (22 L 5)<sup>4</sup> to Peridot (22 L 6) and Art Green (22 L 7), with older mature leaves darker green and approximating Forest Green (23 L 6); small, average length 4 to 4¾ inches (10 to 12 cm.) with a range of 3 to 7 inches (8 to 18 cm.), greatest width of blade approximately equal to length of blade, which is also approximately equal to length of petiole. Divisions medium to small in size.

### PETIOLE

Lighter green than blade divisions, about Moss Green (21 L 2) to Parrot Green (21 L 6); short, average length 4 to 4¾ inches (10 to 12 cm.), with a usual range in length of 3 to 7 inches (8 to 18 cm.); slender, average width five sixty-fourths to eight sixty-fourths of an inch (2.0 to 3.0 mm.) at the middle; average thickness about equal to width, about 40 times as long as thick or wide.

### NECK AND COLLAR

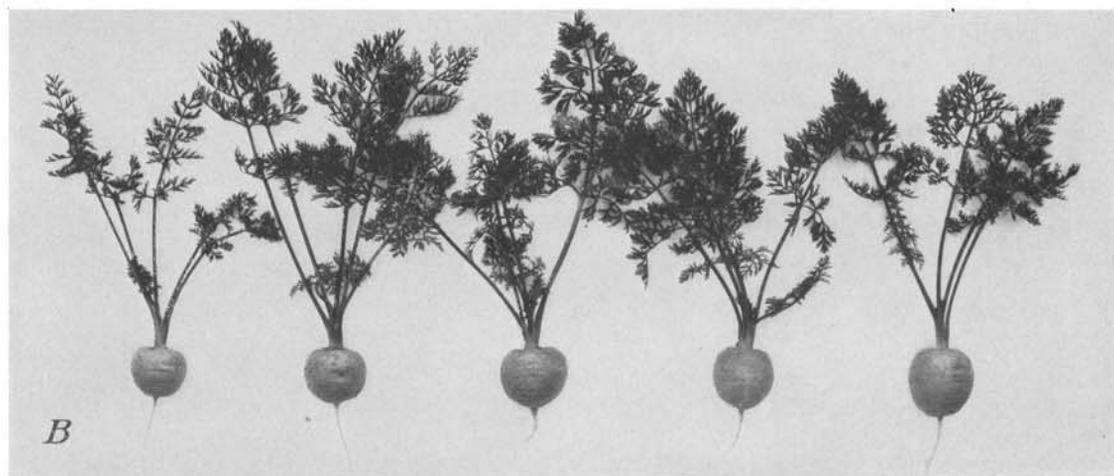
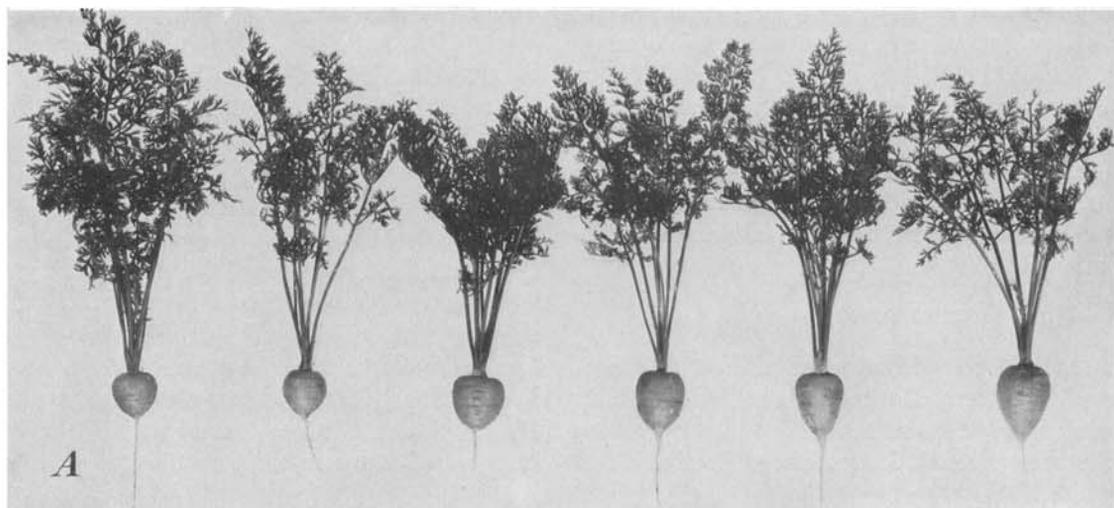
Small neck, usually twenty-two sixty-fourths to twenty-five sixty-fourths of an inch (9 to 10 mm.) in average diameter at smallest point but increases until at point of attachment of petiole bases to root (collar) the diameter is thirty sixty-fourths to thirty-five sixty-fourths of an inch (12 to 14 mm.). Collar medium to much sunken.

### ROOT

Grows almost completely underground; when first usable, 1 inch (2.5 cm.) in diameter, roots are short-conical (top-shaped), but prime marketable roots  $1\frac{1}{4}$  to  $1\frac{3}{4}$  inches (3.2 to 4.5 cm.) in diameter should be round or slightly oval; from 1.0 to 1.2 times as long as thick at the crown, with slightly rounded or rounded shoulders, rounded or slightly tapering sides, and rounded base to a fine taproot and very few, fibrous side roots from fairly numerous, medium-length and medium-depth horizontal depressions in the root surface. Average weight 1.2 to 1.75 ounces (35 to 50 gm.).

<sup>4</sup> References given in this and subsequent descriptions are to plate, column, and row; e.g., 22 L 5 refers to pl. 22, column L, and row 5, in A Dictionary of Color (11) and the name preceding the reference is the name assigned to that particular color.

## FRENCH FORCING CARROT



Acceptable range in type of French Forcing carrot: A, First marketable spring crop 1934 at Arlington, Va.,  $\times \frac{1}{8}$ ; B, mature fall crop 1931 at Arlington, Va.,  $\times \frac{1}{8}$ ; C, mature spring crop 1933 at Davis, Calif.,  $\times \frac{1}{4}$ . Note the rounder base of mature Arlington-grown roots and greater length of Davis-grown roots.

Skin color of shoulders appearing above ground ranges from 14 L 1 to 14 L 7, according to exposure; skin color below ground on prime marketable roots when moist about 10 H 10; cortex (phloem) about 10 J 8, and core (xylem) lighter and yellow, about 9 K 5 to 9 L 7.

Core proportionately small, comprising about 45 to 55 percent of the root diameter in spring and summer crops and 35 to 45 percent in late fall and winter-grown crops.

#### SYNONYMS

Earliest French Forcing, Earliest Red Horn, Earliest Scarlet French Forcing, Earliest Short Horn, Early French Forcing, Early French Short Horn, Early Golden Ball, Early Scarlet French Horn, Early Scarlet Short

Horn, Early Short Scarlet, Early Very Short Horn Scarlet, Extra Early Scarlet, French Early Forcing, French Forcing Horn, French Horn, French Red Forcing, Golden Ball, Golden Ball Forcing, Short Horn, Very Early Scarlet, Very Early Scarlet Forcing, and Very Early Short Horn Scarlet.

#### HISTORY

Probably a French development from the Early Horn type and first introduced in this country in 1861 by Thorburn as Extra Early Forcing. Earliest French Forcing was listed by B. K. Bliss & Sons in 1870 and the same description, but under the name Earliest French Short Horn, was used by the same company in 1867. Round Yellow and Round White carrots were known in France as early as 1750.

## SCARLET HORN

### BRIEF CHARACTERIZATION

Of very limited use, chiefly in home gardens where the soil is shallow or of compact nature.

Early to reach usable size with sparse, small foliage and small, slightly tapering roots 3 to 4 inches long with blunt end, and deep orange-colored flesh and core.

### ADAPTABILITY AND USE

The Scarlet Horn carrot is of high quality and valuable for use in the home garden where the soil is inclined to be shallow or hard. It is of limited use and importance in the United States, as it is too small and too short for commercial bunching purposes. Nantes is equally early, of better quality, and more productive in the better soils.

### SEASON

Early maturing, reaching three-quarters of an inch (1.9 cm.) in diameter in 60 to 70 days from date of germination when grown as a spring and summer crop but requiring 80 to 90 days under cooler temperatures encountered by late fall crops in the Northern States and the winter-grown crops in the Southern States and California. Prime marketable size,  $1\frac{1}{8}$  to  $1\frac{3}{4}$  inches (2.8 to 4.5 cm.), attained in 70 to 80 days as a spring and summer crop but requiring 90 to 100 days as a winter and early spring crop in the Southern States and California.

### PLANT

(Pls. 2 and 4)

Small, at prime marketable stage of maturity average weight about 2.8 ounces (80 gm.), but ranges from 2.3 to 3.5 ounces (65 to 100 gm.) in average weights, depending largely upon the amount of foliage present. Usually 8 to 10 inches (20 to 25 cm.) in average height and 10 to 14 inches (25 to 35 cm.) in average spread, or from 1.0 to 1.6 times as wide as high. Under extremes of environment the average height has been as small as  $3\frac{3}{4}$  inches (9.45 cm.) and as large as  $13\frac{1}{2}$  inches (34 cm.) with the average spread from  $5\frac{1}{4}$  inches (13.4 cm.) to  $19\frac{1}{2}$  inches (50 cm.).

### LEAVES

Few in number, usually average 7 to 9, very seldom less than 5 or more than 13; constitute from 20 to 30 percent of total plant weight of spring and summer crop but only 15 to 20 percent of late fall or winter-grown crop.

### BLADE

Young growth typically light green, ranging from Cerro Green (22 L 5) to Peridot (22 L 6), and Art Green (22 L 7) with older mature leaves darker green

and approximately Forest Green (23 L 6). Small, average length of  $4\frac{1}{4}$  to  $5\frac{1}{2}$  inches (12 to 14 cm.) with a range of  $3\frac{1}{2}$  to 8 inches (9 to 20 cm.); greatest width of blade approximately equal to length, which is usually equal to or slightly longer than the petiole. Divisions small to medium in size.

### PETIOLE

Lighter green than blade division, about Moss Green (21 L 2) to Parrot Green (21 L 6); short, average length of 4 to  $4\frac{1}{4}$  inches (10 to 12 cm.) but ranging from  $3\frac{1}{2}$  to 7 inches (9 to 18 cm.); slender, average width three thirty-seconds to four thirty-seconds of an inch (2.4 to 3.1 mm.) at midlength, average thickness about equal to width; 40 to 60 times as long as wide or thick, ratio depending mainly upon the length.

### NECK AND COLLAR

Small, neck usually eleven thirty-seconds to fourteen thirty-seconds of an inch (9 to 11 mm.) in average diameter at smallest point but increases until at point of attachment of petiole bases to root (collar) the average diameter is fourteen thirty-seconds to sixteen thirty-seconds of an inch (11 to 13 mm.). Collar slightly to medium sunken.

### ROOT

Grows almost completely underground. When first usable, three-fourths of an inch (1.9 cm.) in diameter, the roots are generally long conical in shape; but prime marketable roots,  $1\frac{1}{8}$  to  $1\frac{3}{4}$  inches (2.8 to 4.5 cm.) in diameter, should taper only slightly from square to slightly sloping shoulders to a rounded or blunt base with a fine taproot and very few fibrous side roots from a moderate number of medium length, fairly shallow, horizontal depressions in the root surface. Mid-length diameter from 85 to 95 percent of the crown diameter; average length 3 to 4 inches (8 to 10 cm.); from 2.0 to 2.5 times as long as thick at the crown; average weight 1.7 to 2.8 ounces (50 to 80 gm.).

Skin color when shoulders appear above ground ranges from 14 L 1 to 14 L 7, according to exposure; skin color below ground on prime marketable roots when moist about 10 F 10; cortex (phloem), about 10 F 11, and core (xylem) slightly lighter orange, about 10 I 9.

Core small, comprising about 45 to 55 percent of the crown diameter of the root when grown as a spring and summer crop and only 35 to 45 percent when grown as a late fall or winter crop.

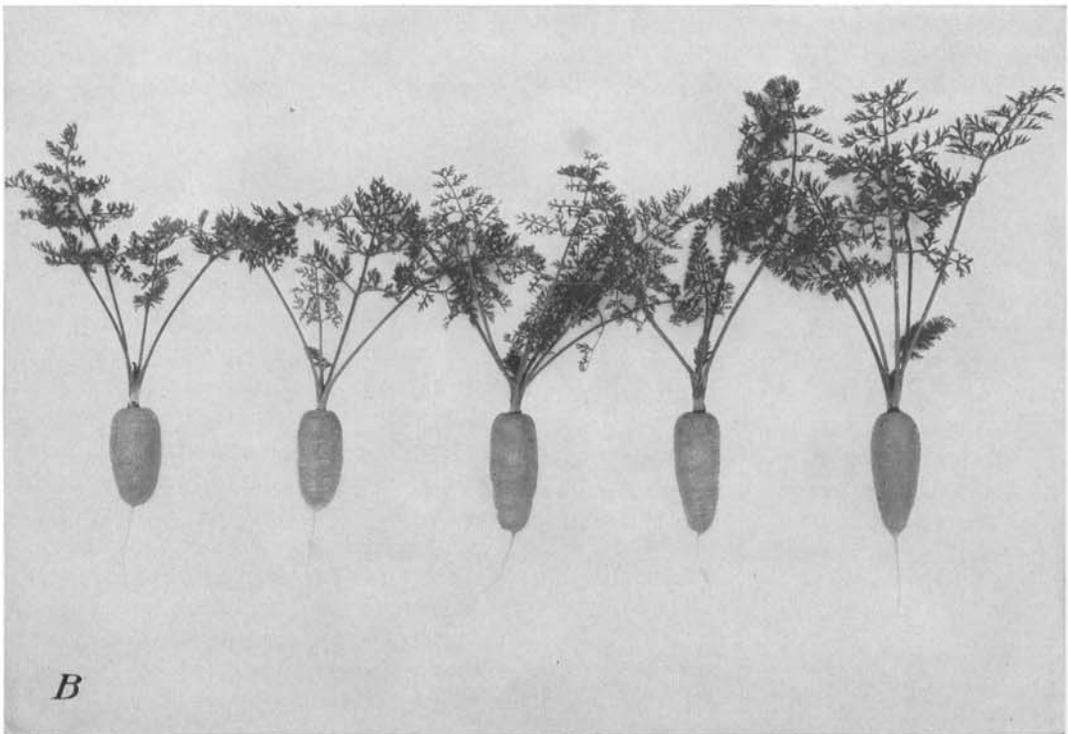
#### SYNONYMS

Early Dutch Horn, Early Scarlet, Early Scarlet Dutch Horn, Early Short Horn, Early Short Scarlet, Dutch Horn Blunt, and Short Horn.

#### HISTORY

A very old type taking its name from the Netherlands town of Hoorn in the neighborhood of which it was probably developed. Horensche wortelen (carrots of Hoorn) were common on the Amsterdam market in 1610. The earliest English seedsmen list Early Horn and Long Orange, and both were probably the first varieties of carrot imported into the United States.

### SCARLET HORN CARROT



Acceptable range in type of Scarlet Horn carrot ( $\times \frac{1}{8}$ ) grown at Arlington, Va.: A, As spring crop 1934, prime marketable; B, fall 1931, mature. Note the more cylindrical shape and rounder bases of the more mature roots in B.

## NANTES

## BRIEF CHARACTERIZATION

Highly recommended for home- and market-garden use because of its excellent quality and earliness.

Early maturing with sparse, small, and very brittle foliage. Roots  $4\frac{1}{2}$  to 6 inches long, nearly cylindrical, with blunt end having deep-orange flesh and core of fine texture and flavor.

## ADAPTABILITY AND USE

Nantes is recommended for home- and market-garden use because of its unexcelled quality and early maturity. The best quality and yields are obtained only on the lighter textured soils, such as fine sand, sandy loams, and muck. The tops and roots are too brittle for commercial bunching and shipment, and it is not a good storage carrot because of its thin skin and fine texture.

## SEASON

Early maturing, reaching three-fourths of an inch (1.9 cm.) in diameter in 60 to 70 days from date of germination when grown as spring and summer crop but requiring 80 to 90 days under cooler temperatures encountered by late fall crops in the Northern States and winter-grown crops in the Southern States and California. Prime marketable size, 1 to  $1\frac{1}{2}$  inches (2.5 to 3.7 cm.), attained in 70 to 80 days as a spring and summer crop but requiring 90 to 100 days as a winter and early spring crop in the Southern States and California.

## PLANT

(Pls. 2, 5, 6, 7, and 8)

Small; at prime marketable stage of maturity, average weight about 3.2 ounces (90 gm.) but ranges from 2.6 to 3.7 ounces (75 to 105 gm.), depending largely on amount of foliage present. Usually 8 to 10 inches (20 to 25 cm.) in average height and 10 to 14 inches (25 to 35 cm.) in average spread or from 1.0 to 1.6 times as wide as tall. Under extremes of environment the average foliage height may be as small as 4 inches (10 cm.) and as large as 12 inches (30 cm.) with the plant width (spread) from  $9\frac{1}{2}$  inches (24 cm.) to 18 inches (46 cm.).

## LEAVES

Few in number, usually average 7 to 9, very seldom less than 5 or more than 13; constitute from 15 to 25 percent of total plant weight of spring and summer crop but only 12 to 20 percent of late fall or winter-grown crop.

## BLADE

Young growth typically light green, ranging from Cerro Green (22 L 5) to Peridot (22 L 6) and Art Green (22 L 7) with older mature leaves darker green and

approximating Forest Green (23 L 6). Small, average length of  $4\frac{3}{4}$  to  $5\frac{1}{2}$  inches (12 to 14 cm.) with a range in average lengths of  $4\frac{1}{2}$  to  $5\frac{3}{4}$  inches (11 to 15 cm.); greatest width of blade approximately equal to length, which is usually equal or slightly longer than the petiole. Divisions small to medium in size.

## PETIOLE

Lighter green than blade divisions, about Moss Green (21 L 2) to Parrot Green (21 L 6); short, average length of 4 to  $4\frac{3}{4}$  inches (10 to 12 cm.) but ranges in average lengths from  $3\frac{1}{2}$  to  $5\frac{1}{4}$  inches (9 to 13 cm.); slender, average width six sixty-fourths to eight sixty-fourths of an inch (2.4 to 3.0 mm.) at midlength; average thickness about equal to width; 35 to 45 times as long as wide, depending mainly on the length.

## NECK AND COLLAR

Very small, neck usually eighteen sixty-fourths to twenty-five sixty-fourths of an inch (7 to 10 mm.) in average diameter at smallest point but increases until at point of attachment of petiole bases to root (collar) the average diameter is twenty-two sixty-fourths to thirty sixty-fourths of an inch (9 to 12 mm.). Collar not sunken.

## ROOT

Grows almost completely underground with a few roots protruding three-eighths to five-eighths of an inch (1 to 1.5 cm.) above the soil level; when first usable, three-fourths of an inch (1.9 cm.) in diameter, the roots are almost cylindrical in shape for the upper one-half to two-thirds of their length, but taper gradually for the lower one-half to one-third to a more or less pointed base. Prime marketable roots,  $1\frac{1}{2}$  to  $1\frac{3}{4}$  inches (2.8 to 4.5 cm.), should be cylindrical throughout their length or only slightly tapered to a rounded (blunt) or short-tapered base with very fine taproot and very few fibrous side roots from a moderate number of medium-length, fairly shallow, horizontal depressions in the root surface. Shoulders round to long sloping. Midlength diameter from 90 to 100 percent of the crown diameter; average length  $4\frac{3}{4}$  to  $5\frac{1}{4}$  inches (12 to 15 cm.) with Louisiana crops shorter and California longer, from 3.5 to 6.2 times as long as thick at the crown; average weight 2.1 to 3.2 ounces (60 to 90 gm.), depending mainly on length.

Skin color when shoulders appear above ground ranges from light to dark red, approximately Tapestry Red (7 J 5) for the dark red; skin color below ground on prime marketable roots when moist about 10 F 10; cortex (phloem) about 10 C 10; and core (xylem) only slightly yellower, about 10 I 9.

Core small, comprising about 45 to 55 percent of the crown diameter of the root when grown as a spring and summer crop and only 35 to 45 percent when grown as a late fall or winter crop.

#### SYNONYMS

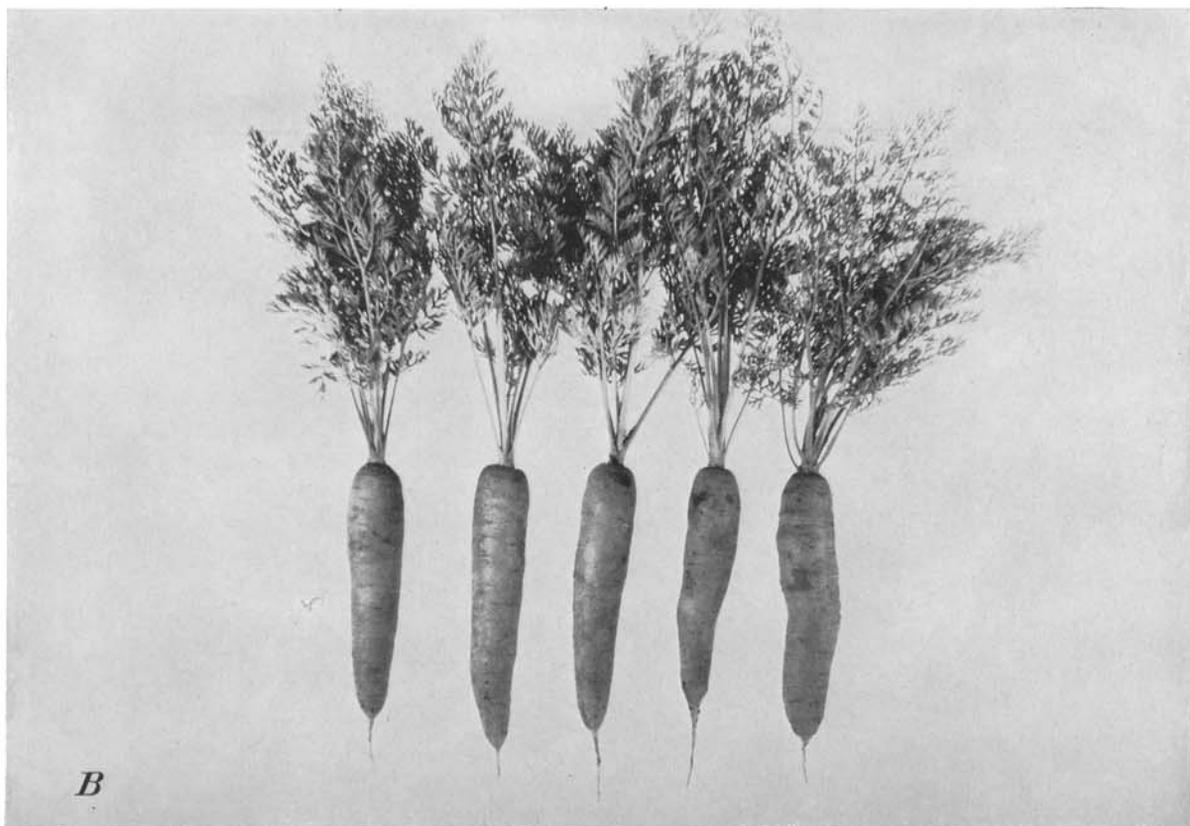
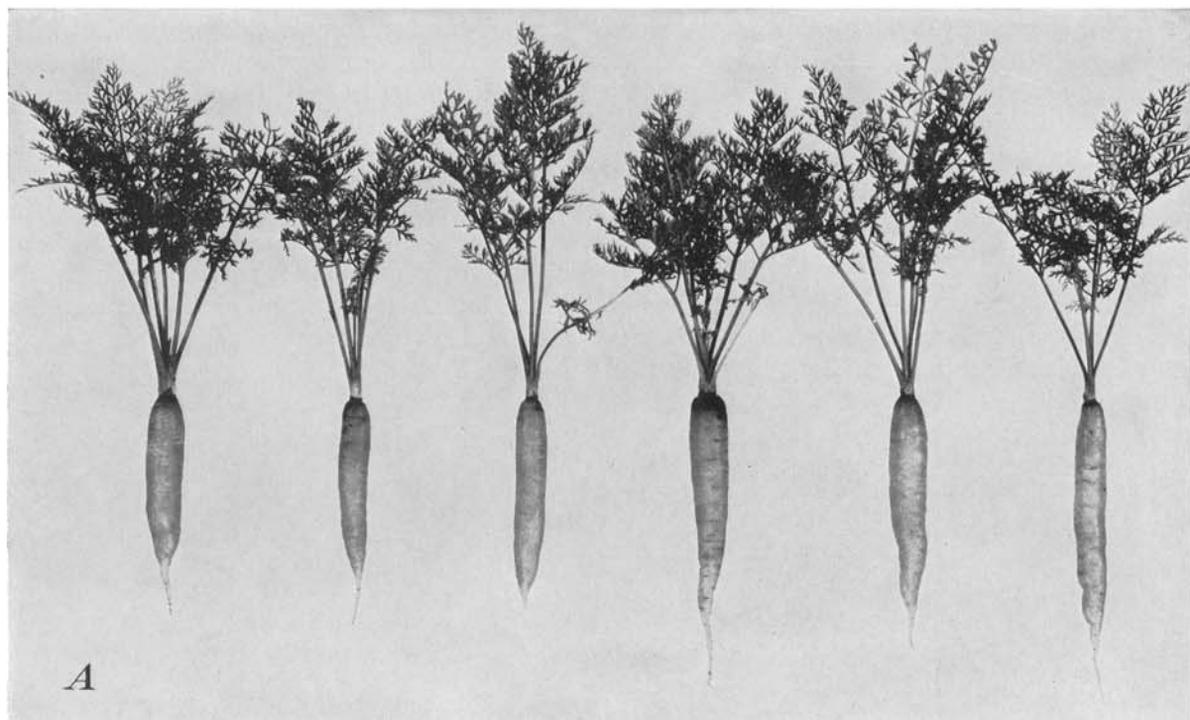
Coreless, Early Half Long Nantes, Early Nantes, Half Long Coreless Nantes, Half Long Nantes, Half

Long Scarlet, Half Long Scarlet Nantes Stump Rooted, Half Long Scarlet Stump Rooted, Half Long Stump Rooted Nantes, Improved Nantes, Nantes Half Long, Nantes Half Long Scarlet, Nantes Half Long Stump Rooted, Nantes Stump Rooted, and Stump Rooted.

#### HISTORY

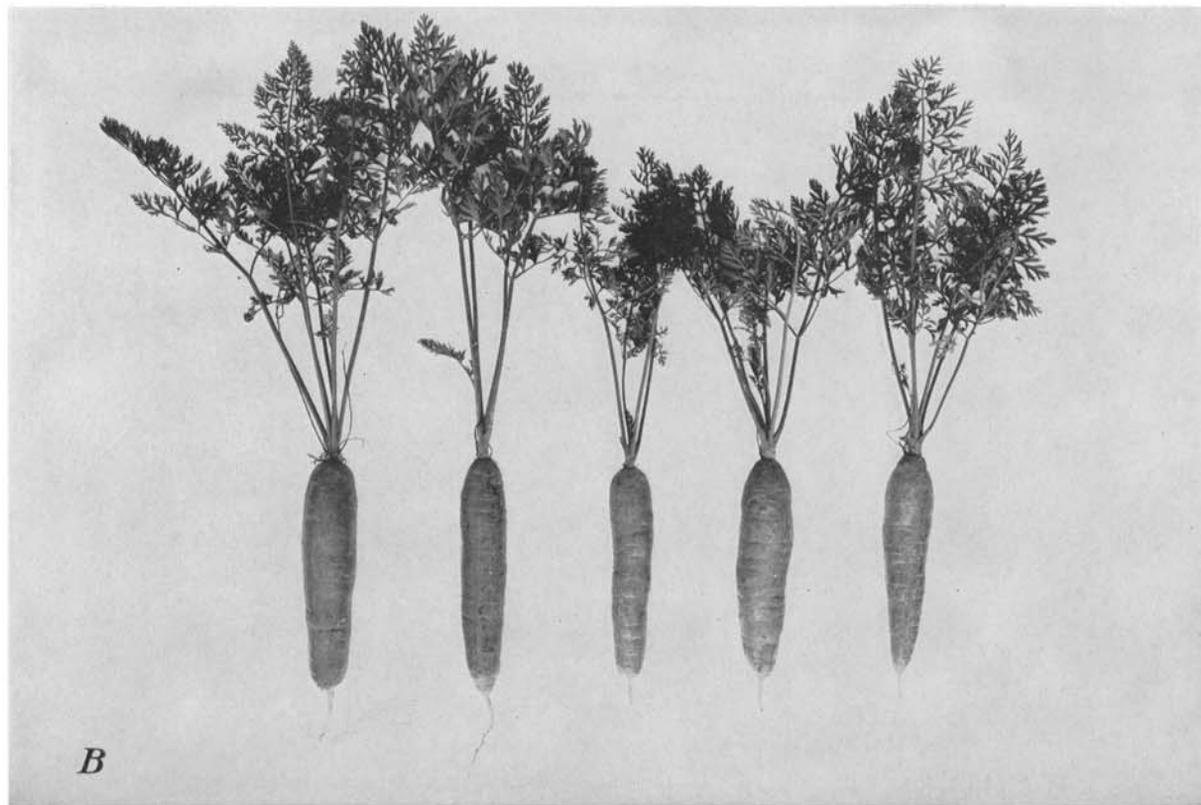
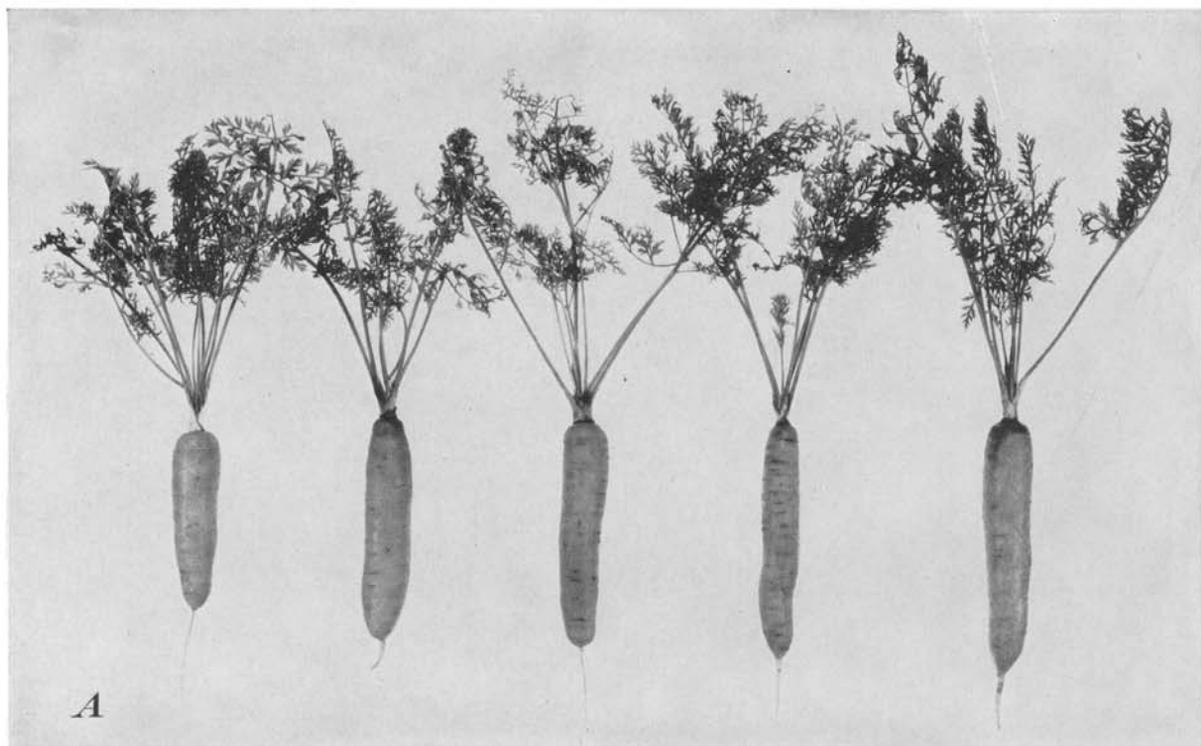
Early Half Long Scarlet Nantes first appeared in the B. K. Bliss & Sons catalog for 1870. Other and later catalogs indicate that it was a more refined strain of the older Half Long Stump Rooted variety (itself a strain of Early Horn) developed in the vicinity of Nantes, France.

# NANTES CARROT



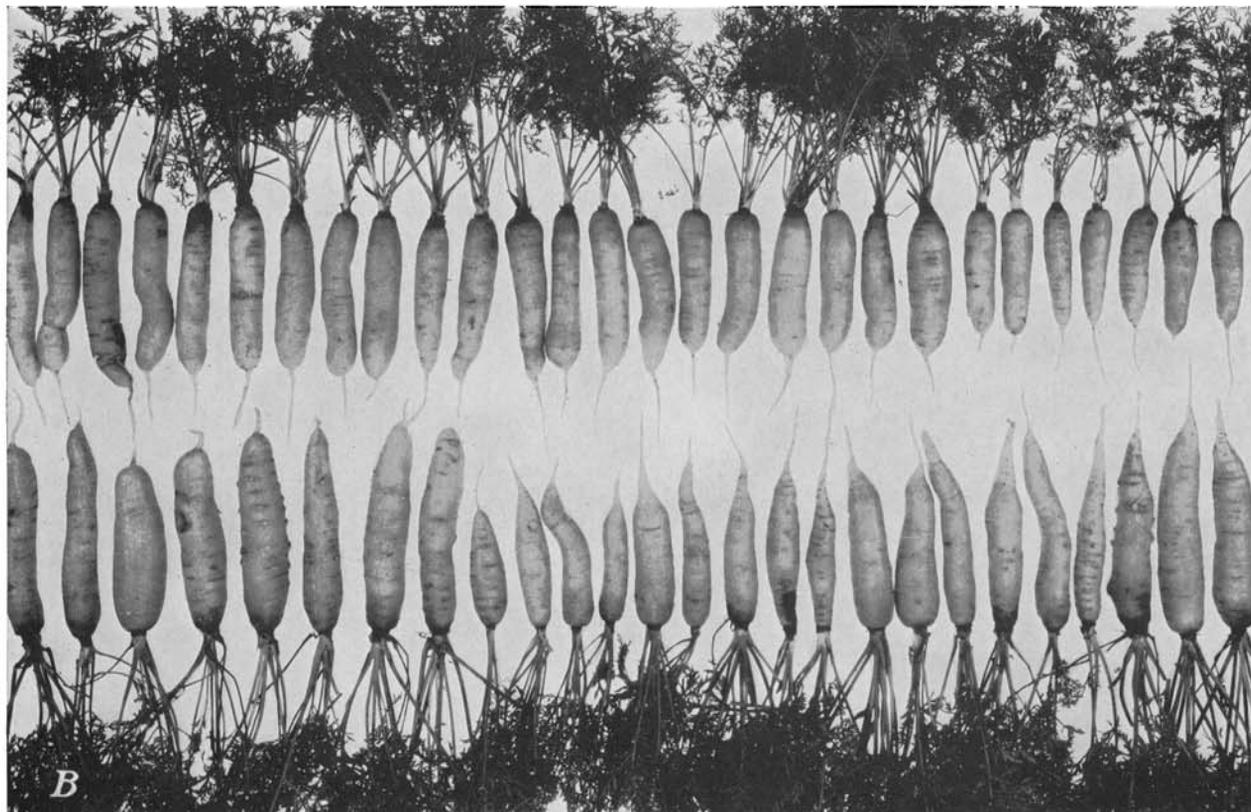
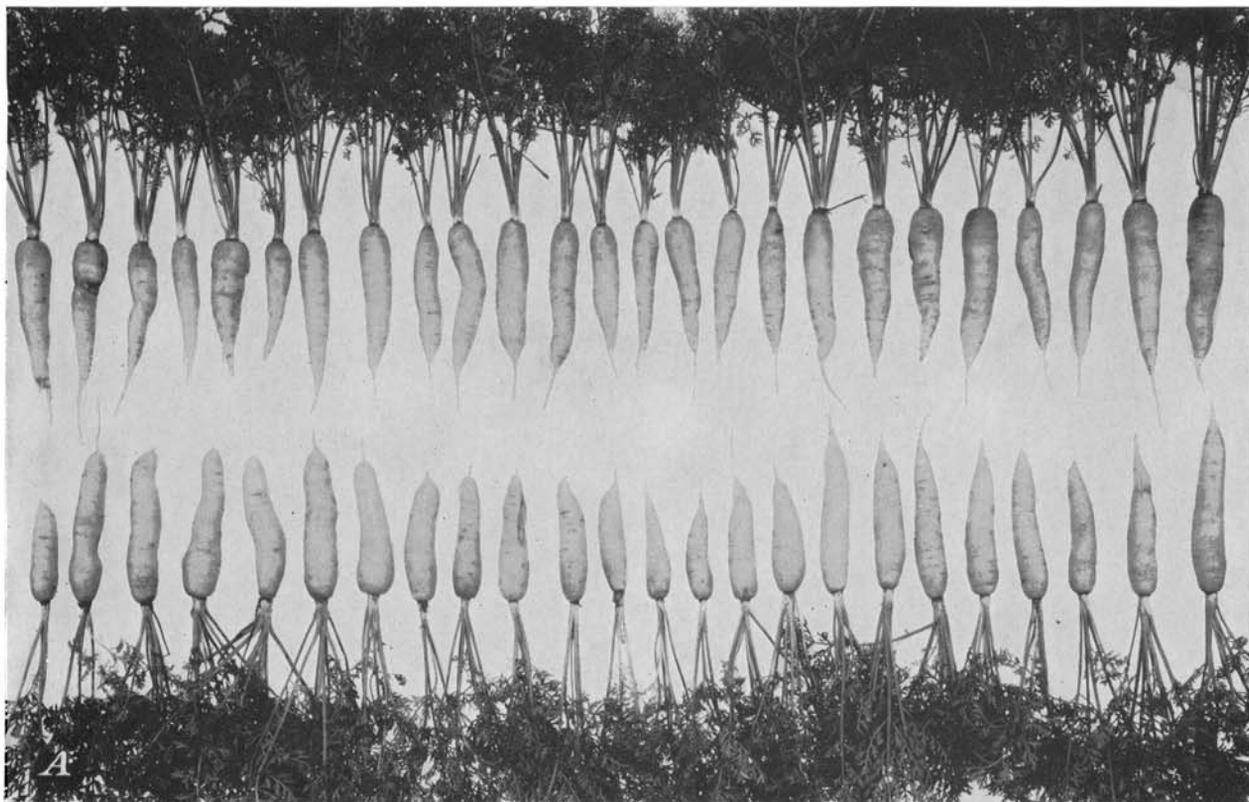
Acceptable range in type of Nantes carrot grown as (A) spring crop 1934, at Arlington, Va., first marketable  $\times \frac{1}{8}$ ; (B) as spring crop 1932, at Davis, Calif., prime marketable stage of maturity.

### NANTES CARROT



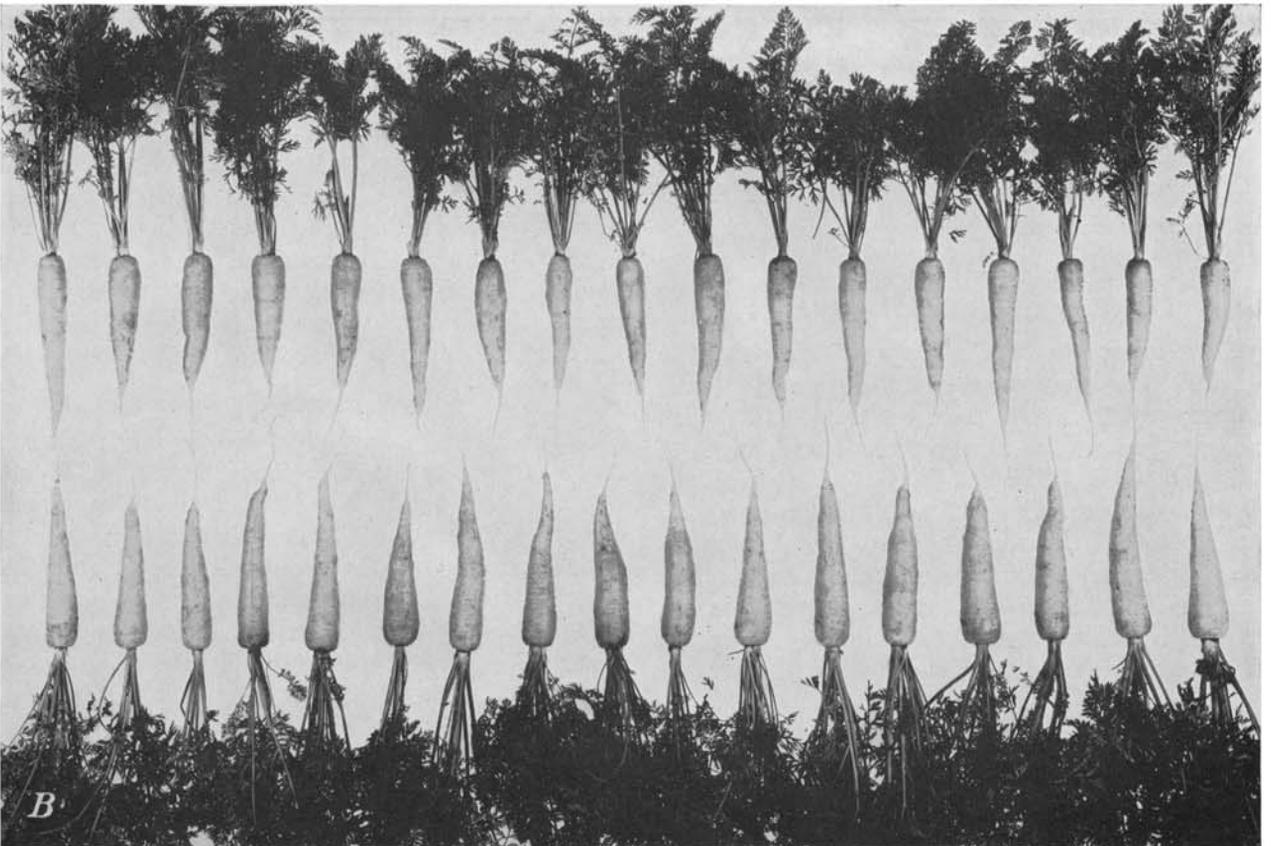
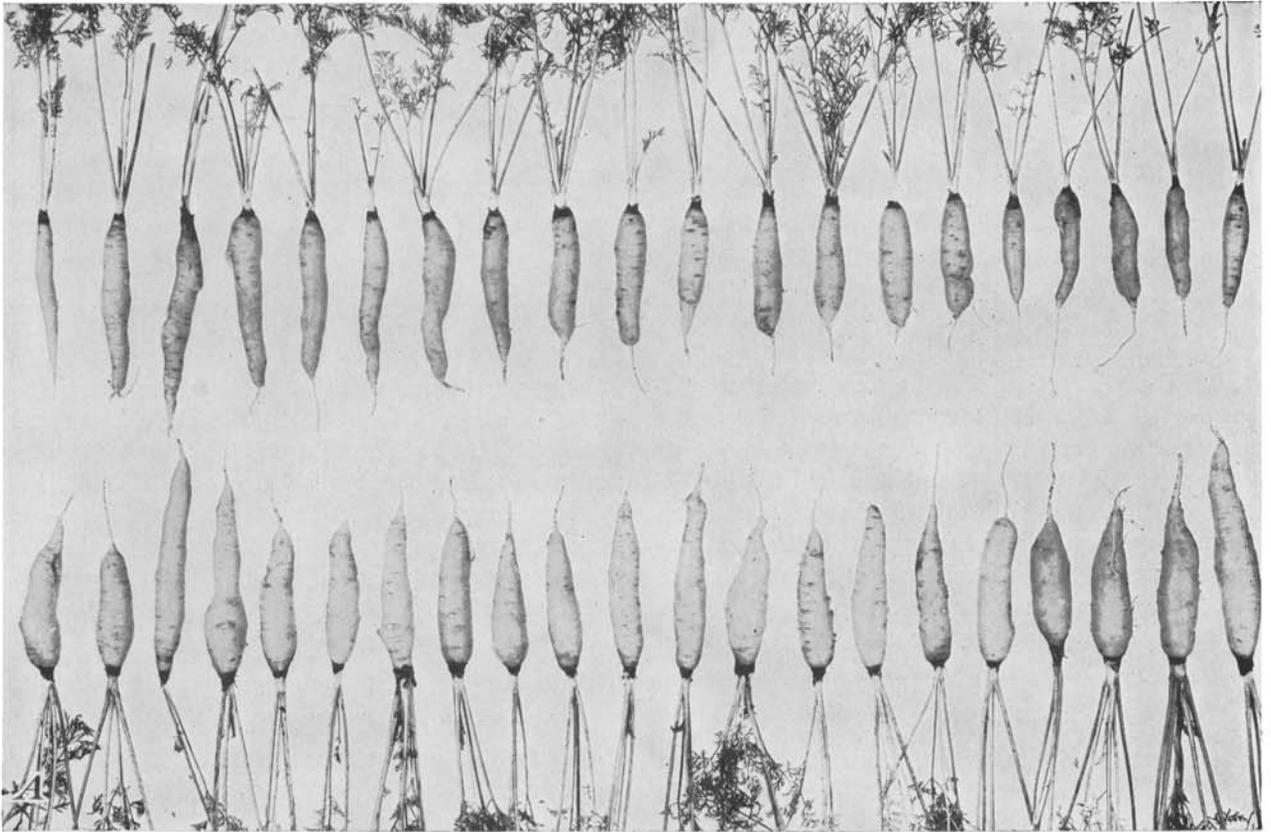
Acceptable range in type of mature Nantes carrot,  $\times \frac{1}{8}$ : A, Grown at Arlington, Va., spring 1932; B, at Norfolk, Va., fall 1931. Compare with plate 5, A, and note more cylindrical shape and more rounded tips on mature roots.

## NANTES CARROT



Random sample of good strain of Nantes carrot, grown in spring 1932 at Arlington, Va., showing effect of age on size and shape,  $\times \frac{1}{6.5}$ . B is 1 month older than A. Note the rounding out of the tips on the older roots and the rough surface due to high temperatures and second growth.

## NANTES CARROT



Random sample of the same strain of Nantes carrot grown at Beltsville, Md., in 1935, showing difference in shape when grown (A) during a dry, hot spring and summer, and (B) during a cool, moist fall season,  $\times \frac{1}{8.5}$ . Note marked difference in shape of crown and tip of root. Disease in late spring killed most of the leaves and prevented normal maturity.

**RED CORE CHANTENAY****BRIEF CHARACTERIZATION**

The most widely used general-purpose variety. Especially valuable for storage and canning factory purposes.

Midseason in maturity with a large strong top or foliage. Roots  $4\frac{1}{2}$  to  $5\frac{1}{2}$  inches long and  $1\frac{1}{4}$  to 2 inches thick when used for bunching, tapering to a blunt end and with deep-orange flesh and core; of good quality.

**ADAPTABILITY AND USE**

The Red Core Chantenay is the most valuable general-purpose variety. It is recommended for home gardens where only a single variety is to be grown, as it grows well in most soil types. Still used for bunching purposes in many market-gardening sections, although the longer varieties are supplanting it in carlot-shipping sections. Large acreages are grown for use in soups, for canning, and for manufacturing, because of the large yields of uniformly and deeply colored roots that are produced under favorable conditions.

**SEASON**

Midseason maturity, reaching three-fourths of an inch (1.9 cm.) in diameter in 65 to 75 days from date of germination when grown as a spring and summer crop, but requiring 90 to 100 days under cooler temperatures encountered by late fall crops in the Northern States and the winter-grown crop in the Southern States and California. Prime marketable size for bunching,  $1\frac{1}{4}$  to  $2\frac{1}{4}$  inches (3.2 to 5.7 cm.) attained in 75 to 85 days as a spring and summer crop, but requiring 90 to 120 days as a winter and early spring crop in the Southern States and California.

**PLANT**

(Pls. 2, 9, 10, 11, and 12)

Large, at prime marketable stage of maturity the average weight is approximately 6.2 ounces (175 gm.) but may range from 4.9 to 8 ounces (140 to 225 gm.), depending on amount of foliage present and length of root. Usually 14 to 18 inches (35 to 45 cm.) in height and 16 to  $19\frac{1}{2}$  inches (40 to 50 cm.) in average spread or from 1.0 to 1.6 times as wide as tall. Under extremes of environment average heights have been as small as 9 inches (23 cm.) and as large as  $19\frac{1}{2}$  inches (50 cm.) with average spreads as small as 12 inches (30 cm.) and as large as  $23\frac{1}{2}$  inches (60 cm.).

**LEAVES**

Large in number, average 10 to 13, very seldom less than 9 or more than 15; constitute from 30 to 35 percent of total plant weight of spring and summer crops, but only 25 to 30 percent of late fall or winter crops.

**BLADE**

Young growth typically light green, ranging from Cerro Green (22 L 5) to Peridot (22 L 6) and Art Green (22 L 7) with older mature leaves darker green and approximately Forest Green (23 L 6). Large, average length 8 to 10 inches (20 to 25 cm.) and a range in average lengths of  $6\frac{3}{4}$  to  $10\frac{1}{4}$  inches (17 to 26 cm.); greatest width of blade slightly larger or equal to length, which is usually 20 to 30 percent longer than the petiole. Divisions medium in size.

**PETIOLE**

Lighter green than blade divisions, about Moss Green (21 L 2) to Parrot Green (21 L 6); medium to long, average length of  $6\frac{1}{4}$  to 8 inches (16 to 20 cm.), but ranging from  $4\frac{1}{2}$  to  $8\frac{3}{4}$  inches (11 to 22 cm.); stout, average width of two-sixteenths to three-sixteenths of an inch (3 to 5 mm.) at midlength; average thickness almost equal to width; 40 to 45 times as long as wide or thick.

**NECK AND COLLAR**

Medium to large, neck usually thirty-four sixty-fourths to fifty sixty-fourths of an inch (14 to 20 mm.) in average diameter at smallest point, but increases until at point of attachment of petiole bases to root (collar) the average diameter is forty-five sixty-fourths to fifty-eight sixty-fourths of an inch (18 to 23 mm.). Collar slightly to medium sunken.

**ROOT**

Grows almost completely underground; when first usable, three-fourths of an inch (1.9 cm.) in diameter, the roots are generally long-conical in shape, but as the roots mature the lower half of the root fills out and eventually the base should become rounded or stump-rooted. At prime marketable stage of maturity,  $1\frac{1}{4}$  to 2 inches (3.2 to 5.0 cm.), the shoulders are square to rounded, sides taper gradually to a blunt-pointed or rounded base with a medium fine taproot and a moderate number of fine fibrous side roots from a moderate number of medium length, fairly shallow horizontal depressions in the root surface. Midlength diameter from 80 to 90 percent of the crown diameter, average length from  $4\frac{1}{2}$  to  $5\frac{1}{4}$  inches (11 to 13 cm.) with spring crop at Norfolk and Louisiana slightly

shorter and California crops slightly longer, from 2.2 to 3.2 times as long as thick at the crown; average weight from 3.5 to 6.2 ounces (100 to 175 gm.), depending mainly on length.

Skin color when shoulders appear above ground ranges from 14 L 1 to 14 L 7, according to exposure; skin color below ground on prime marketable roots when moist about 10 F 10 to 10 C 10; cortex (phloem) about 10 C 10; and core (xylem) slightly more yellow, 10 I 9.

Core large, comprising about 60 to 75 percent of the crown diameter when grown as a spring and

summer crop, but only 50 to 60 percent when grown in late fall or winter.

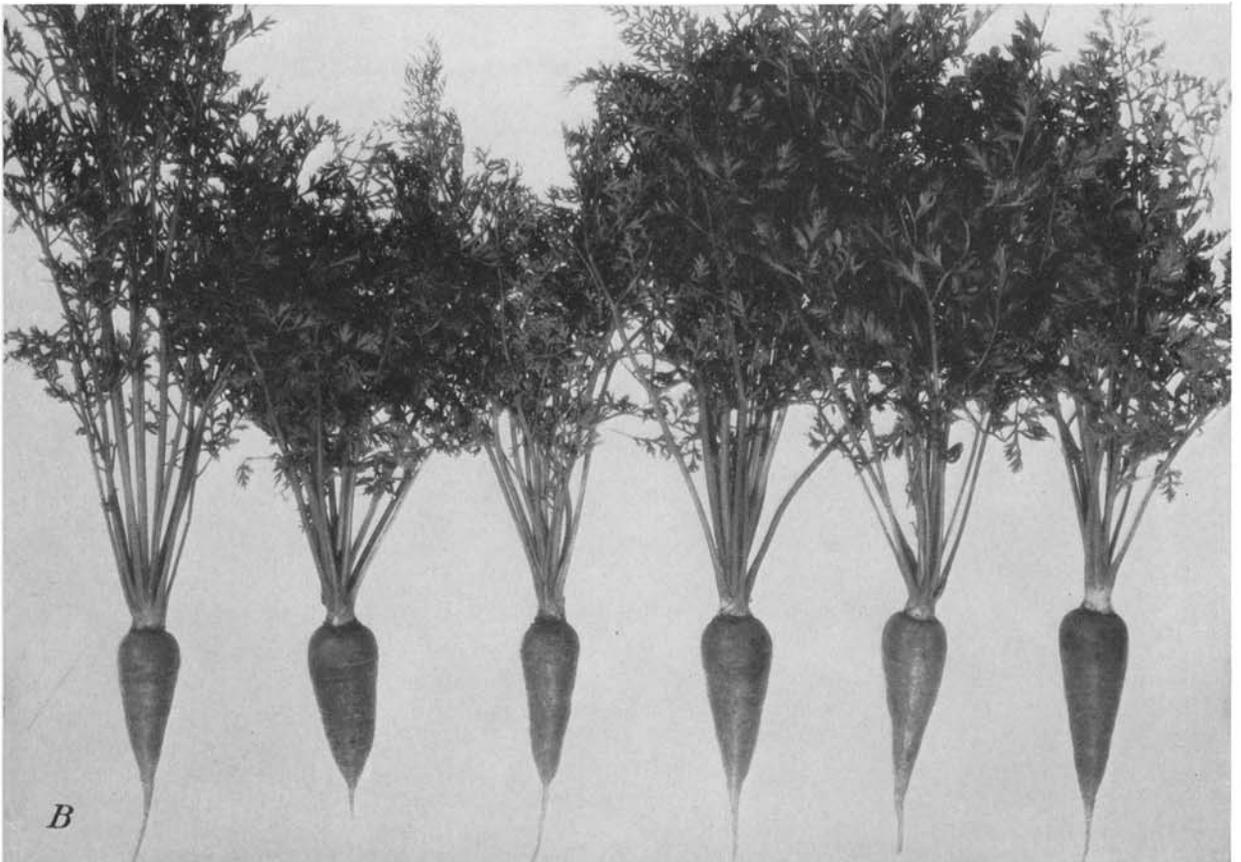
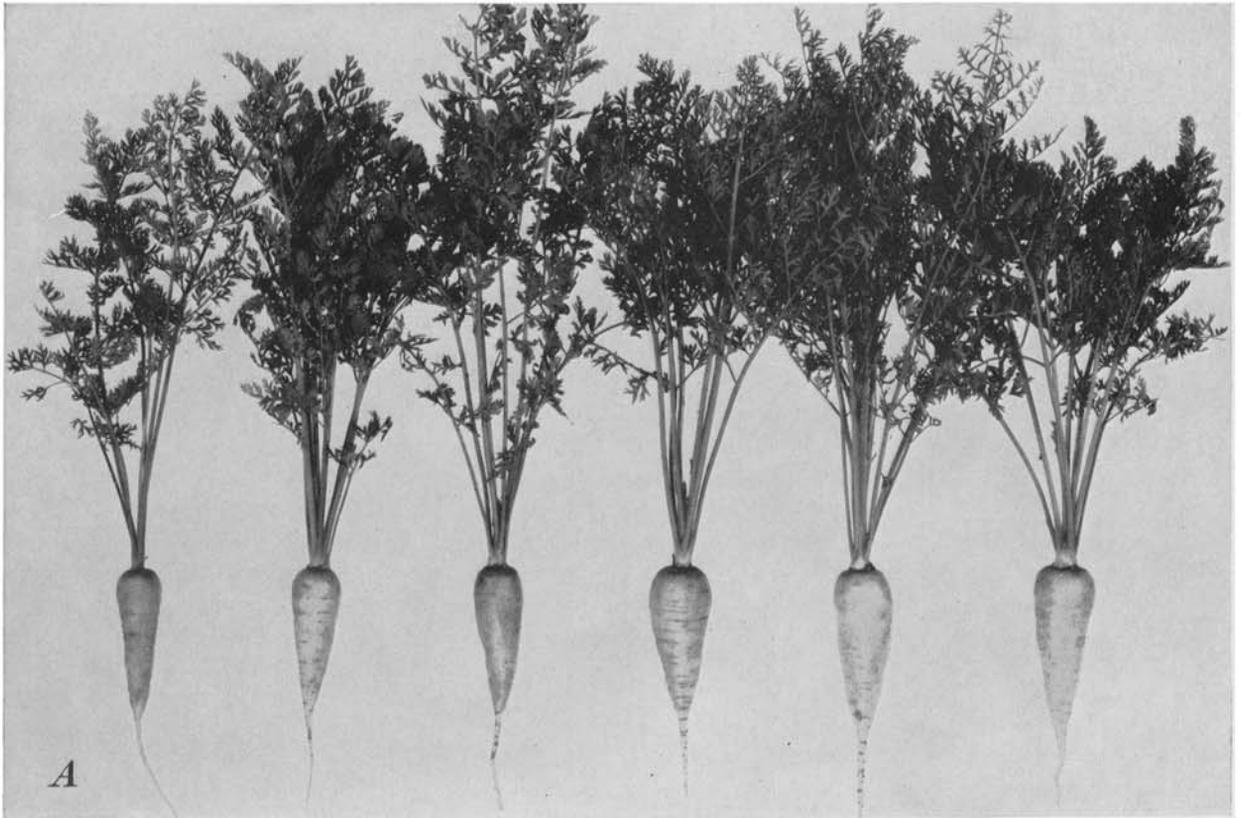
#### SYNONYMS

Coreless Chantenay, Goldinhart, Rotheroz; Ruby Core.

#### HISTORY

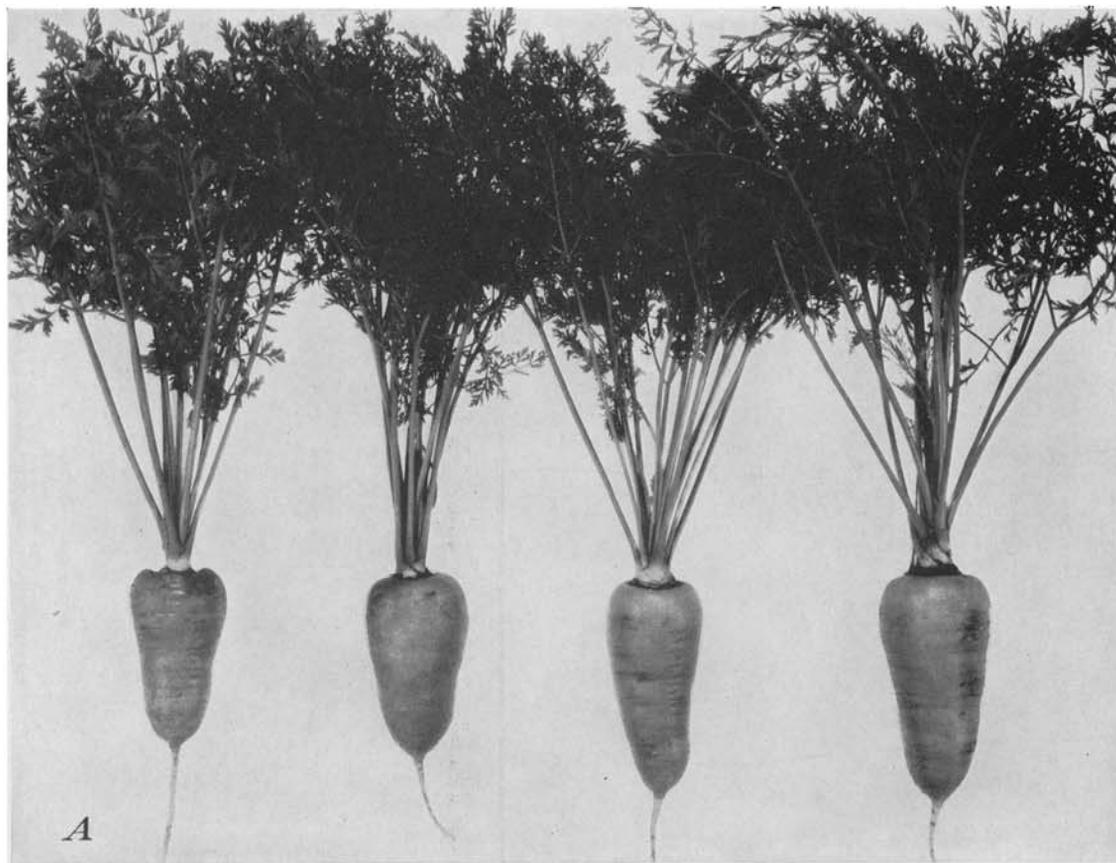
Red Core Chantenay was produced by continued selection of "red" or orange-colored roots originally from the Chantenay variety. It was introduced to the seed trade in 1929 by C. C. Morse & Co.

### RED CORE CHANTENAY CARROT



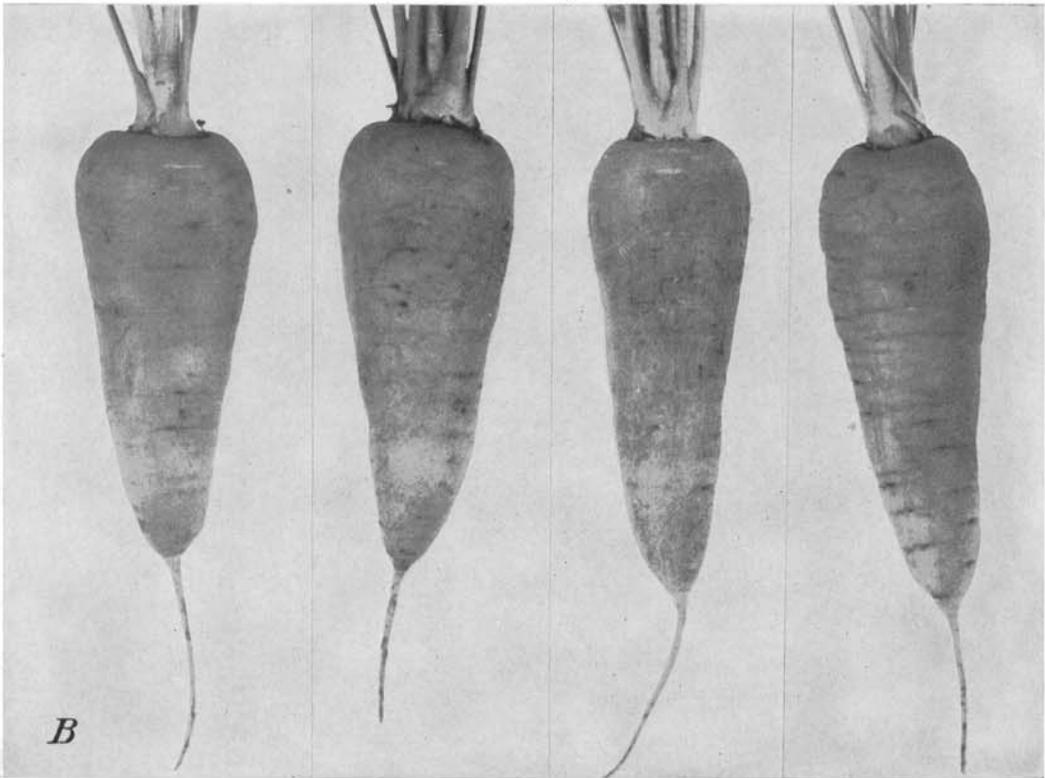
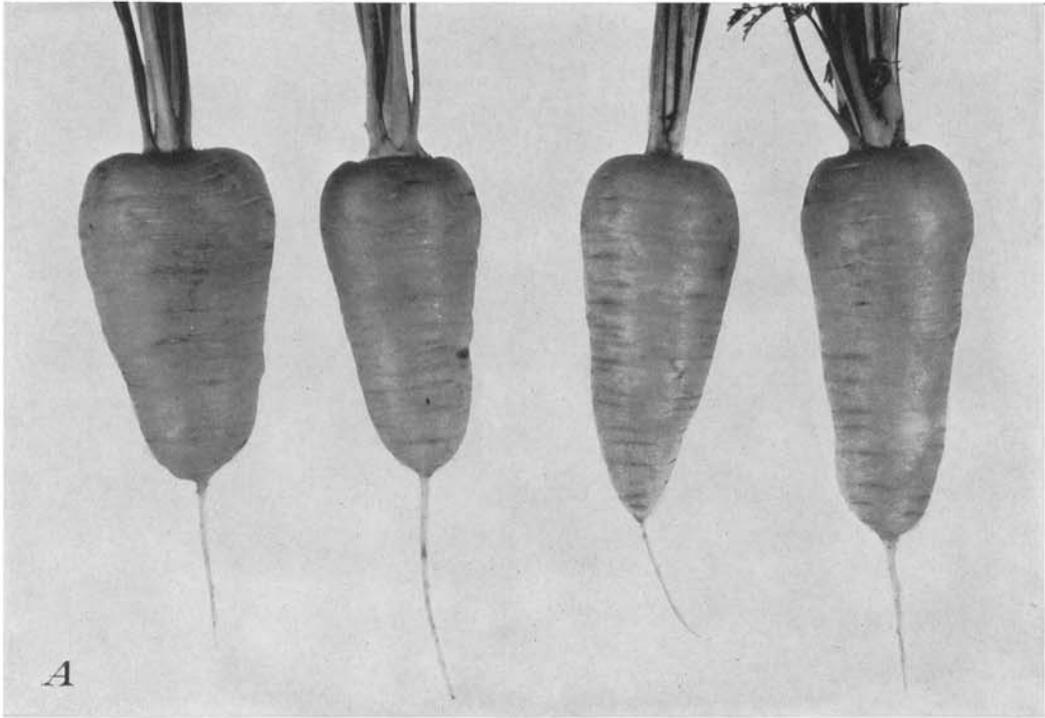
Acceptable range in type of Red Core Chantenay carrot grown at Arlington, Va., as a spring crop (A) in 1934 at first marketable and (B) in 1933 at prime marketable stage of maturity,  $\times \frac{1}{8}$ . Compare with plate 10, A, and note increase in crown diameter and thickness and roundness of tip with increased age.

### RED CORE CHANTENAY CARROT



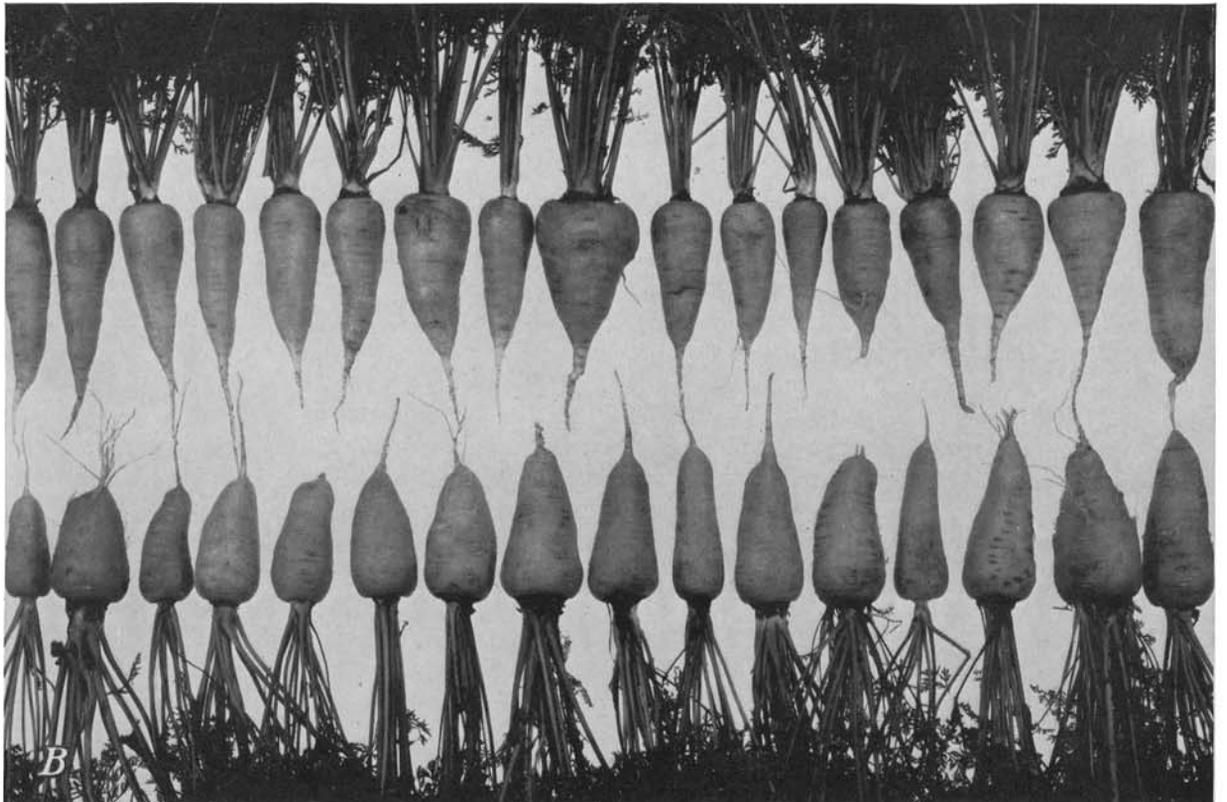
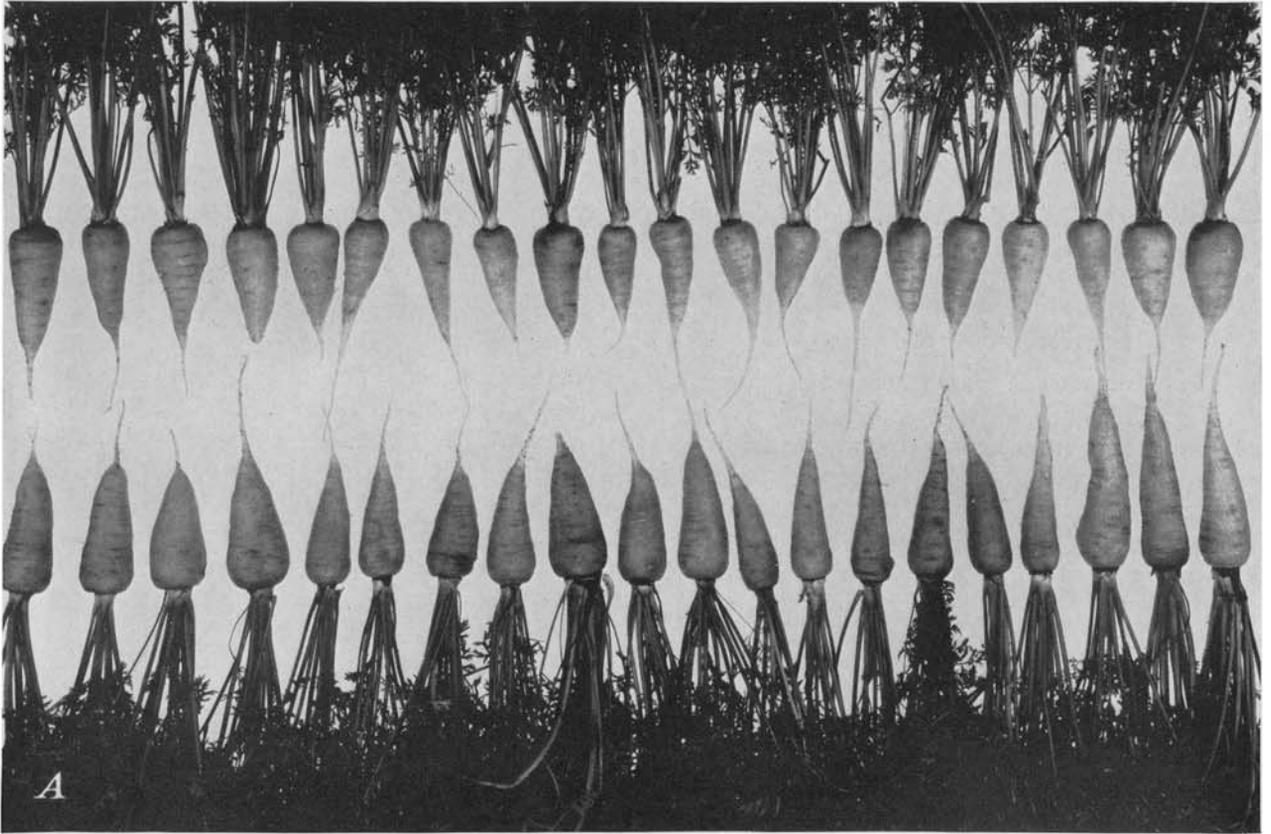
Acceptable range in type of mature Red Core Chantenay carrot,  $\times \frac{1}{8}$ . A, Grown at Arlington, Va., spring crop, 1932; B, at Norfolk, Va., fall crop, 1931. Note the failure of the Norfolk fall crop to attain rounded tip.

### RED CORE CHANTENAY CARROT



Acceptable range in type of Red Core Chantenay carrot at prime marketable stage of maturity grown at Davis, Calif., (A) in spring 1933; (B) in spring 1932, showing difference in size and shape produced in different seasons,  $\times \frac{1}{2}$ .

## RED CORE CHANTENAY CARROT



Random sample of good strain of Red Core Chantenay carrot grown in spring 1932 at Arlington, Va., showing effect of age on size and shape,  $\times \frac{1}{8}$ . B is 1 month older than A and shows failure of many roots to develop rounded tips although there is a marked increase in this respect with greater age.

## DANVERS

## BRIEF CHARACTERIZATION

The most extensively used variety for bunching purposes, but is being supplanted by longer varieties in certain shipping sections.

Midseason in maturity with large, strong foliage. Roots 5 to 6 inches long by  $1\frac{1}{4}$  to  $1\frac{3}{4}$  inches thick when used for bunching, tapering to a short-tapered or slightly rounded end and with deep-orange flesh and slightly yellower core.

## ADAPTABILITY AND USE

The Danvers carrot is primarily used for bunching in market-garden and shipping sections but is also a good storage carrot and when overgrown is valuable for stock feed. In carlot-shipping sections with light-textured soils longer and better colored varieties are rapidly supplanting it for bunching. It is not adapted to heavy or shallow soils. The interior color is usually not deep enough nor uniform enough for canning purposes.

## SEASON

Midseason maturity, reaching three-fourths of an inch (1.9 cm.) in diameter in 70 to 85 days from date of germination when grown as a spring and summer crop, but requiring 90 to 100 days under cooler temperatures encountered by late fall crops in the Northern States and the winter crop in the Southern States and California. Prime marketable size for bunching,  $1\frac{1}{4}$  to 2 inches (3.2 to 5.0 cm.), attained in 80 to 90 days as a spring and summer crop but requiring 90 to 120 days as a winter and early spring crop in the Southern States and California.

## PLANT

(Pls. 2, 13, and 14)

Large, at prime marketable stage of maturity the average weight is approximately 6.2 ounces (175 gm.), but may range from 4.6 to 7 ounces (130 to 200 gm.), depending largely on amount of foliage and length of root. Usually 12 to 16 inches (30 to 40 cm.) in height and 14 to 18 inches (35 to 45 cm.) in average spread, or from 1.0 to 1.6 times as wide as tall. Under extremes of environment, the average height has been as small as  $9\frac{1}{2}$  inches (24 cm.) and as large as 18 $\frac{1}{2}$  inches (47 cm.), with an average spread from 12 inches (30 cm.) to 20 $\frac{1}{2}$  inches (52 cm.).

## LEAVES

Large in number, average 9 to 12, very seldom less than 8 or more than 15; constitute from 35 to 45 percent of the total plant weight of spring and summer crops and only 25 to 30 percent of late fall or winter crops.

## BLADE

Young growth typically light green, ranging from Cerro Green (22 L 5) to Peridot (22 L 6) and Art Green (22 L 7) with older mature leaves darker green and approximately Forest Green (23 L 6). Large, average length of 8 to 10 inches (20 to 25 cm.) and a range in average lengths of  $5\frac{3}{4}$  to 10 inches (15 to 25 cm.); greatest width of blade usually smaller than or equal to blade length, which is 10 to 45 percent longer than the petiole. Divisions medium in size.

## PETIOLE

Lighter green than blade divisions, about Moss Green (21 L 2) to Parrot Green (21 L 6); medium to long, average length of  $5\frac{3}{4}$  to 8 inches (15 to 20 cm.), but ranges from  $4\frac{1}{2}$  to 9 inches (11 to 23 cm.); stout, average width of two-sixteenths to three-sixteenths of an inch (3 to 5 mm.) at midlength, average thickness almost equal to width; 35 to 50 times as long as wide.

## NECK AND COLLAR

Medium to large, neck usually thirty-four sixty-fourths to forty-five sixty-fourths of an inch (14 to 18 mm.) in average diameter at smallest point, but increases until at point of attachment of petiole bases to root (collar) the average diameter is forty sixty-fourths to sixty sixty-fourths of an inch (16 to 24 mm.). Collar not, or only slightly, sunken.

## ROOT

Grows almost completely underground. When first usable, three-fourths inch (1.9 cm.) in diameter, the roots are long-conical in shape with a long, tapering base, but as the roots mature the lower half fills out and eventually the base should become short-tapered or slightly rounded. At prime marketable stage of maturity,  $1\frac{1}{4}$  to 2 inches (3.2 to 5.0 cm.), the shoulders are almost square to rounded, sides taper gradually to a short-tapered or slightly rounded base with a medium fine taproot and a moderate number of medium length fairly shallow, horizontal depressions in the root surface. Midlength diameter is from 75 to 85 percent of the crown diameter; average length from  $5\frac{1}{8}$  to  $5\frac{1}{2}$

inches (13 to 15 cm.) with spring crops at Norfolk and in Louisiana slightly shorter and in California and Texas slightly longer; from 2.9 to 4.3 times as long as thick at the crown; average weight from 3 to 4.7 ounces (85 to 135 gm.), depending mainly on length.

Skin color when shoulders appear above ground ranges from 14 L 1 to 14 L 7, according to exposure; skin color below ground on prime marketable roots when moist about 10 F 10; cortex (phloem) about 10 F 11, and core (xylem) usually more yellow, 10 I 5, although some roots as orange as 10 I 9.

Core medium to large, comprising from 55 to 65 percent of the crown diameter when grown as a spring and summer crop, and 45 to 55 percent when grown in late fall or winter.

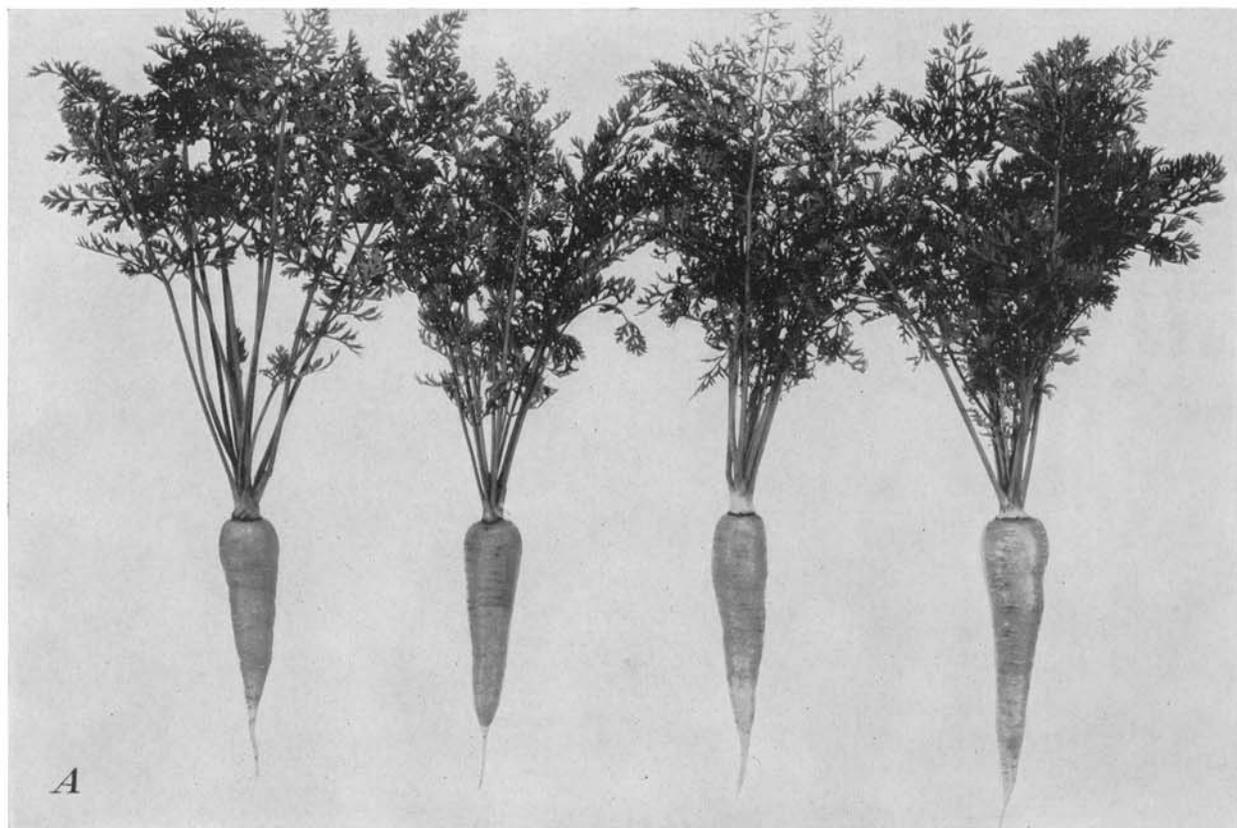
#### SYNONYMS

Danvers Half Long, Danvers Half Long Improved, Danvers Half Long Orange, Danvers Half Long Scarlet, Danvers Improved, Danvers Intermediate, Exhibition Danvers, Half Long Danvers, Half Long Orange, Selected Half Long Danvers, Improved Danvers Half Long, Market Garden, Orange Danvers, Prize Danvers, Selected Danvers, and Stump Rooted Half Long.

#### HISTORY

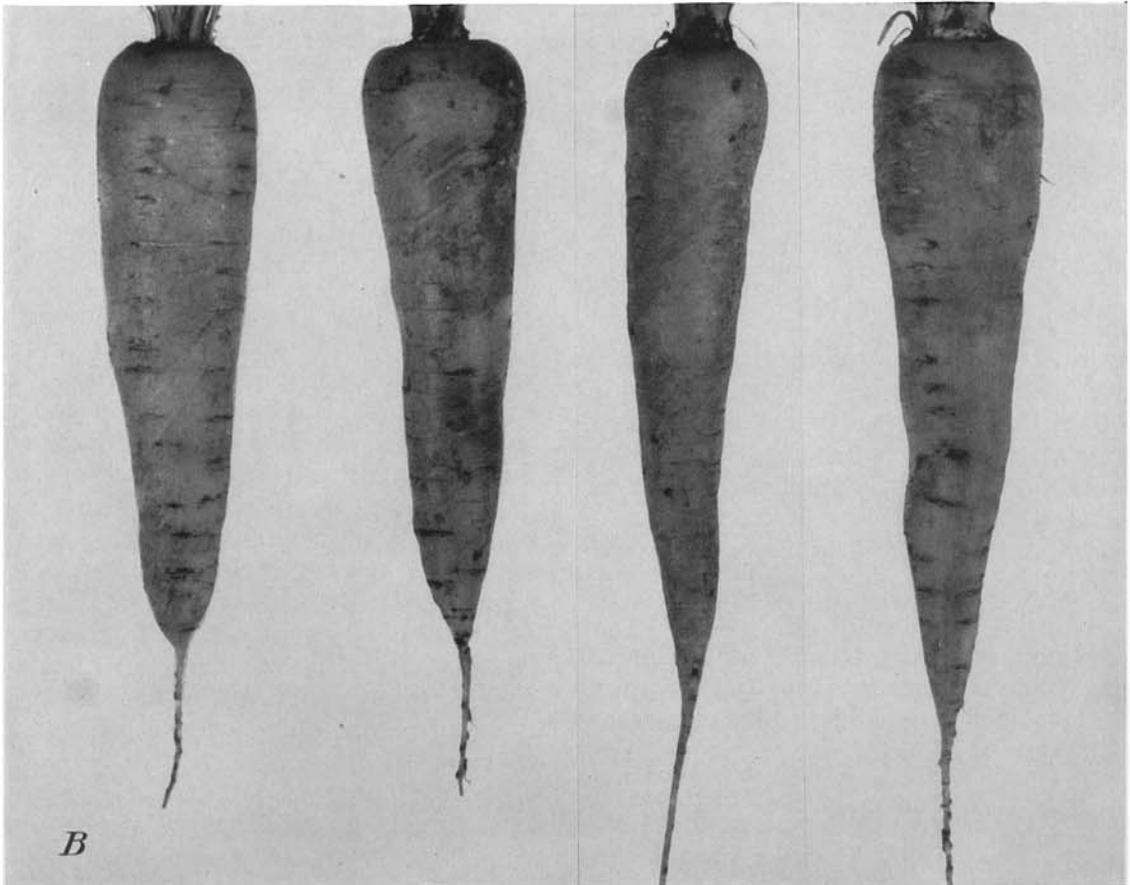
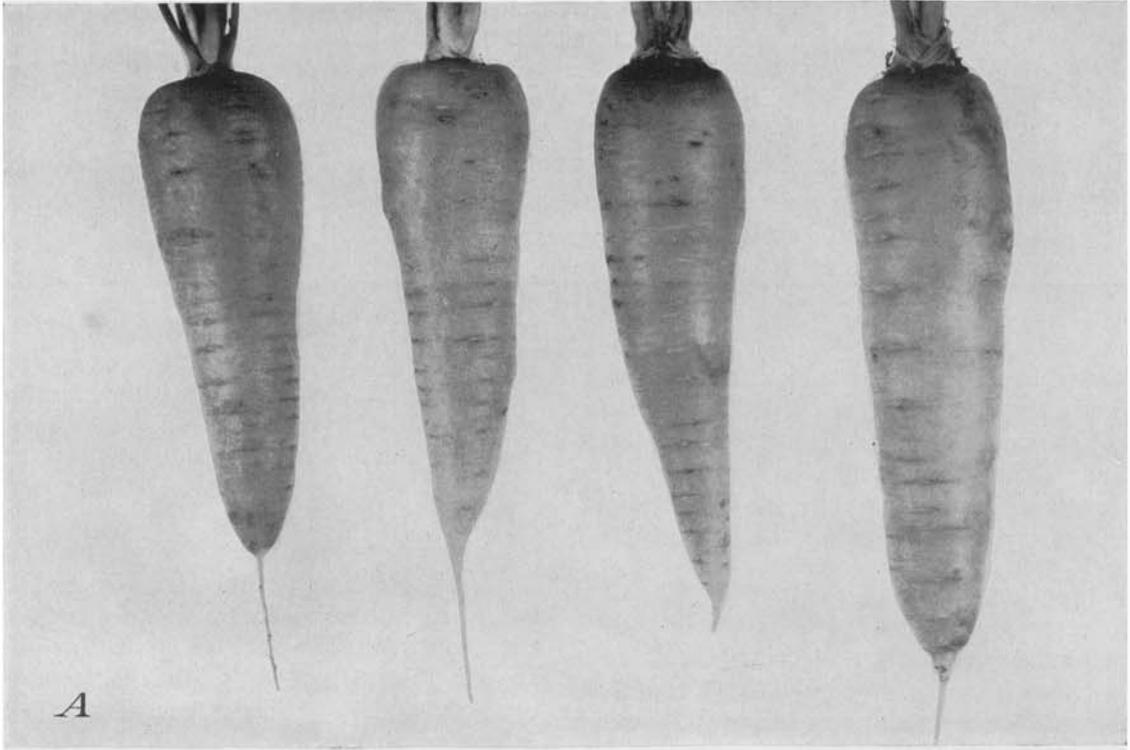
First listed in the United States by Schlegel, Everett & Co. in 1871, and developed at an early date by carrot growers in the vicinity of Danvers, Mass., from which town it obtained its name. It was first known locally as the Danvers carrot.

### DANVERS CARROT



Acceptable range in type of mature Danvers carrot grown (A) at Arlington, Va., spring crop 1932, and (B) at Norfolk, Va., fall crop 1931,  $\times \frac{1}{2}$ .

### DANVERS CARROT



Acceptable range in type of prime marketable Danvers carrot grown at Davis, Calif.: A, In spring 1933; B, in spring 1932, showing difference in size and shape produced in different seasons,  $\times \frac{1}{2}$ .

## IMPERATOR

### BRIEF CHARACTERIZATION

Extensively used for bunching purposes in certain carlot-shipping sections of the United States. Adapted only to deep sandy or loamy soils.

Midseason to late in maturity with large strong foliage. Roots 6 to 7 inches long by 1 to 1½ inches thick when used for bunching, tapering only slightly to a short-tapered end and with deep-orange flesh and slightly yellower core.

### ADAPTABILITY AND USE

Imperator is a relatively new variety that is extensively grown in certain sections of California and Texas for shipment as bunched carrots. It requires deep, well-drained, sandy, or loamy soils and a long growing season of moderate temperatures to produce the long, straight, slender, well-colored roots desired by the discriminating buyer.

### SEASON

Midseason to late in maturity, reaching three-fourths of an inch (1.9 cm.) in diameter in 75 to 85 days from date of germination when grown as a spring and summer crop but requiring 95 to 110 days under cooler temperatures encountered by late fall crops in the Northern States and by winter crops in the Southern States and California. Prime marketable size for bunching, 1 to 1½ inches in diameter (2.5 to 4.2 cm.) attained in 80 to 90 days as a spring and summer crop, but requiring 95 to 120 days as a winter and early spring crop in the Southern States and California.

### PLANT

(Pls. 1, 2, 15, and 16)

Medium to large in size; at prime marketable stage of maturity the average weight is approximately 4.5 ounces (125 gm.) but may range from 2.6 to 6.5 ounces (75 to 185 gm.), depending on amount of foliage and length of root. Usually 12 to 16 inches (30 to 40 cm.) in average height and 10 to 14 inches (25 to 35 cm.) in average spread, or from 1.0 to 1.3 times as tall as wide.

### LEAVES

Medium in number, average 8 to 10, very seldom less than 7 or more than 14; constitute from 35 to 45 percent of the total plant weight of spring and summer crops, and 25 to 40 percent of late fall or winter crops.

### BLADE

Young growth typically light green, ranging from Cerro Green (22 L 5) to Peridot (22 L 6) and Art Green (22 L 7) with older mature leaves darker green and ap-

proximately Forest Green (23 L 6). Large; average length of 5¾ to 10 inches (15 to 25 cm.); greatest width of blade equal to or slightly greater than blade length, which is 10 to 25 percent longer than the petiole. Divisions medium in size.

### PETIOLE

Lighter green than blade divisions, about Moss Green (21 L 2) to Parrot Green (21 L 6); medium to long, average length of 5¾ to 8 inches (15 to 20 cm.); stout, average width of two-sixteenths to three-sixteenths of an inch (3 to 5 mm.) at midlength; average thickness equal to or slightly larger than width; 35 to 50 times as long as wide.

### NECK AND COLLAR

Medium size; neck usually thirty-four sixty-fourths to forty-five sixty-fourths of an inch (14 to 18 mm.) in average diameter at smallest point with very little if any increase in diameter at point of attachment of petiole bases to root (collar). Collar not sunken.

### ROOT

Grows completely underground; when first usable, ¾ of an inch (1.9 cm.) in diameter, the roots are long-conic in shape with a tapered base, but as the roots mature the lower half of the root fills out, carrying the thickness down toward the base. At prime marketable stage of maturity, 1 to 1½ inches (2.5 to 4.2 cm.) in diameter, the shoulders are almost square to slightly sloping, the sides taper gradually to a short tapered base with a medium to fine taproot and a medium number of medium-length, fairly shallow horizontal depressions in the root surface. Midlength diameter is from 80 to 95 percent of the crown diameter; average length about 6¾ inches (17 cm.), but shorter as a spring crop at Norfolk and in Louisiana, and longer in California; from 4.2 to 5.4 times as long as thick at the crown; weight from 2.3 to 3.5 ounces (65 to 100 gm.), depending mainly on length.

Skin color when shoulders appear above ground ranges from 14 L 1 to 14 L 7, according to exposure; skin color below ground on prime marketable roots when moist, about 10 F 10; cortex (phloem) about

10 F 11 and core (xylem) usually more yellow, about 10 I 5, although some as orange as 10 I 9.

Core, medium to large, comprising from 50 to 65 percent of the crown diameter when grown as a spring crop and 45 to 55 percent when grown in late fall or winter.

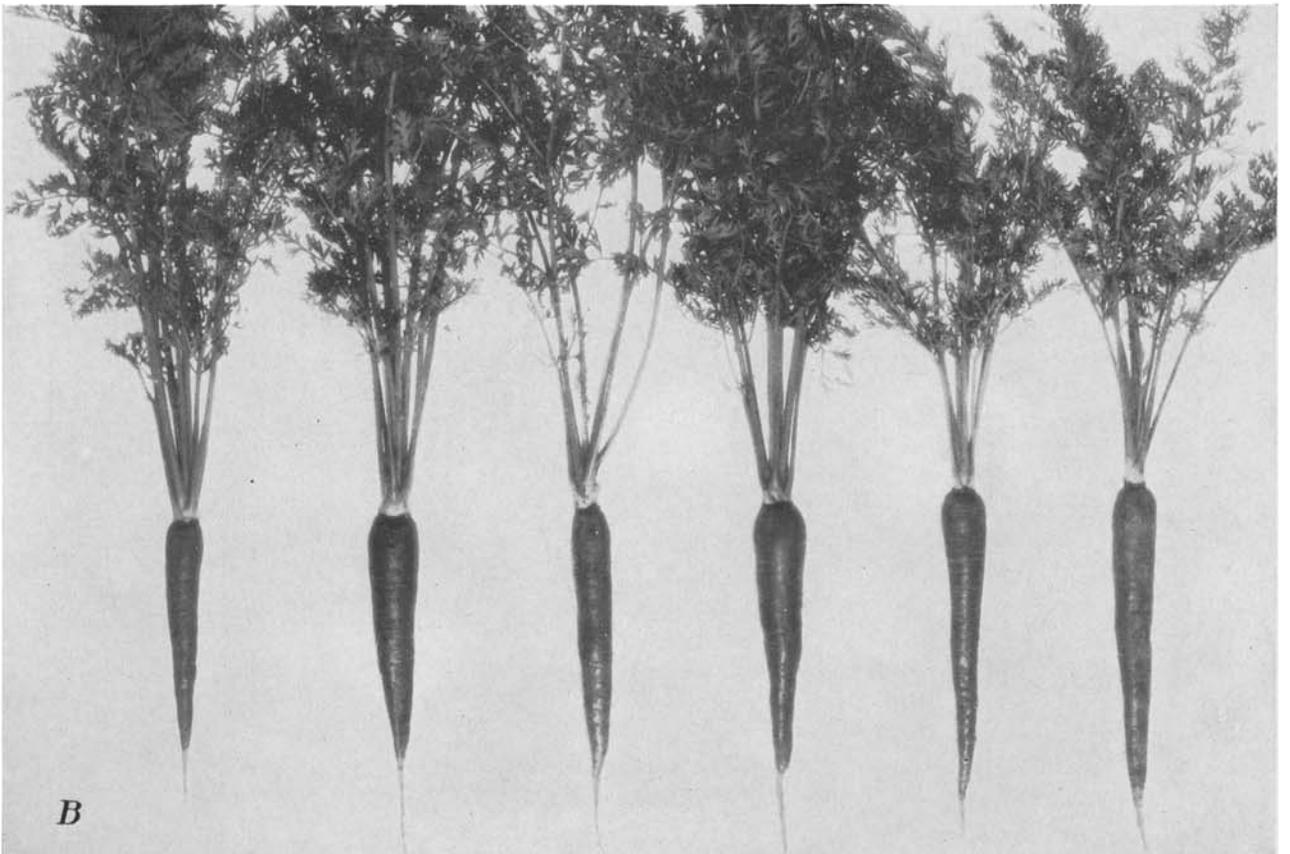
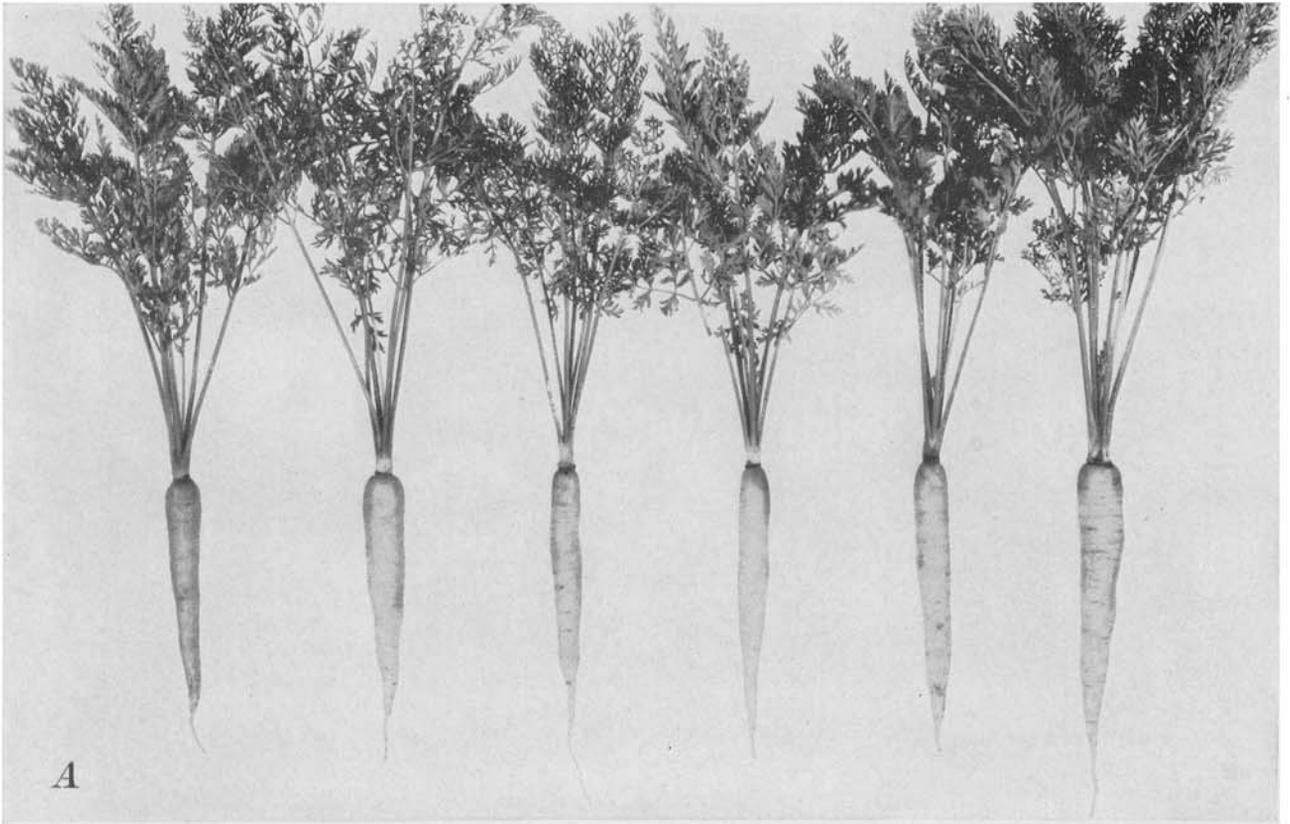
Lompoc.

#### SYNONYM

#### HISTORY

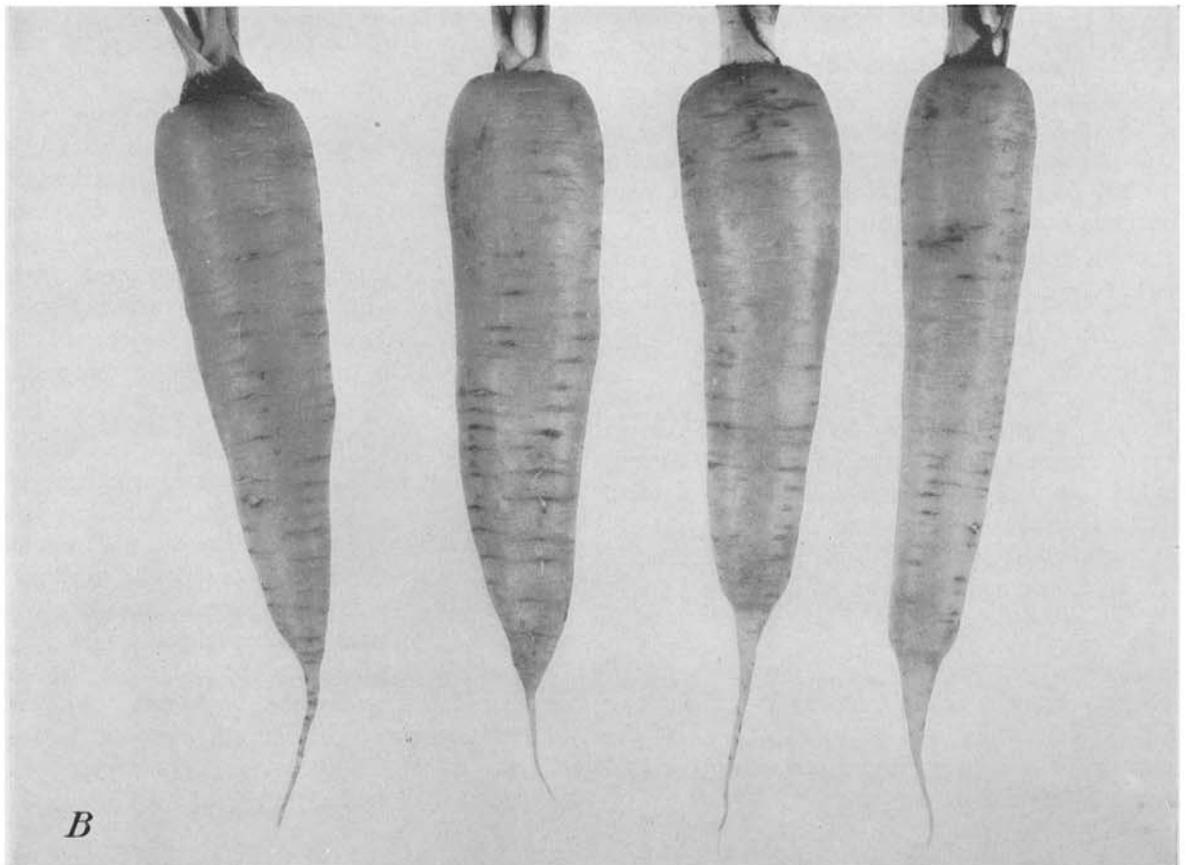
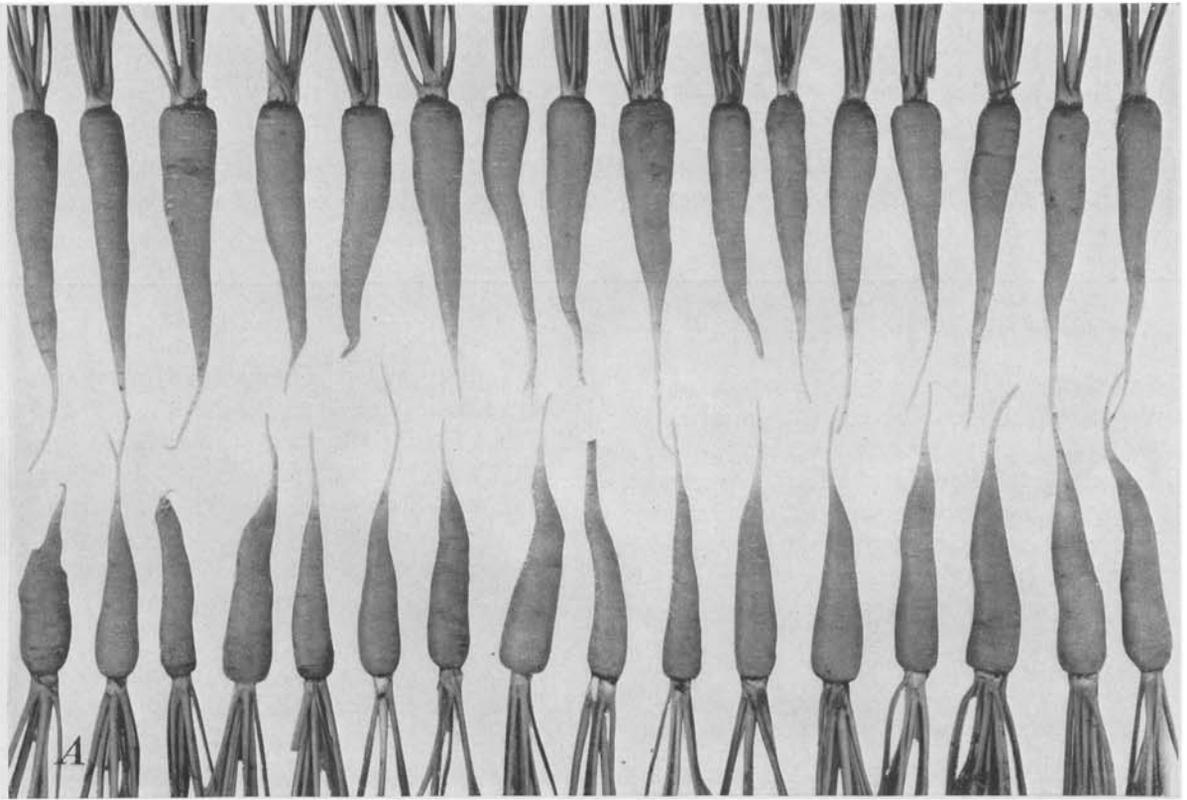
The Emperor is the result of a cross between Nantes and Chantenay. It was introduced in 1928 by Associated Seed Growers, Inc.

### IMPERATOR CARROT



Acceptable range in type of plants of Emperor carrot at first marketable stage of maturity: A, Spring crop of 1934; B, spring crop of 1933 at Arlington, Va.,  $\times \frac{1}{8}$ .

### IMPERATOR CARROT



*A*, Random sample from good strain of Emperor carrot at prime marketable stage of maturity, grown at Baton Rouge, La., spring of 1933,  $\times \frac{1}{8}$ ; *B*, acceptable range in type of Emperor carrot at prime marketable stage of maturity, grown at Davis, Calif., spring of 1933,  $\times \frac{1}{2}$ . (Compare with pl. 14.)

## LONG ORANGE

## BRIEF CHARACTERIZATION

Adapted only to the deeper, lighter soils and of very limited use in the United States for bunching or for stock feed.

Midseason to late in maturity with large, strong foliage. Roots for bunching 1¼ to 2 inches thick by 7 to 10 inches long, tapering to a long, slender end and with deep-orange flesh and yellower core.

## ADAPTABILITY AND USE

Mainly used for the production of stock feed, but occasionally grown in home or market gardens. Because of the difficulty in harvesting its long roots, the varieties Oxheart and Red Core Chantenay are preferred to Long Orange for the production of roots for stock feed on the heavier soil types. It is not adapted to heavy, shallow, or poorly drained soils and requires a long growing season for large production.

## SEASON

Midseason to late maturity, reaching three-fourths of an inch (1.9 cm.) in diameter in 70 to 85 days from date of germination when grown as a spring and summer crop, but requiring 90 to 100 days under cooler temperatures encountered by late fall crops in the Northern States and the winter crop in the Southern States and California. Prime marketable size for bunching, 1¼ to 2 inches (3.2 to 5.0 cm.), attained in 90 to 100 days as a spring and summer crop but requiring 100 to 120 days as a winter and early spring crop in the Southern States and California.

## PLANT

(Pls. 2, 17, and 18)

Large, at prime marketable stage of maturity the average weight is approximately 6.2 ounces (175 gm.) but may range from 4.5 to 8.8 ounces (125 to 250 gm.), depending on amount of foliage and length of root. Usually 12 to 16 inches (30 to 40 cm.) in average height and average spread of 16 to 19½ inches (40 to 50 cm.), or from 1.0 to 1.6 times as wide as tall.

## LEAVES

Numerous, average 9 to 13, seldom less than 8 or more than 15; constitute from 40 to 48 percent of the total plant weight of spring and summer crops and 30 to 38 percent of late fall or winter crops.

## BLADE

Young growth typically light green, ranging from Cerro Green (22 L 5) to Peridot (22 L 6) and Art Green (22 L 7) with older mature leaves darker green and approximately Forest Green (23 L 6). Large; average length of 7½ to 9½ inches (19 to 24 cm.); greatest width of blade usually equal to or slightly larger than blade length, which is 10 to 45 percent longer than the petiole. Divisions medium to large in size.

## PETIOLE

Lighter green than blade division, about Moss Green (21 L 2) to Parrot Green (21 L 6); medium to long, 5¼ to 8 inches (15 to 20 cm.); stout; average width of four thirty-seconds to seven thirty-seconds of an inch (3 to 5.5 mm.) at midlength; average thickness slightly less than width; 30 to 50 times as long as wide.

## NECK AND COLLAR

Medium to large, neck usually five-eighths to six-eighths of an inch (16 to 19 mm.) in average diameter at smallest point, but increases until at point of attachment of petiole bases to root (collar) the average diameter is ¾ to 1 inch (19 to 25 mm.) with some of the larger roots having collar diameter of one thirteen-thirty-seconds to one sixteen-thirty-seconds of an inch (36 to 38 mm.). Collar slightly to much sunken.

## ROOT

Grows almost completely underground; when first usable, three-quarters of an inch (1.9 cm.) in diameter, the roots are long and very slender with a long pointed base. At prime marketable stage of maturity, 1¼ to 2 inches (3.2 to 5.0 cm.), the shoulders are square or rounded, sides taper in a straight line to a long tapered base with a medium taproot and a medium number of medium-depth, fairly shallow horizontal depressions in the root surface. Midlength diameter is from 60 to 85 percent of the crown diameter; average length is from 7 to 8½ inches (18 to 22 cm.) under ordinary

conditions, but in California the average reached 10 to 11 inches (25 to 28 cm.) and at Norfolk, Va., was as short as  $5\frac{1}{4}$  inches (13 cm.); from 4.0 to 6.7 times as long as thick at the crown; average weight from 2.6 to 4.6 ounces (75 to 130 gm.) but averaged only 1.8 ounces (53 gm.) one spring at Norfolk, whereas one of the California crops averaged 9.4 ounces (268 gm.).

Skin color when shoulders appear above ground ranges from 14 L 1 to 14 L 7 according to exposure; skin color below ground on prime marketable roots when moist, about 10 F 10 to 10 C 10; cortex (phloem) about 10 B 11, and core (xylem) more yellow, ranging from 10 K 6 to 10 K 9.

Core large, comprising from 65 to 72 percent of the

crown diameter when grown as a spring or summer crop in the Northern States and 40 to 60 percent when grown in the late fall or during the winter in the Southern States and California.

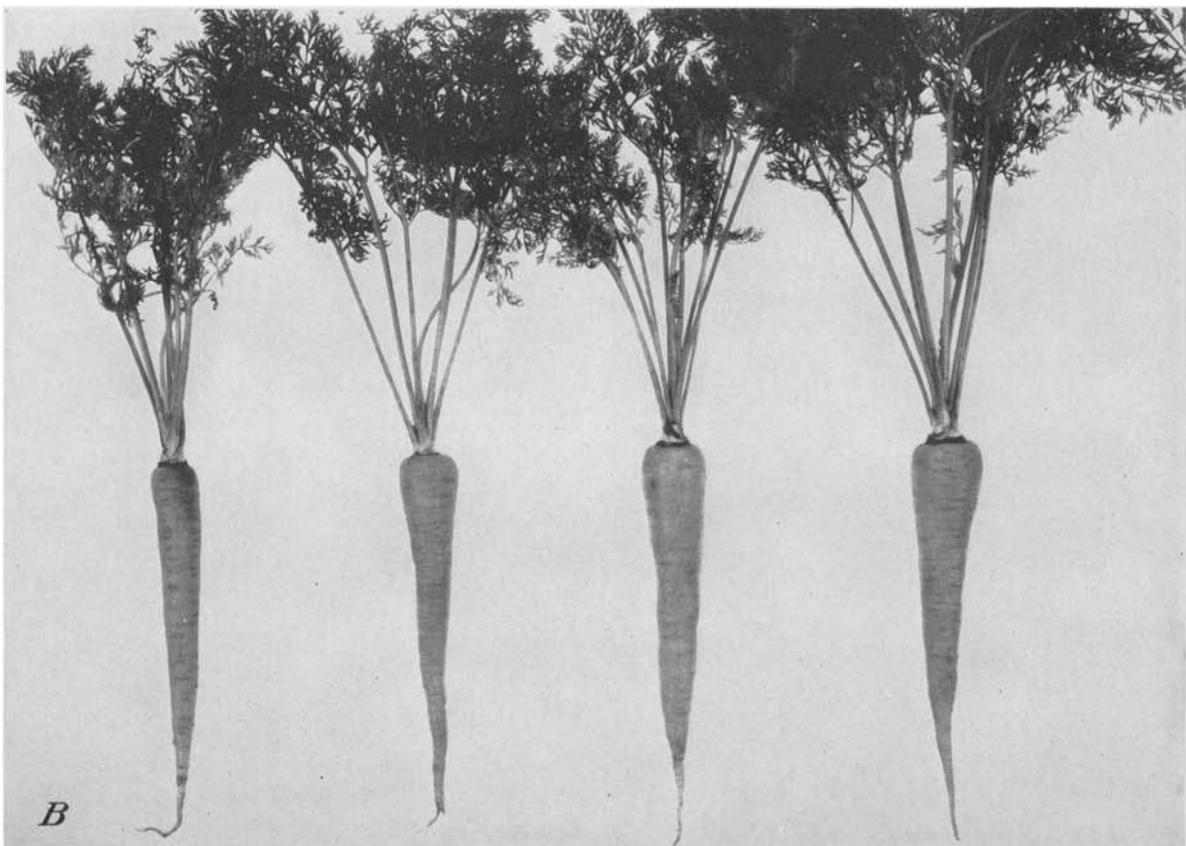
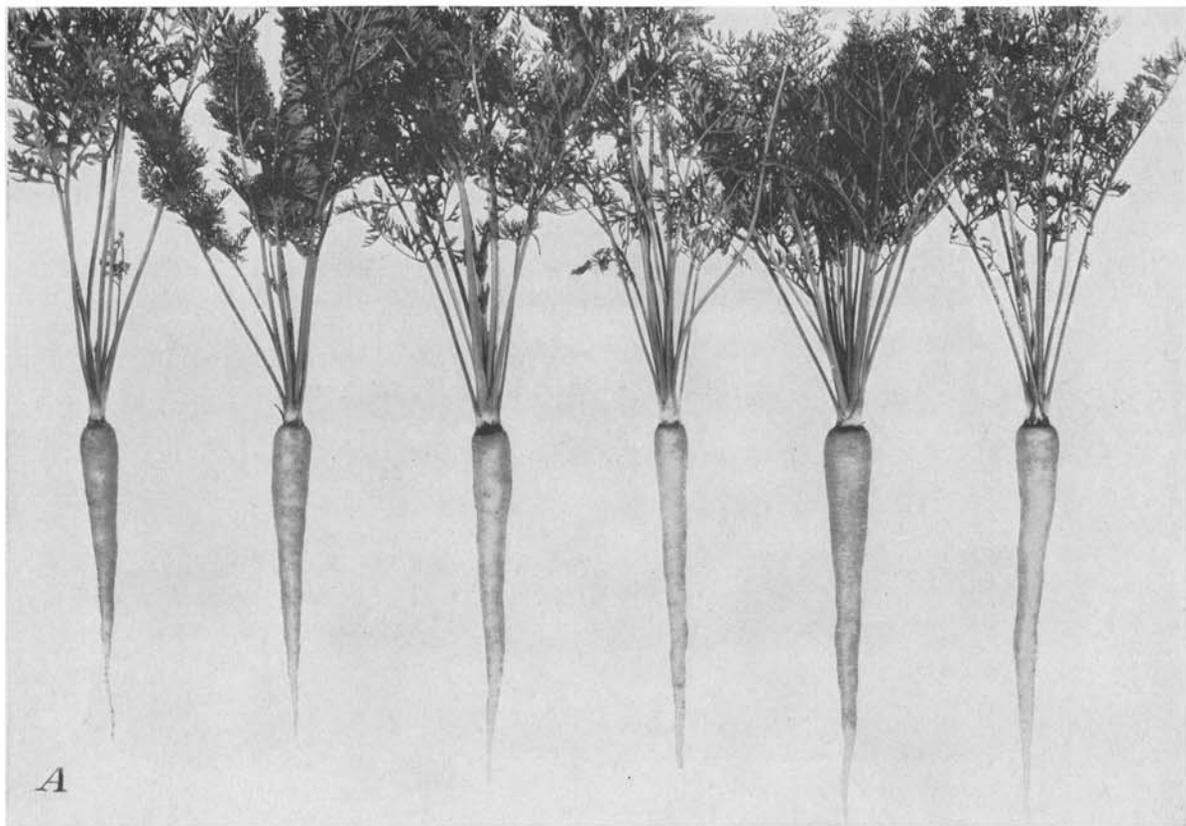
#### SYNONYMS

Long Red; Long Red Surrey; Long Scarlet; Red Surrey; and Surrey.

#### HISTORY

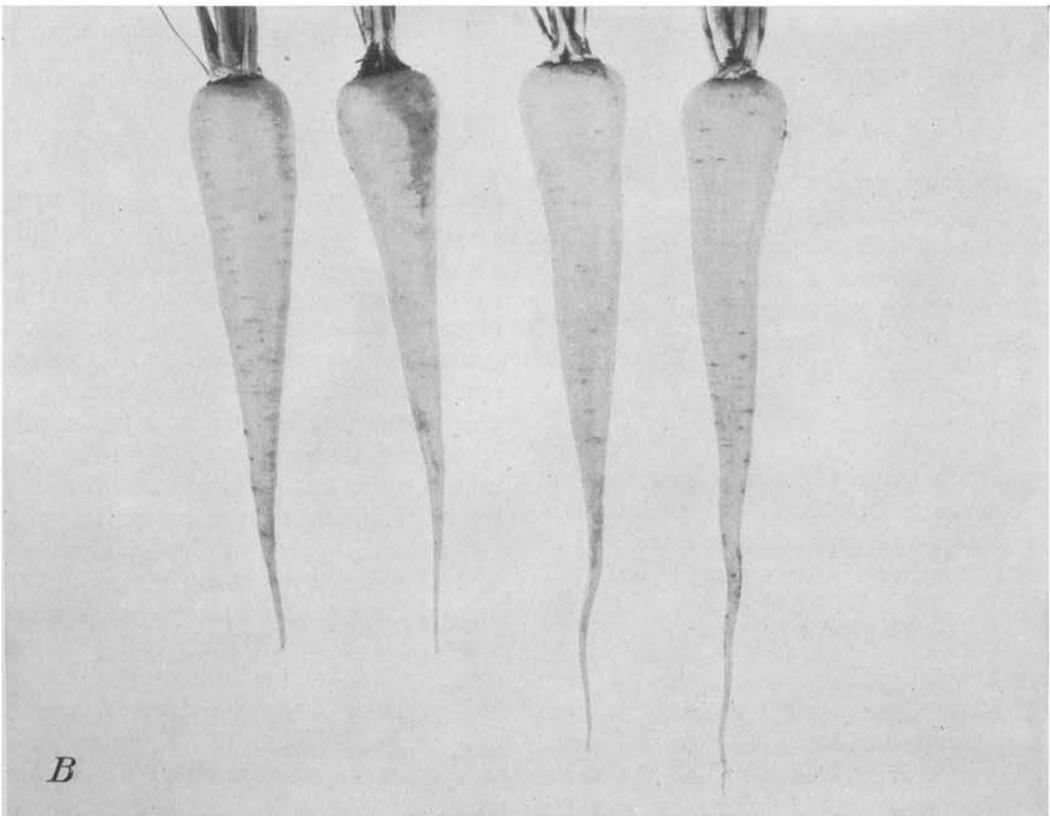
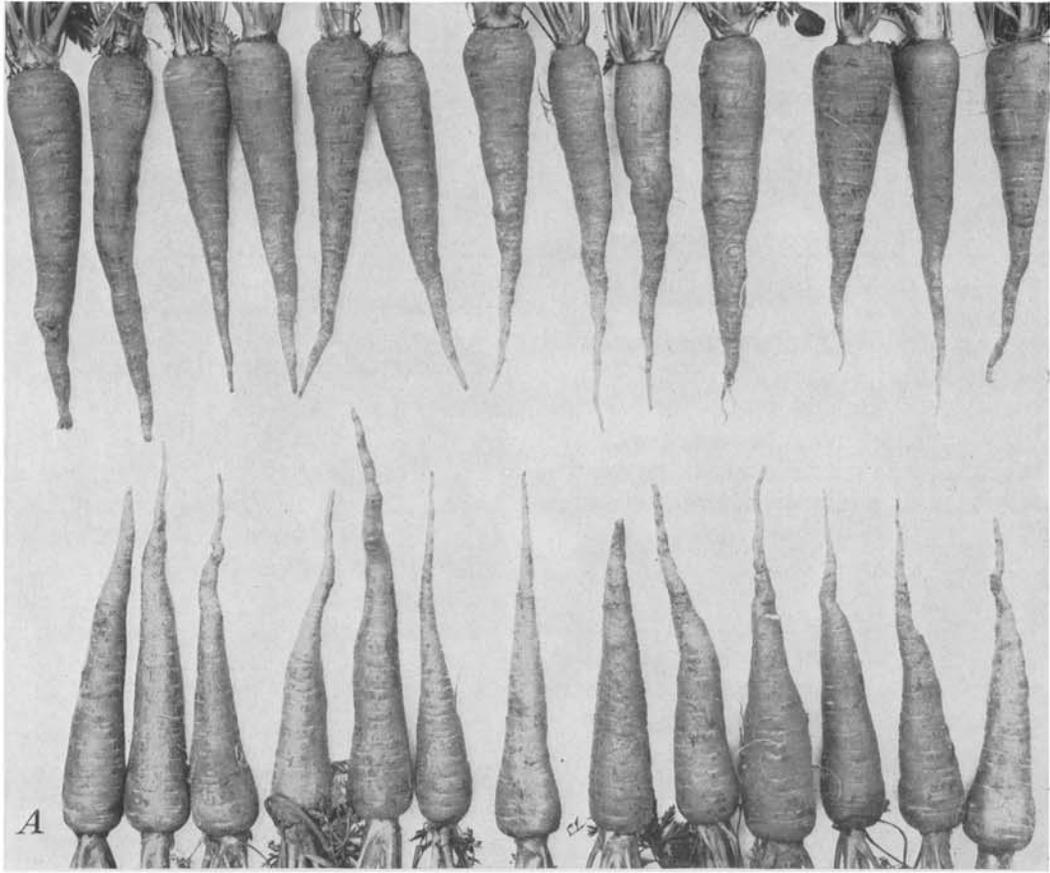
Although the present type is probably an improvement in color and smoothness, the descriptive name appears in the earliest English printed records and the long yellow, long white, and long purple types were known to the ancients.

## LONG ORANGE CARROT



Range in type of plants of Long Orange carrot at (A) first marketable stage of maturity, spring 1934; and (B) at mature size, spring 1932, grown at Arlington, Va.,  $\times \frac{1}{2}$ . Fourth root from left in A and first in B are too slender.

# LONG ORANGE CARROT



*A*, Random sample of mature roots of Long Orange carrot grown in fall 1931 at Norfolk, Va.,  $\times \frac{1}{8}$ ; *B*, acceptable range in size and shape of prime marketable roots of Long Orange grown at Davis, Calif., in spring 1933,  $\times \frac{1}{4}$ .

## OXHEART

## BRIEF CHARACTERIZATION

Largely limited to the production of roots for stock feed.

Midseason in maturity with large, strong foliage. Roots short-conic or heart-shaped with blunt end, 2 to 2½ inches thick by 3 to 4 inches long, and with medium-orange, coarse flesh and yellower core.

## ADAPTABILITY AND USE

Oxheart is capable of producing large tonnage on the shallower and heavier soils, and because of this characteristic and its low quality its present-day use is largely limited to the production of roots for stock feed. It is still planted in some home gardens and is grown to a limited extent by market gardeners for the San Francisco market.

## SEASON

Midseason maturity, reaching 1¼ inches (3.2 cm.) in diameter in 70 to 80 days from date of germination when grown as a spring or summer crop, but requiring 80 to 100 days under cooler temperatures encountered by late fall crops in the Northern States and the winter crop in the Southern States and California. Prime marketable size, 1½ to 2 inches (3.7 to 5 cm.), for bunching attained in 75 to 90 days as a spring and summer crop, but requiring 90 to 110 days as a winter and early spring crop in the Southern States and California.

## PLANT

(Pls. 2, 19, 20, 21, and 22)

Large, at prime marketable stage of maturity the average weight is approximately 6.2 ounces (175 gm.) but may range from 4.5 to 8.8 ounces (125 to 250 gm.), depending largely on amount of foliage. Usually 12 to 18 inches (30 to 45 cm.) in average height and 14 to 19½ inches (35 to 50 cm.) in average spread, or from 1.0 to 1.6 times as wide as tall.

## LEAVES

Numerous, generally 10 to 14, seldom less than 8 or more than 16; constitute from 25 to 40 percent of the total plant weight of spring and summer crops and 20 to 30 percent of late fall or winter crops.

## BLADE

Young growth typically light green, ranging from Cerro Green (22 L 5) to Peridot (22 L 6) and Art Green (22 L 7) with older mature leaves darker green and approximately Forest Green (23 L 6). Large, average lengths of 7 to 8½ inches (18 to 22 cm.); greatest width

of blade usually equal to or slightly larger than blade length which is 0 to 25 percent longer than the petiole. Divisions medium to large in size.

## PETIOLE

Lighter green than blade divisions, about Moss Green (21 L 2) to Parrot Green (21 L 6); medium to long, 6¼ to 8¼ inches (17 to 21 cm.); stout, average width of six sixty-fourths to twelve sixty-fourths of an inch (2.5 to 5.0 mm.) at mid length, average thickness almost equal to width; 40 to 60 times as long as wide.

## NECK AND COLLAR

Medium to large, neck usually nineteen thirty-seconds to twenty-five thirty-seconds of an inch (15 to 20 mm.) in average diameter at smallest point but increases until at point of attachment of petiole bases to root (collar) the average diameter is twenty-one thirty-seconds to thirty-five thirty-seconds of an inch (17 to 28 mm.). Collar medium to much sunken.

## ROOT

Grows almost completely underground; when first usable, 1¼ inches (3.2 cm.) in diameter, the roots are short-conic with a short, tapered base, but as they mature the straight-line taper of the sides becomes convex and the base sloping to rounded. At maturity the shoulders are square, the sides slightly convex, and the base short-tapered or rounded, resulting in a short, thick-conical or heart-shaped root with medium thick taproot and a medium number of medium to long, medium to deep horizontal depressions in the root surface. With a crown diameter of 2 to 2½ inches (5.0 to 6.5 cm.), midlength diameter is from 82 to 95 percent of the crown diameter; average length is from 2¾ to 3½ inches (7 to 9 cm.) except in California, where it averages 4 to 4¼ inches (10 to 12 cm.); from 1.2 to 1.7 times as long as thick at the crown; average weight from 3.5 to 6 ounces (100 to 170 gm.) with California roots averaging up to 7 ounces (200 gm.).

Skin color when shoulders appear above ground ranges from 14 L 1 to 14 L 7, depending upon exposure; skin color below ground on prime marketable roots when moist about 10 I 9; cortex (phloem) about 10 J 8,

and core (xylem) usually more yellow, from 9 H 8 to 9 L 8, although it may be as orange as the phloem.

Core large, comprising from 60 to 70 percent of the crown diameter when grown as a spring and summer crop and 50 to 60 percent when grown in late fall or winter.

#### SYNONYMS

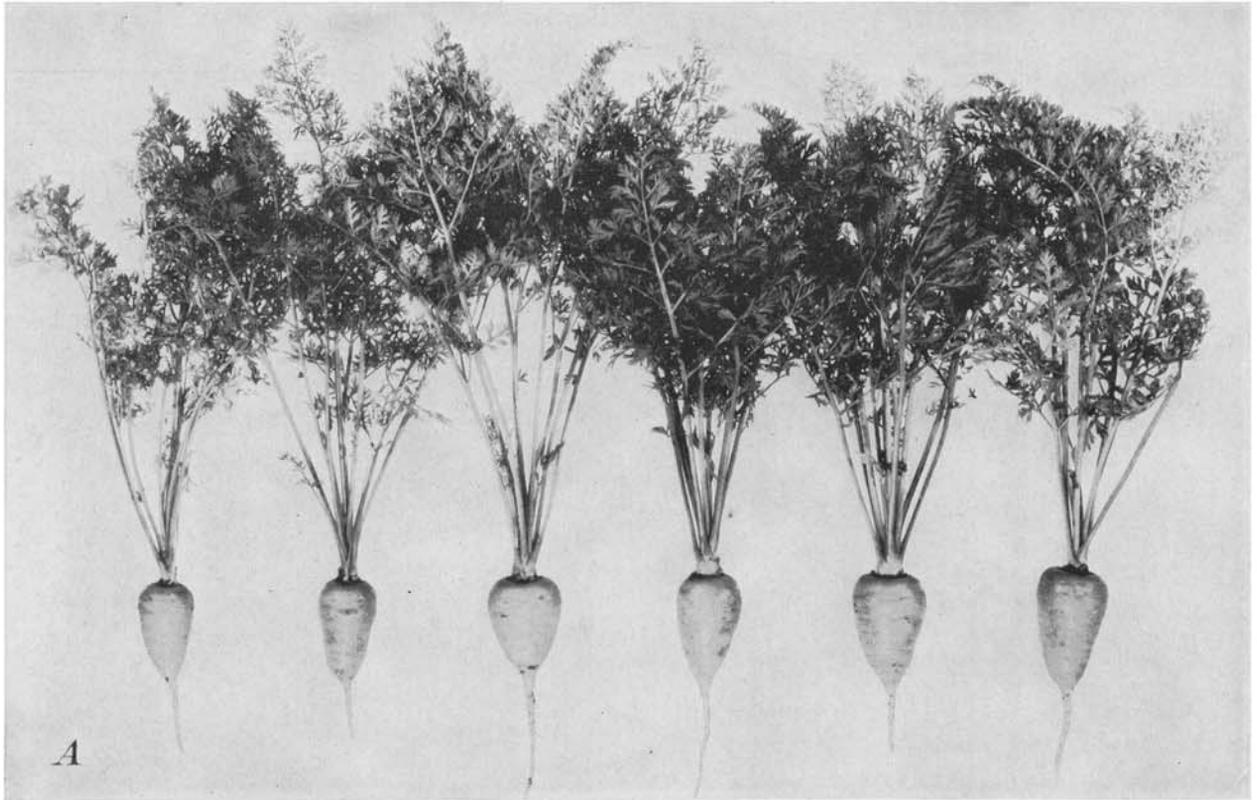
Early Gem, Early Guerande, Early Oxheart, Gem,

Guerande, Half Long Guerande, Half Long Stump Guerande, Half Long Stump Rooted Guerande, Large Scarlet Stump Rooted, and Norfolk Gem.

#### HISTORY

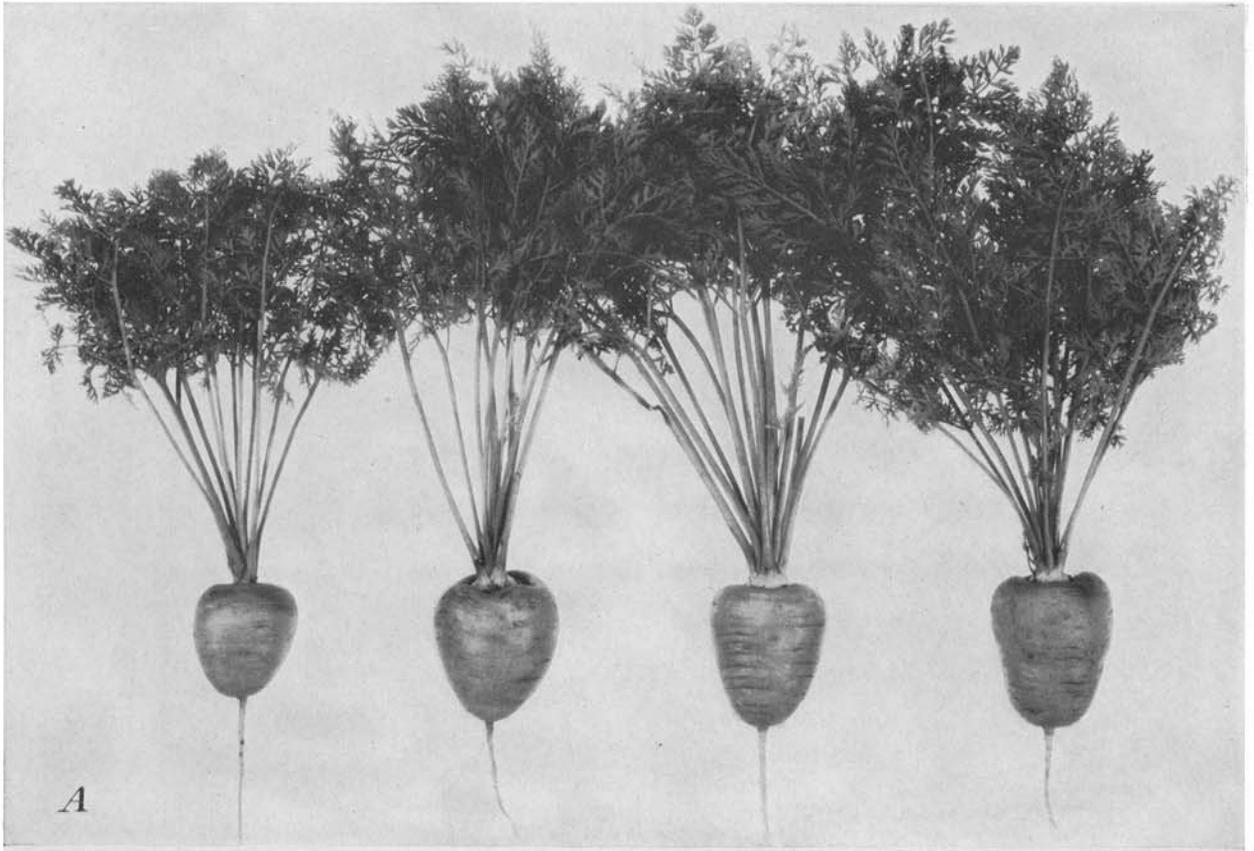
Oxheart or Guerande is an introduction from France and was first listed in the United States in 1884 by W. Atlee Burpee & Co. and by James J. H. Gregory.

## OXHEART CARROT



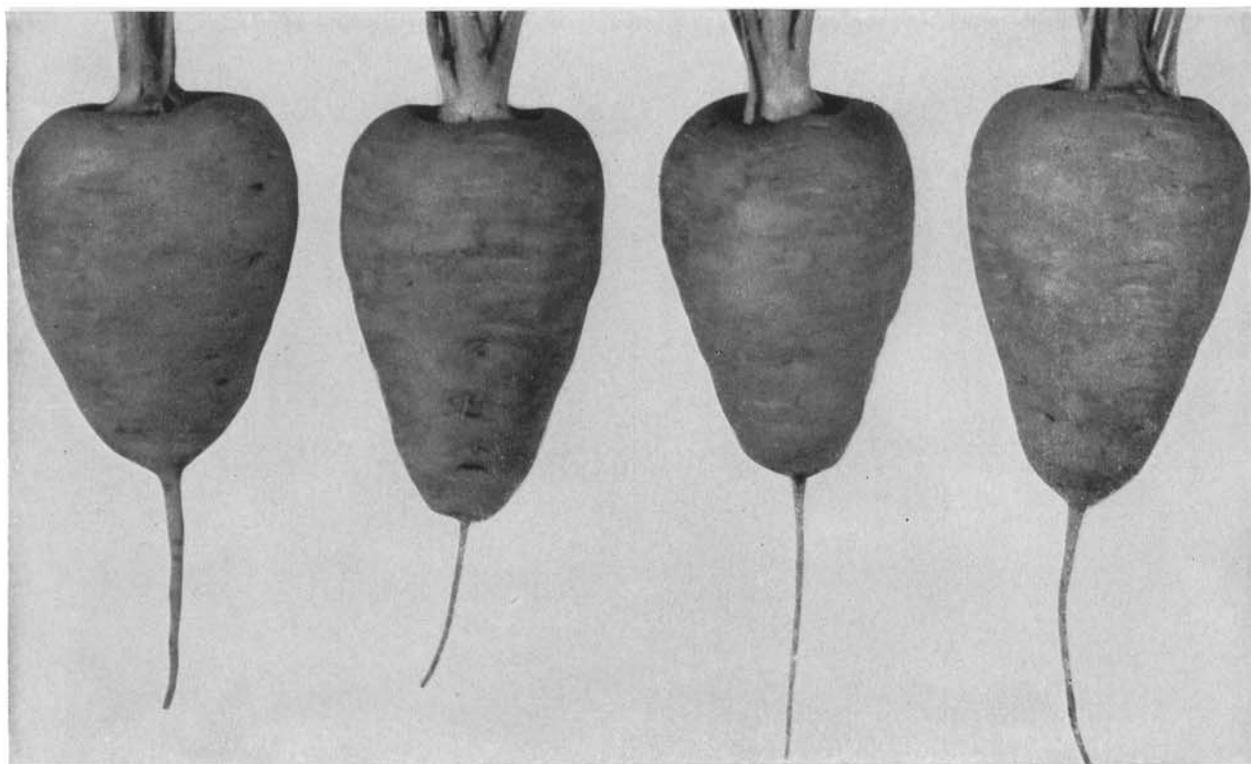
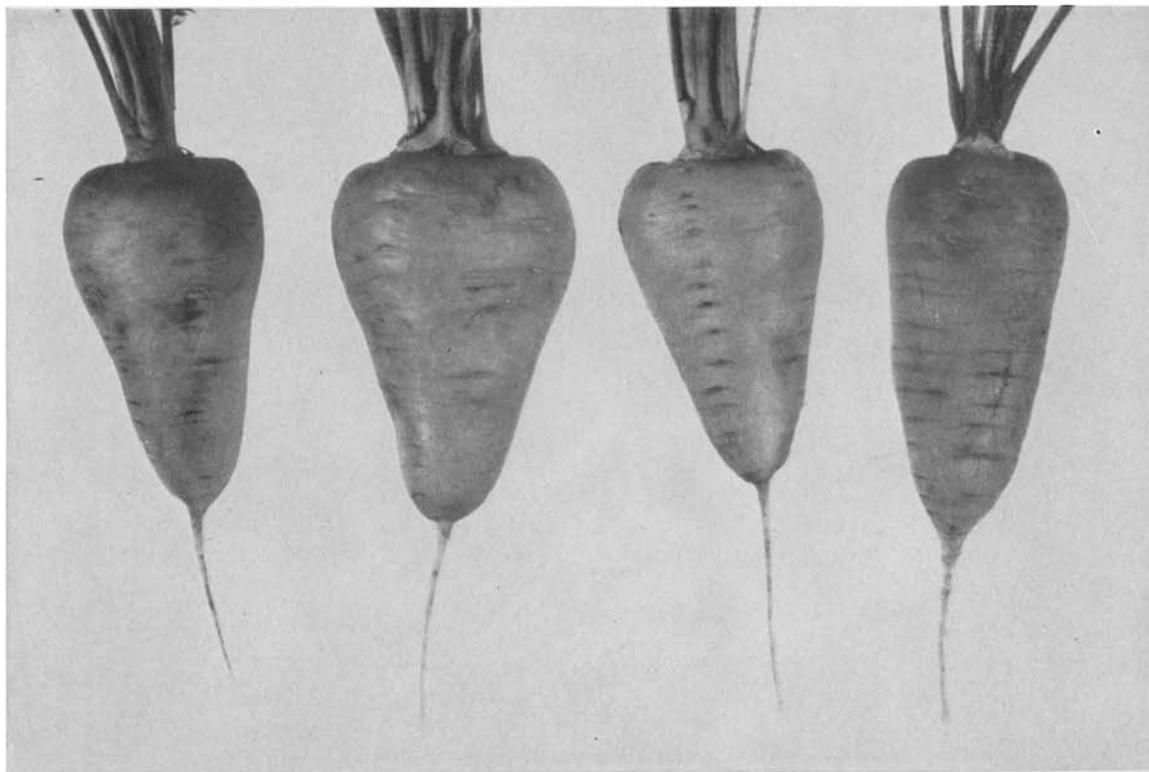
Acceptable range in type of Oxheart carrot when (A) first marketable, spring 1934, and (B) prime marketable stage of maturity, spring 1933 at Arlington, Va.,  $\times \frac{1}{8}$ . Compare with plate 20, A, and note the increase in roundness of the tip with maturity.

# OXHEART CARROT



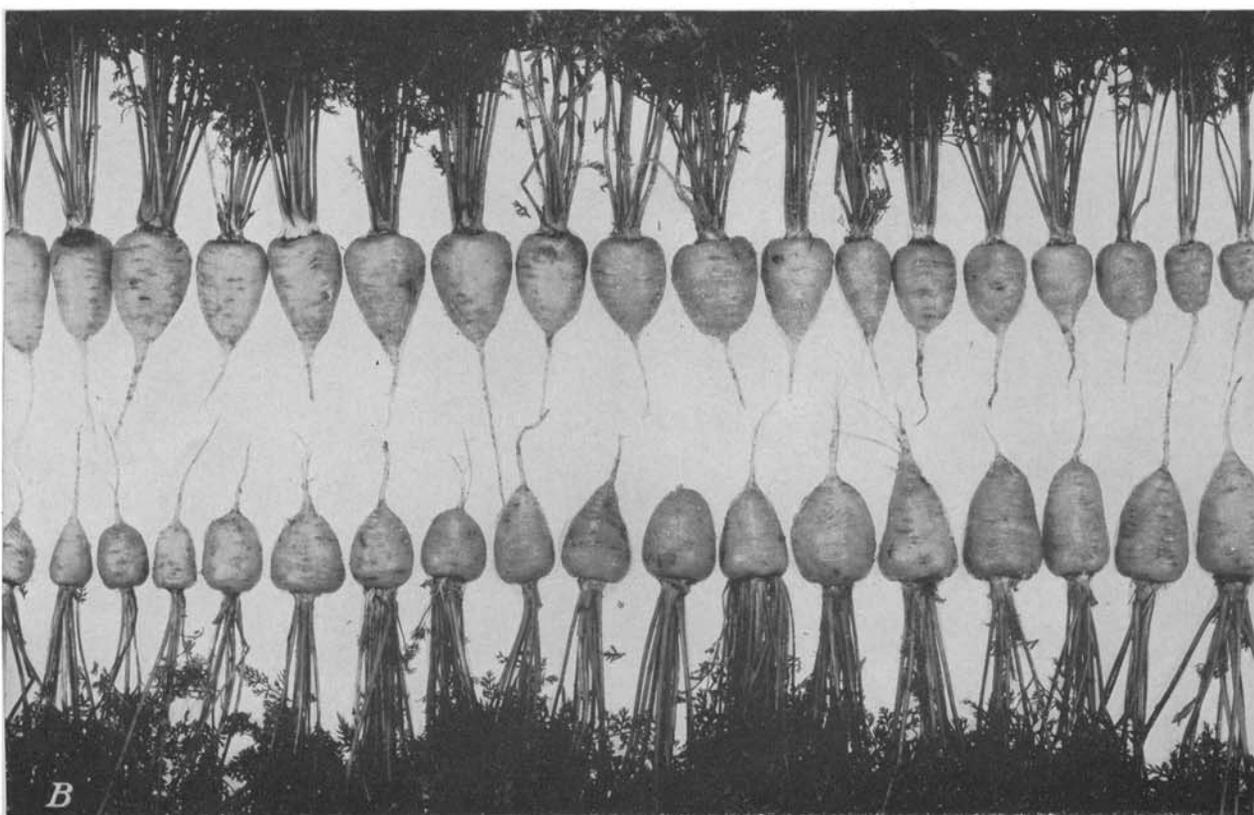
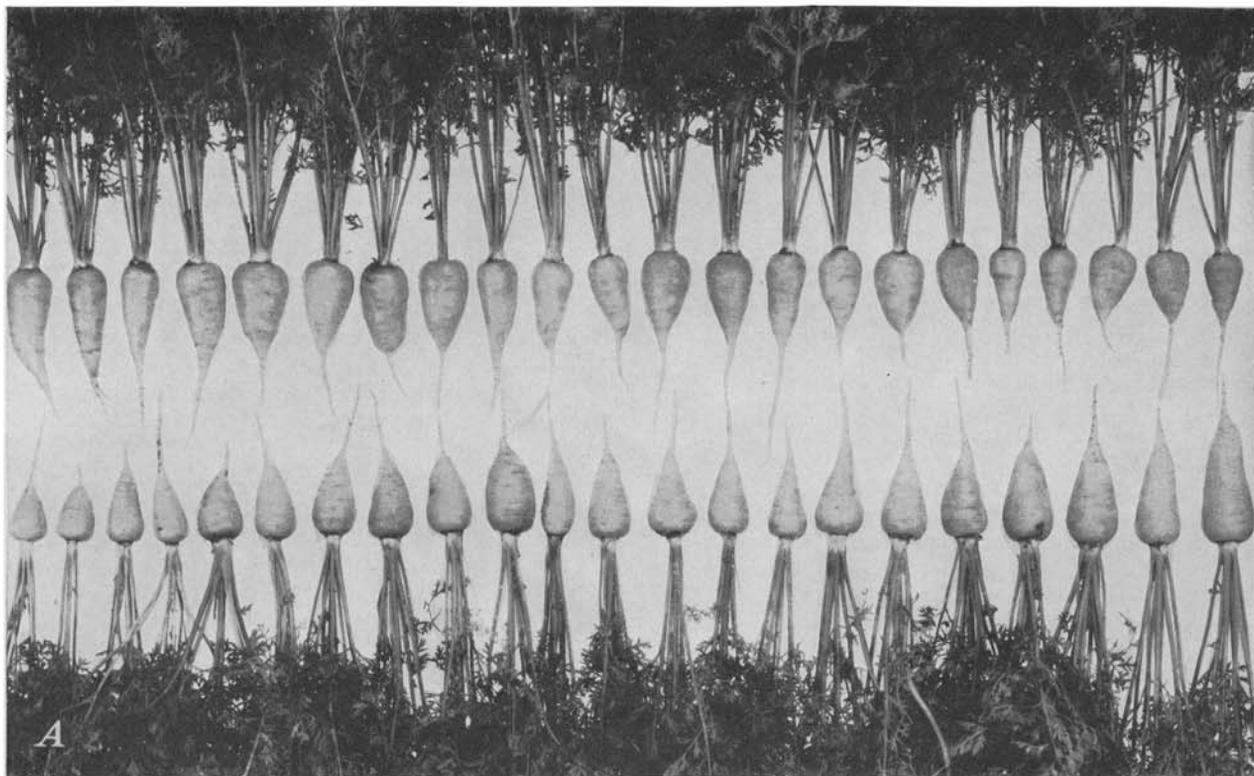
Acceptable range in type of mature Oxheart carrot: A, Spring crop 1932 at Arlington, Va.; B, fall crop 1931 at Norfolk, Va.,  $\times \frac{1}{2}$ .

### OXHEART CARROT



Acceptable range in type of Oxheart carrot at maturity: A, Spring crop 1933; B, spring crop 1932 at Davis, Calif.,  $\times \frac{1}{8}$ .

## OXHEART CARROT



Random sample of good strain of Oxheart carrot grown in spring 1934 at Arlington, Va., showing effect of age on size and shape,  $\times \frac{1}{6.5}$ . B is 1 month older than A and shows the rounding out of the tip with increased age and the roughness caused by high temperatures and second growth.

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