UNITED STATES DEPARTMENT OF AGRICULTURE

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DESCRIPTIONS OF TYPES OF PRINCIPAL AMERICAN VARIETIES OF RED GARDEN BEETS

Prepared Jointly by Specialists of the United States Department of Agriculture and of the experiment stations of California, Louisiana, Texas, and Virginia

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DESCRIPTIONS OF TYPES OF PRINCIPAL AMERICAN VARIETIES OF RED GARDEN BEETS

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INTRODUCTION

This publication is the sixth 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 cooperation, 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.

[1] 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. This publication represents the work of all the authors, aided by the criticisms and suggestions of the various agencies referred to herein.

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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 characteristics of the most important varieties of garden beets (*Beta vulgaris* L.) 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.

As 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 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, whether 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 from the trade. 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.

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 that 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 on 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.

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. Some have been compared with principal varieties, under the heading Similar Variety. If, in the future, a number of these new introductions are sufficiently different 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.

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 under the name of a standard variety, a practice that invariably leads to confusion and distrust. Morse Detroit variety of beet is an example of a stock or strain sufficiently distinct to warrant the new name, although it is still being sold in a great many instances under the old name of Detroit Dark Red.

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 to which they may be compared and by pointing out the strong and weak points of the present varieties.

METHODS OF PROCEDURE

The present list of beet varieties (Flat Egyptian, Crosby Egyptian, Light Red Crosby, Early Wonder, Detroit Dark Red, Morse Detroit, Ohio Canner, and Long Dark Red) covers between 85 and 95 percent of the acreage of garden beets grown in the United States, according to reports submitted by seed growers and dealers at the date the work was started, and contains all of the important varieties grown in any section of the country. Seed of the best available stocks of these varieties was secured from domestic and European seed growers through the vegetable research committee of the American Seed Trade Association.

In order to avoid bias for any particular strain during these studies, sources of the material were not divulged; each strain carried only a variety name and number. After the first season's work, one strain was selected on which the records were taken each season. The same seed was used by all collaborators throughout a 3-year period. Observations, measurements, and work outlines were uniform, having been previously agreed upon by the workers in the various locations.

The following descriptions are based on the results obtained from two crops (winter-spring) grown at Weslaco, Tex., during 1931–32 and 1932–33; three crops (one spring and two winter-spring) grown at Winter Haven, Tex., during 1931-33; three spring crops grown at Davis, Calif., during 1931–33; five crops (three spring and two fall) grown at Baton Rouge, La., during 1931–33; five crops (three spring and two fall) grown at Norfolk, Va., and seven crops (five spring and two fall) grown at the Arlington Experiment Farm, Arlington, Va., and at the United States Horticultural Station, Beltsville, Md., (both near Washington, D. C.) during 1931–35. The last 2 years' work at Arlington and Beltsville were devoted to a survey and to a comparison of more recent stocks and strains with those used for the first 3 years' work.

The manuscript and figures have been critically reviewed by all the collaborators and also by most of the major American beet breeders and seed producers. As 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. Although 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.

Seed was also obtained of Crimson Globe and Early Blood Turnip varieties, but the samples submitted contained such a wide range of different types that it was impossible to determine the desired type, and work with these varieties was discontinued at the end of the first year.

The choice of names in this publication has been influenced by priority, descriptiveness, brevity, popularity, or use. The present forms have been retained, instead of shorter forms, to prevent any misunderstanding. Where names now used for these varieties 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, the listing of the old name may be discontinued.

Synonyms were obtained from Ritchie (*24*),[2] Tracy (*29*), unpublished Bureau of Plant Industry records for 1921, and trial-ground records of American seedsmen who have so kindly made their notes available to the authors. No attempt was made to determine the synonomy of the names listed in the hundreds of retail seedsmen's catalogs and price lists. Unless it was an integral part of the varietal name, the seedsman's name was omitted in the list of synonyms. Where the same name occurs as a synonym under two varieties it is an indication that, in at least one instance, different types have been used under the same name.

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 garden beets are grown in the United States.

Plant characters, such as habit, leaf color, leaf shape, etc., were noted several times prior to harvest. The detailed notes, measurements, and color readings on which the type descriptions are based were made at prime marketable stage of development as a bunching beet. The diameter at which the roots were considered prime marketable for bunching differed slightly according to shape, as pointed out in the descriptions.

As soon as the majority of the plants in the row had attained prime marketable diameter, leaf characters and plant habit were noted. The amount of root above ground, height, and spread of 20 to 50 plants typical

[2] Italic numbers in parentheses refer to Literature Cited, p. 57.

of the variety and of prime marketable size were then measured. The work was done while the plants were in a turgid condition, usually in the morning.

Plants with misshapen or offtype roots were discarded and additional typical plants pulled until the desired number was obtained. These plants, typical for both foliage and root, were then taken to the laboratory and thoroughly washed. The plant weight and neck diameter were obtained, after which the foliage was cut off at the base of the oldest turgid petiole and weighed. A count of the number of leaves over 2 inches in length was then obtained, and one of the longest normally developed leaves was selected from each plant for measurement, shape notes, and color readings.

As soon as the data from the leaves had been obtained, data on root weight, shape, size, etc., were recorded. After the external features of the roots had been described, they were cut through the greatest diameter and the internal characters of color, texture, flavor, etc., recorded.

Root-color readings were made on washed roots while the surface was still wet or moist. Specimens representing the average were selected for color readings, although less complete notes were also made on the color of the extremes. Leaf-color readings were made on the unwilted specimens that gave the mass color effect in the field (the largest leaves). All color names given in this publication are from A Dictionary of Color (*17*); all readings were made in the laboratory under light from a north window and followed as closely as possible the procedure suggested for making color comparisons.

Photographic records were also obtained wherever possible. In order to study variation due to environmental effects, a random sample of the same strain grown at different locations was selected for photographing. Only those beets that were misshapen owing to insect or mechanical injuries or those too small or too large were discarded. All other beets were retained as they were pulled, in the order in which they grew in the row, until the desired number had been obtained. To show the change in shape with age, all uninjured roots were retained in the sample, regardless of diameter. Although all the photographs could not be published in this report, they were useful to refer to in preparing the type descriptions and the discussion on the effect of environmental factors on varietal characteristics.

DEFINITIONS

First usable.—When the majority of the roots of the "turnip" or globe-shaped varieties reach 2 inches in diameter and the long variety 1¼ inches in diameter they are first usable.

Plant height.—The distance from the soil surface in the row between the plants to the highest point reached by any of the foliage is the plant height.

Plant spread.—The greatest distance between the ends of turgid attached leaves on opposite sides of the plant.

Leaf number.—All leaves over 2 inches in length.

Petiole length.—Petiole length is measured from the base to the point where petiole and blade wing is 1 cm. in width.

Petiole diameter.—Diameter in same plane as blade of leaf, measured at midlength.

Petiole thickness.—Diameter at right angle to petiole diameter and measured at the same point.

Petiole channel.—The concave surface of petiole (side nearest growing point) is called the petiole channel.

Blade width.—Greatest distance at right angle to midrib when blade is flattened out.

Blade margin.—Refers to blade surface at the periphery.

Blade edge.—Refers to the outline of the blade.

Neck diameter.—Neck diameter is the distance between points of attachment of the outermost turgid petioles on opposite sides.

Neck length.—Neck length is the vertical distance from the point of attachment of the outermost turgid petiole to the lowest leaf scar.

Shoulder of root.—That portion above the point of greatest diameter.

Root length.—Root length is the distance from the base of succulent petioles to that point on the base or taproot one-half inch in diameter for flat, oblate round, or top-shaped varieties and one-fourth inch in diameter for long varieties.

Oblate root shape.—Flattened at top and bottom with rounded sides.

Top-shaped root.—One with square or rounded shoulder and conical or tapered base.

IMPORTANT CONSIDERATIONS IN COMPARING BEET 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 beets, 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 the effect of the environment. Two or more strains of several standard varieties should be included in 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 conditions 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 so 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.

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. The rest of the plants should be left 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, actual 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 offtype or unusual plants should also be included in the report or characterization of the stock 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 they are being compared with the color plate in this publication or with A Dictionary of Color (*17*).

Obviously, all characteristics of the plant should be carefully studied and considered before identification or characterization is attempted. Beet varieties usually differ from one another in more than one character.

INFLUENCE OF ENVIRONMENT ON PLANT AND VARIETAL CHARACTERISTICS

Because of daily 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 and summaries are largely based on 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 of cited work, as interested readers may consult the original articles. Mention is also made of effects observed during the course of these type-book studies, and, wherever possible, the environmental complex thought to be responsible is described.

INFLUENCE OF ENVIRONMENT ON RATE OF GROWTH OF FOLIAGE

Because the leaves of beet plants are sometimes used for food the effect of environmental factors on the rate of growth of the foliage is important. In greenhouse studies growth in length of leaf was found to be greater when the seedlings [3] or mature transplanted roots [4] of the Crosby Egyptian variety were grown in a warm house (70° to 80° F.) than when grown at a medium temperature (60° to 70° F.). Growth at 50° to 60° was slower than at 60° to 70°. In another experiment (*3*) seedlings of different ages made less growth in a cold house (40° to 50°) than at 60° to 70°.

In seedlings grown in wet soil (49 percent of water-holding capacity) the increase in leaf length was most rapid for the first few weeks but was then surpassed by the plants in the medium-soil-moisture plot (34 percent). The leaves on the medium-soil-moisture plot were longer than those on the dry plot (23 percent) in most instances at the date of harvest.[3]

The use of electric light from 5 to 10 p. m. daily in addition to the normal daylight period of 10 to 12 hours increased the length of leaf at harvest time in all three soil-moisture plots in the cool house, and in the high and medium-soil-moisture plots in the medium-temperature house. In the warm greenhouse the additional light had practically no effect on foliage elongation.[5] The same period of additional illumination increased the rate of leaf elongation made by mature transplanted roots when grown in the cool, medium, or warm greenhouses.[6]

INFLUENCE OF ENVIRONMENT ON WEIGHT OF FOLIAGE

The greatest weight of foliage (on marketable-size roots) was produced at temperatures between 50° and 60° F., and there was very little difference in average weight of leaves per plant produced at 60° to 70° and at 70° to 80°. The leaves also constituted the greatest percentage of the total plant weight in the 50° to 60° greenhouse.[5]

The weight of foliage of Light Red Crosby produced in 92 days in the fall and early winter in a greenhouse maintained between 56.8° and 63.9° F. (average temperature of 59.9°) was about 2.3 times as large as that produced with the temperature range between 64.0° and 75.4° (average of 71.2°).[7]

[3] MURRAY, H. R. THE EFFECT OF SOME ENVIRONMENTAL FACTORS ON THE COLOR AND GROWTH OF GARDEN BEETS. Unpublished thesis, Cornell University. 1929.

[4] MAGRUDER, ROY. THE EFFECT OF LENGTH OF STORAGE PERIOD, STORAGE TEMPERATURE, GROWING TEMPERATURE, AND LENGTH OF DAY ON THE GROWTH, SEED STALK, AND FLOWER DEVELOPMENT OF MATURE GARDEN BEETS. Unpublished thesis, Cornell University. 1930.

[5] See footnote 3.

[6] See footnote 4.

[7] PINO, A. L. A STUDY OF THE TABLE BEET IN AN ATTEMPT TO DISCOVER THE CONDITIONS, CLIMATIC AND CULTURAL, WHICH CAUSE ITS DISCOLORATION. Unpublished thesis for M. S. degree, Mich. State College. 1928.

Murray [8] found that, in general, a greater weight of tops of Crosby Egyptian was produced in the soils with moisture at 34 percent of water-holding capacity than at 49 or 23 percent.

Pino [9] and Chroboczek (*3*) found foliage growth to be roughly proportional to the amount of water applied to plants in small pots in the greenhouse.

The amount and proportion of the major fertilizing elements applied to greenhouse and field crops have been found [8] [9] (*26*) to have a marked effect on the weight of foliage produced by table or red beets. Nitrogen is probably the most effective element in producing foliage but of course must be accompanied by adequate amounts of the other essential elements to produce maximum growth.

INFLUENCE OF ENVIRONMENT ON PLANT HABIT, BLADE, AND PETIOLE CHARACTER

Leaves of Crosby Egyptian beets grown in a 50° to 60° F. greenhouse in fertile soil had relatively short, thick, straight, erect petioles with thick, heavily savoyed or bullate, relatively broad blades as contrasted with plants grown at 70° to 80° that had long, slender, drooping, and curved petioles with thin, almost smooth or flat-surfaced, relatively narrow blades. Leaves of plants grown at 60° to 70° were intermediate in these characters.[10]

In addition to the color changes on the blade discussed on this page and the smaller size attained, certain nutritional-element deficiencies cause marked changes in the character of the plant and leaves. Boron deficiency is evidenced by the early death of a large number of the older leaves, shortened petioles of the younger leaves with later development of black or brown ladderlike scabby lesions on the inside or concave surface of the petiole, distorted leaf blades due to early death of small scattered areas or spots, and the eventual death of the terminal bud (*14*, *19*, *28*). Beets markedly deficient in magnesium produce less foliage than normal plants, and it is more ragged and puckered in outline (*2*).

Distance between plants and the season of the year in which they are grown also affect plant habit. The leaves are more erect when the plants are close together than when the leaves do not touch those of neighboring plants. Fall-grown plants are more compact than spring-grown, and frosts in late fall cause a weakening of the petioles that results in the plants becoming progressively flatter in habit as successive frosts occur. Measurements of largest leaf per plant show a tendency in some varieties for fall-grown leaves in the Northern States to be relatively narrower than those of the spring crop. Increased soil moisture and slightly higher temperatures seemed to be the factors responsible for the more slender growth of blades in 1933 as compared with blades grown in 1932, as shown in plates 3, 13, 20, 28, and 35. Length of day and soil type were the same in both years, but the average mean temperature for the first 45 days of 1933 was 2° F. higher and rainfall 3.10 inches more than in 1932.

INFLUENCE OF ENVIRONMENT ON BLADE AND PETIOLE COLOR

Although the progressive change in color of the blades of the varieties of garden beet described herein is normally from light green to dark green to dark red to yellow to brown with the maturity of the plant, the stage in the plant's growth and the order in which these changes occur may be greatly influenced by environmental conditions. High temperatures, by hastening maturity, cause an earlier reddening and subsequent death of the blade than medium temperatures.[10] A change from a medium to a low temperature or the occurrence of several mild frosts soon results in dark-red or bronzed foliage on plants of all sizes and varieties (*3*, *11*). Fall-grown crops in the Northern States and winter-grown crops in California and the Southern States frequently have so much bronzing or reddening of the foliage because of low temperatures just before harvest, as to be objectionable on the market. The market prefers green foliage to contrast with the red of the roots.

Premature reddening of the blade may also be caused by a deficiency of nitrogen (*3*, *28*), phosphorus (*28*), magnesium (*2*, *28*), or manganese (*11*, *28*), or by a very low level of soil fertility [8] or moisture. High acidity in the soil also produces small red foliage (*13*). A deficiency of iron results in chlorosis (yellowing) of the young center leaves (*28*).

Observations in the greenhouse and in the field indicate that the depth of color of the petiole is affected by the same factors and in the same way as the reddening of the blades.

INFLUENCE OF ENVIRONMENT ON ROOT WEIGHT

A growing temperature of between 50° and 60° F. produced larger Crosby Egyptian roots (by weight) than temperatures of 60° to 70° and of 70° to 80° in Murray's experiments.[8] The roots from the 70° to 80° greenhouse were smaller on an average than those from the 60° to 70° house. Pino,[9] growing Light Red Crosby in the greenhouse in the fall and early winter,

[8] See footnote 3, p. 5.
[9] See footnote 7, p. 5.
[10] See footnote 4, p. 5.

found that the average root weight of plants grown at 56.8° to 63.9° was 20 percent greater than that of those grown at 64.0° to 75.4°.

In general, Murray [11] found that the heaviest roots were produced in soils of medium-moisture content.

Pino, using Light Red Crosby grown in 6-inch pots in the greenhouse at an average temperature of 71.2° F. during the fall and early winter, found that heavy watering produced roots over twice as heavy as those receiving the usual amount of water. Watering barely sufficient to prevent wilting produced a weight of root about half that of the normally watered plants. Chroboczek (*3*) obtained essentially the same results with the Crosby Egyptian variety in small pots in the greenhouse.

The average application of 3.1 acre-inches of water per crop of Crosby beets in addition to rainfall during the spring and fall at Ames, Iowa, (*10*) resulted in increases in yield of roots from 104 to 127 percent, with a 3-year average of approximately 120 percent.

Early Wonder beets grown in sand culture in the greenhouse at different nitrate-nitrogen levels produced larger roots with 16 hours of light daily than with 10 hours at any of the three stages of maturity at which they were harvested (*21*, *22*).

Fertilizer experiments conducted in different States [11] [12] (*5*, *7*, *15*, *16*, *20*, *21*, *22*, *26*) and over rather long periods of time, all indicate that the garden or table beet requires large amounts of readily available plant food to produce maximum development of roots in the shortest time. The optimum amount and ratio of nitrogen, phosphoric acid, and potash are influenced by the soil type, soil acidity, and the factors mentioned above.

More space available for growth (distance between rows or plants in the row) has resulted in faster growth but, beyond certain limits, has reduced total yield per unit area (*26*).

INFLUENCE OF ENVIRONMENT ON PLANT WEIGHT

As there is a very close parallel between the weight of the foliage and the weight of the root, factors that have a similar effect on both would have the same effect on plant weight. No further reference is made in this section to those experiments (described on pp. 5 and 6) where data are presented for foliage and roots separately. In a number of experiments, however, the entire plant constitutes the harvest unit.

The ratio and amount of nitrogen, phosphoric acid, potash, and manure that will produce the largest plants depends on soil type, previous treatment, rotation followed, season of year, amount of moisture, and many other factors, and must be determined experimentally for each location (*4*, *5*, *6*, *7*, *12*, *15*, *16*, *22*, *23*).

A number of elements besides nitrogen, phosphorus, and potash have been shown to be limiting factors in the field in the production of table beets. In Rhode Island (*11*) applications of manganese sulfate have increased size when no visible deficiency symptoms were apparent on the control plots. On some of the calcareous glade soils of Florida (*25*) the addition of manganese is essential for the production of normal beets. In the sandier, well-drained soils of the Norfolk truck-crop district, it is recommended that a soil reserve of 500 to 700 pounds per acre of magnesia be built up to prevent abnormalities resulting from magnesium deficiency and that it be maintained by the addition of magnesia in the fertilizer or in the limestone applied in the amount of 50 to 100 pounds per acre per year (*2*). Boron has also been shown to be a limiting factor in beet production in certain soils in New York (*19*) and Michigan (*14*).

Soil acidity is a very important factor to be considered in obtaining size typical of the several beet varieties (*13*). New Jersey (*1*) recommends that the soil be nearer pH 7.0 than pH 6.0. Plots with a reaction of pH 7.65 produced by magnesian limestone yielded more beets than one of pH 6.83. Rhode Island (*10*) recommends that the reaction be kept below pH 7.0 to prevent manganese deficiency, which decreases size even though visible symptoms are not present. On Long Island (*30*) the number of marketable plants and their average weight was very rapidly reduced as the soil became more acid than pH 5.8. On an Illinois dark-colored silt loam with a limestone requirement of 2 to 2½ tons per acre, the use of 2 tons of limestone every 3 years did not result in increased growth (*16*), whereas in another location (*15*) with a soil of about pH 6.0 the use of 3 tons of limestone over an 8-year period increased the yield about 20 percent. Experiments in Virginia (*13*) have shown that at the pH at which beets are injured, aluminum becomes markedly soluble in the soil solution. Abundant phosphates and organic matter tend to counteract the aluminum toxicity of acid soils.

DEVELOPMENTAL HISTORY OF SHAPE IN GARDEN-BEET ROOTS

Although the ultimate shape of the beet root is largely determined by hereditary factors, the shape is also influenced by the environmental conditions under which it develops and varies with the stage of growth at which it is observed (age and size). As a background for the discussion of the effect of environment

[11] See footnote 3, p. 5.
[12] See footnote 7, p. 5.

on root shape, the following brief statement is made of the changes observed with increase in size and age.

In typically flat varieties, the very small roots are wedge-shaped or long conic, and as they reach usable size (three-fourths to 1 inch) they become nearly round or short-top shaped because of faster growth in the horizontal direction. Growth in this direction continues at a greater rate than growth in length, with the result that as the root increases in diameter it becomes relatively flatter, i. e., the ratio of diameter to depth becomes larger. until mature. (See pls. 17, 18, 23, 24.)

Flat Egyptian becomes increasingly lobed as it increases in diameter, owing to the unequal growth of secondary cambiums. (See pl. 3.) Renewed growth following cessation due to any condition other than low temperature usually results in the formation of an enlargement above the original root (*3*). If the secondary growth is rapid the enlargement may be round and of the same diameter as the root, but if secondary growth is slow, the enlargement may be conical, terminated by a tuft of leaves.

In oblate, round, and oval-shaped varieties the early stages follow the same plan as in the flat varieties but involve increase in diameter over a greater vertical length. Increase in diameter is greatest near the top of the root at the beginning and progresses toward the taproot. Thus, mature round roots are progressively long top-shaped, short top-shaped, ovate, and round with increase in age and diameter.

The increase in diameter of half-long and long varieties likewise takes place first near the top of the root and then progresses downward. In certain varieties of these types, growth in length, although slower than in diameter, actually increases the length of the root above ground. In spring-grown crops, the death of the older leaves during the long period required to mature these varieties results in the formation of a conical neck not usually found in the fall-grown crops or in those in which most of the leaves are retained in vigorous condition.

It becomes very important, therefore, for the breeder to know the desired shape and the diameter at which the beet is to be harvested. He must also take into account the effect of environmental factors on shape in order to proceed intelligently with the selection of mother beets produced under different environmental conditions.

INFLUENCE OF ENVIRONMENT ON ROOT SHAPE

A study of factors affecting the shape of Morse Detroit (*27*), based on a large number of measurements, showed that small roots were longer, more top shaped, and have thicker taproots in proportion to their equatorial diameter than large roots. Therefore, no satisfactory study of environmental influences on beet roots can be made on random samples unless the size of root is taken into account.

This same study showed that roots grown in heavy clay soil were longer and had thicker taproots than those grown in deep sandy soil. Soils that bake upon drying and those containing stones and coarse organic matter are known to result in misshapen roots, as is also too close spacing in the row.

Thompson's data on the influence of season of growth (at the Arlington farm and the Horticultural station at Beltsville) indicate that the roots from crops grown in the fall and early winter tended to be longer and have thicker taproots proportionately than crops grown in the spring and early summer. Additional evidence to support this conclusion is furnished in plates 4, 8, 10, 12, 19, and 25 for this and other varieties. Other unpublished photographs and data from the same and other locations show the same tendency when beets are grown under similar conditions, i. e., decreasing temperatures and length of day with possible moisture shortage during the early part of the growing season.

Thompson found no significant differences in any of three shape indices to be due to great extremes in the rate of fertilizer application. He also concluded that although significant measurable differences were obtained, variations in shape are not great except when the crops are grown under wide extremes of soil, climatic, and seasonal conditions.

The amount of soil around the developing plant greatly altered the shape of Light Red Crosby roots in Pino's experiments.[13] In one lot soil was kept pulled up around the shoulders or crown and in another was pulled away. The roots from the covered plot were more nearly square across the shoulders and relatively shorter in length than those in the uncovered plot (ratio of depth to diameter of covered 0.88, and of uncovered 1.05). In a later planting in which the differential treatment started at an earlier stage of development the roots showed a tendency to tapered shoulders.

All the varieties grown at Davis, Calif., had more tapered bases and larger taproots than those grown at Baton Rouge, Norfolk, Arlington, or Beltsville during the same season of the year. (See pls. 15, 16.) The same effect but to a lesser degree was observed in the crops grown during the winter and early spring at Weslaco and Winter Haven, Tex. At the Texas and California locations it was necessary to irrigate by the furrow method, and it is entirely possible that soil-moisture conditions may be responsible for at least part of the observed difference in shape. Although

[13] See footnote 7, p. 5.

every effort was made to supply sufficient water for normal rapid growth, it is possible that during certain periods the roots may not have been able to absorb moisture as rapidly as it was given off by leaves into the arid air. Then, too, the smaller amount of moisture available in the upper soil layers may cause a greater development of the taproot than in more humid regions. Periods of water shortage during the early growth of the fall crop at Arlington and Beltsville are very common and may be part of the cause of larger taproots and rounder shoulders than in spring crops where moisture is rarely a limiting factor to growth. (See pls. 4, 8, 10, 12, 19, 25.)

At Davis it has been observed that the crops that were planted in January or early in February (as these were) and made their early growth under rather low temperature conditions have a heavier taproot than those planted somewhat later. The fall crops usually planted in late August or early September and making their early growth under rather high temperature conditions also have finer taproots than the early planted spring crop. Slow growth caused by low temperature and moisture may be the unfavorable factors responsible for the misshapen roots grown in California in 1933. (See pls. 16, 27.)

INFLUENCE OF ENVIRONMENT ON FLESH COLOR

To the consumer and certainly to the canner, flesh color is very important. The consumer wants the cooked beets to have a uniform or very slightly zoned dark-red color, and this is only possible when the colored zones are dark in color and wider than the white or light-colored zones. A knowledge of the factors influencing color formation is, therefore, very important.

In Murray's experiments [14] in the greenhouse with Crosby Egyptian, the plants grown at 50° to 60° F. contained the lowest and the plants in the 70° to 80° temperature the highest percentage of poorly colored roots. Light Red Crosby, however, produced slightly better color, i. e., less white flesh, in the roots grown at an average temperature of 71.2° (range of 64.0° to 75.4°) than at 59.9° (range of 56.8° to 63.9°). This difference in results may be due to a difference in the pigments contained in the two varieties, for Light Red Crosby has orange-red or vermilion colored zones whereas Crosby Egyptian has dark purplish-red colored ones.

The effects of different soil-moisture levels on root color in Murray's [14] and in Pino's [15] work were contradictory and inconsistent.

Reducing the intensity of the light by shading with cheesecloth had no effect on root color in Pino's experiments. He did find, however, that twice as many well-colored roots of Light Red Crosby were produced in plots in which the soil had been pulled away from the developing root as in those in which the soil had been pulled up around the developing root or in which level cultivation had been practiced.

Growers, canners, and investigators (*9*) have known for a long time that the season of the year at which the crop was grown, the kind of weather encountered, and length of time in the field all had an effect on flesh color. In the Northern States crops grown in the spring have poorer color than those grown in the fall. Plates 6, 20, and 26 illustrate clearly the differences observed in 1935 at Beltsville. Other spring-grown crops contained more white flesh than this one, making the comparison more marked. The color plate (pl. 30) also shows not only the relative width of the different colored zones but the difference in depth of color that is probably due to a greater concentration or more of the pigment in the cells. Excessive or heavy rains following a dry period during a season of increasing temperatures have resulted in poor color. On the other hand, rains during the late summer or early fall when temperatures are usually decreasing have resulted in an increase in depth or amount of color in beets for canning. An extra 2 to 4 weeks in the field in the fall, with the usual amount of rainfall, also usually results in better color, probably because of the accompanying decrease in temperature.

River-bottom silty loam soils have been reported (*9*) to produce better colored roots than many upland soils, and muck soil of cattail or similar formation when cropped for a number of years will produce darker colored beets than muck soils more nearly virgin in nature.

In general, it has been observed that the largest roots in a harvest on any given date are usually the poorest in color (contain the most white flesh), and the smallest roots are the best in color. The differences are greatest in the spring-grown crops.

A deficiency of any element or of water that would slow down the utilization of carbohydrates in new growth would be expected to result in their accumulation and increase pigment formation. Low temperatures result in carbohydrate accumulation through a reduction in the rate of utilization in growth and in respiration. Better color in roots allowed to remain longer in the field in the fall is probably the result of lower temperatures. Lower temperatures are also probably the important factor in cases where a rain is thought to be responsible for increased color, as lower

[14] See footnote 3, p 5.
[15] See footnote 7, p. 5.

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temperatures usually accompany and follow rainfall, especially in the fall.

Now that a rapid chemical method has been devised (*18*) for accurately determining the quantity of betanin (the conspicuous red anthocyanin pigment) present in beet roots, a more accurate analysis of the factors influencing color formation in the root will be possible.

INFLUENCE OF ENVIRONMENT ON FLESH QUALITY

High quality, to the consumer, means tender texture, succulence, pleasing flavor, deep-red color, and, in some instances, ability (i. e., storage ability) to retain these qualities until used. In order to be crisp, succulent, and free from fiber (woody tissue) it is necessary that growth be rapid. Any factor discussed in the preceding sections that greatly reduces the rate of growth is liable to result in tough, woody, or stringy roots. Factors affecting color have also been discussed on page 9. The amount of nitrogen in the roots of garden beets increased with the amount supplied in the soil (*26*). The mineral content of the roots is also influenced greatly by the conditions under which they are grown.

Crist (*8*), using Detroit Dark Red beets, found that the fertilizers that produced the largest yields also produced plants that were more succulent, i. e., they had more water per gram of dry matter and they lost their water more slowly after harvesting than unfertilized plants or those fertilized with only a single fertilizer material. This fact is especially important to the long-distance shipper of bunched beets.

INFLUENCE OF ENVIRONMENT ON ANNUAL SEEDERS IN GARDEN BEETS

Under certain combinations of environmental factors, beets may produce seedstalks and flowers the first growing season instead of the desired edible root (*3*). Continuous low temperatures (below 50° F.) during germination or in later stages of growth did not induce flowering in plants that later were grown at a temperature above 70°. If, however, the plants were grown for 30 days or longer below 50°, then at temperatures between 60° and 70°, all of the plants produced seedstalks instead of edible roots. Plants grown continuously at temperatures above 70° did not produce seedstalks and those grown at 60° to 70° produced only a small percentage of seedstalks when grown under normal light conditions.

Increasing the light period by artificial illumination at night increased the speed of seedstalk appearance in cool temperatures and the percentage of plants with seedstalks in the 60° to 70° F. temperature range. Continuous illumination at temperatures above 70° enabled some plants to produce seedstalks, whereas 8 hours of light was sufficient at temperatures of 50° or lower. Freezing injury delayed seedstalk appearance. Checking the growth of the young plants by drought, removing all or part of the foliage, pruning the roots at transplanting time or later in the row in the field did not result in seedstalk formation. Hastening the growth by supplying sufficient water and nitrogen and by providing other conditions favorable for vigorous growth increased the tendency to produce seedstalks in plants grown under suitable temperature and light conditions.

The age of the seedling at the time it encounters the low temperature is an important factor in producing annual seeders. The older the plants when exposed to low temperatures, the greater the percentage that produced seedstalks. Age is more important than size.

ERRATUM SLIP

United States Department of Agriculture
MISCELLANEOUS PUBLICATION 374

Page 11, Table 1, The diameter to depth ratio of the Long Dark Red Variety, should read .21 - .31.

DISTINGUISHING VARIETAL CHARACTERISTICS

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

TABLE 1.—*Use and distinguishing characteristics of the principal varieties of mature red garden beets*

Variety	Chief uses	Season	Leaves	Foliage		Neck diameter
				Height	Color change	
			Number	*Inches*		*Inches*
Flat Egyptian	Home, market	Very early	11–15	10–12	Reddens early	1 3/16–1 5/16
Crosby Egyptian	do	Early	12–18	12–15	Reddens midseason	1 1/16–1 7/16
Light Red Crosby	do	do	12–18	12–15	do	1 1/16–1 7/16
Early Wonder	Market, home	do	12–18	12–15	do	1 1/16–1 7/16
Detroit Dark Red	Canning, market, home	Midseason	10–15	12–14	Reddens late	1–1 3/8
Morse Detroit	Canning, market	do	12–18	10–12	do	7/8–1 1/8
Ohio Canner	do	Late	12–18	11–13	Reddens midseason	1 1/16–1 7/16
Long Dark Blood	Home, market	do	15–30	18–24	Reddens early	1–2

Variety	Mature root							Zone prominence
	General shape	Depth	Diameter to depth ratio	Shoulder shape	Base shape	Skin color	Flesh color	
		Inches						
Flat Egyptian	Flat	1½–1⅞	1.55–1.85	Square to slightly rounded.	Square to slightly rounded.	Dark purplish red	Dark reddish purple.	Distinct.
Crosby Egyptian	Oblate to short top	1¾–2½	1.25–1.5	do	Slightly flattened to round.	Medium purplish red.	do	Do.
Light Red Crosby	Oblate	1¾–2½	1.25–1.5	do	do	Orange red	Orange red	Do.
Early Wonder	Deep oblate to round	2¼–2¾	1.05–1.30	Rounded	Rounded	Medium purplish red.	Dark reddish purple.	Do.
Detroit Dark Red	Round to oval	2⅜–3⅛	.90–1.06	Round to slightly sloping.	Round to slightly tapered.	Maroon red	Dark red	Indistinct.
Morse Detroit	Deep oblate to round	2¼–2¾	1.00–1.30	Square to rounded	Slightly flattened to round.	Dark purplish red	Dark purplish red	Do.
Ohio Canner	Oblate to deep oblate	2–2½	1.10–1.40	Rounded	do	do	Dark red	Very indistinct.
Long Dark Blood	Long, slender	8–12	3.2 –4.8	Sloping	Pointed	do	do	Indistinct.

CLASSIFICATION OF PRINCIPAL AMERICAN VARIETIES OF RED GARDEN BEETS

A. Roots flat, skin dark purplish red, flesh dark reddish purple with distinct zones. — Flat Egyptian.

A.A. Roots not flat.

B. Roots oblate to deep oblate to short top-shaped.

C. Skin dark purplish red, flesh dark red with indistinct zones. — Ohio Canner.

C.C. Skin not dark purplish red.

D. Skin medium purplish red, flesh dark reddish purple with distinct zones. — Crosby Egyptian.

D.D. Skin orange red, flesh orange red with distinct zones. — Light Red Crosby.

B.B. Roots not oblate.

C. Roots oval to round to deep oblate.

D. Skin dark purplish red, flesh dark purplish red with indistinct zones. — Morse Detroit.

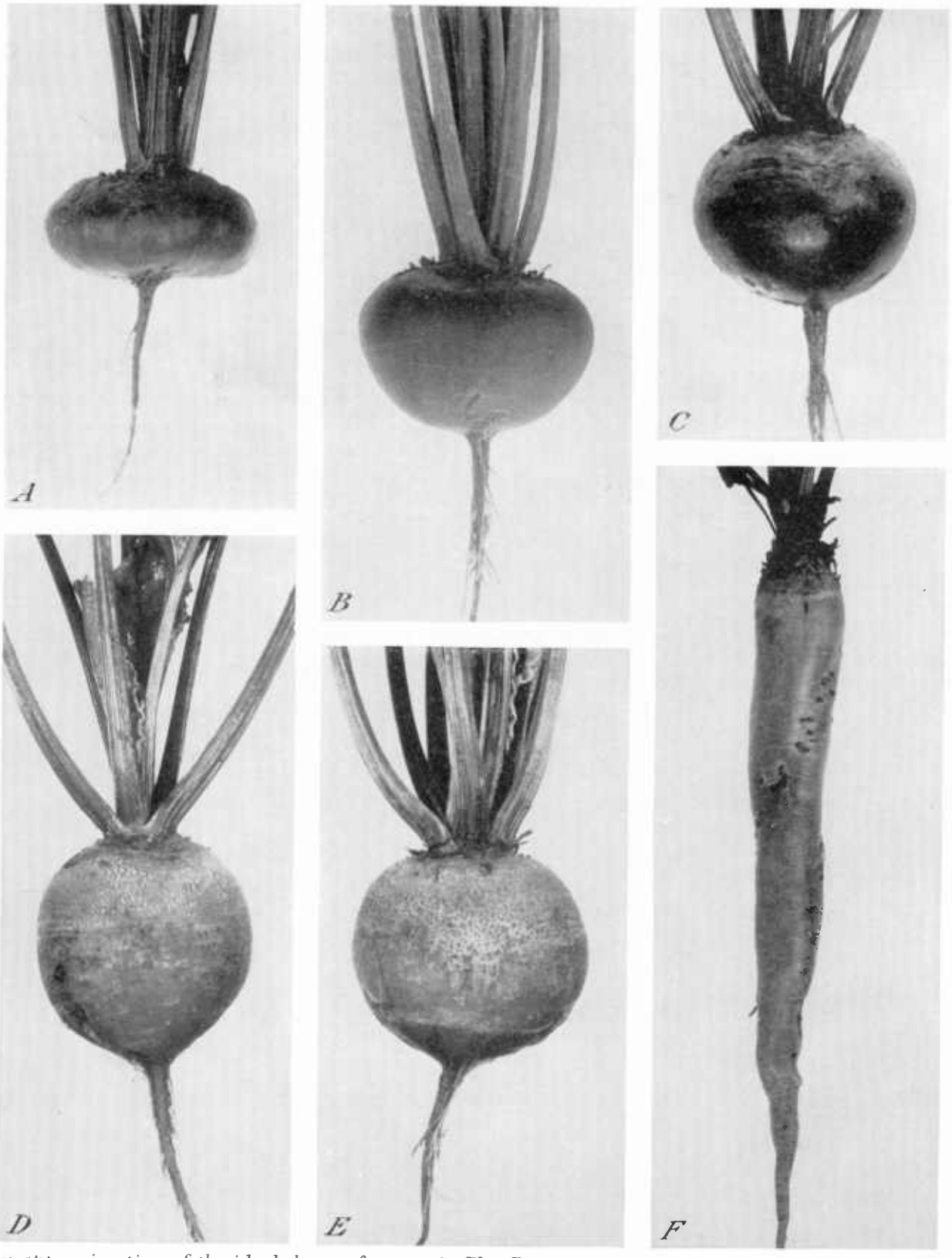
D.D. Skin not dark purplish red.

E. Skin medium purplish red, flesh dark reddish purple with distinct zones. — Early Wonder.

E.E. Skin maroon red, flesh dark red with indistinct zones. — Detroit Dark Red.

C.C. Roots long, skin dark purplish red, flesh dark red with indistinct zones. — Long Dark Blood.

IDEAL SHAPE OF BEET ROOTS



An approximation of the ideal shape of roots: A, *Flat Egyptian*, × ½; B, *Crosby Egyptian and Light Red Crosby*, × ½; C, *Early Wonder and Ohio Canner*, × ½; D, *Detroit Dark Red*, × ½; E, *Morse Detroit*, × ½; F, *Long Dark Blood*, × ⅓.

FLAT EGYPTIAN

BRIEF CHARACTERIZATION

The earliest variety and is still used to a limited extent in home and market gardens. Very early maturing with short foliage that soon turns red, and with flat, somewhat lobed, dark purplish-red roots with concentric zones of narrow white and broad dark purplish-red flesh.

ADAPTABILITY AND USE

Flat Egyptian (pl. 1) is the most widely used variety for forcing in hotbeds and coldframes because of its small foliage and earliness, but it has been displaced in the shipping sections by Crosby Egyptian and Early Wonder, which are smoother, deeper, and only a few days later in reaching marketable size. After Flat Egyptian reaches 2 inches in diameter it has a tendency to become lobed or irregular in cross section and to crack or split on the bottom. Used to a limited extent for the production of baby beets for canning, as it assumes a nearly round shape at a smaller diameter and in a shorter number of days than other varieties.

SEASON

Early maturing, the majority of roots reaching 2 inches (5 cm.) in diameter in 41 to 55 days from date of seedling emergence from soil when grown as an early-spring or early-fall crop in the Northern States, and in 60 to 70 days as a late-winter to early-spring crop in the Southern States and California and as a late-fall crop in the Northern States. To reach 2½ to 3 inches (6.3 to 7.6 cm.) in diameter requires from 46 to 60 days from date of seedling emergence when grown as an early-spring and an early-fall crop in the Northern States, and 70 to 85 days as a late-winter to early-spring crop in the Southern States and California and as a late-fall crop in the Northern States.

PLANT [16]

(Pl. 2)

Medium size; when roots reach 2¼ to 3 inches (5.7 to 7.6 cm.) in diameter the average plant weight ranges from 5.2 to 7 ounces (150 to 200 gm.) depending on relative development of foliage; usually 9½ to 12 inches (24 to 30 cm.) high under average conditions with a spread of 12 to 16 inches (30 to 40 cm.) or 1.2 to 1.6 times as wide as tall.

LEAVES

(Pls. 2 and 3, *A* and 3, *B*)

Few to medium in number, typically between 11 and 15 with seldom less than 8 or more than 18; average weight ranges from 2.6 to 3.5 ounces (75 to 100 gm.) under ordinary conditions of growth but may be twice as large under extremely favorable conditions; constitute from 40 to 55 percent of the total plant weight.

BLADE

Young growth typically light green in color, about Calla Green (22 L 4)[17], but darkening to Art Green (22 L 7) and Cedar Green (23 L 5) with increased age; with approaching maturity becomes heavily stippled and eventually suffused with reddish purple (54 L 4, 55 H 6, or 56 L 3). Small, average length ranging from 5½ to 7 inches (14 to 18 cm.), with shortest blades on fall-grown crops; average width ranging from 4 to 5¼ inches (10 to 13 cm.); length-to-width ratio varies from 1.3 to 1.7 with the narrowest leaves, relatively speaking, being produced in the fall-grown crop in the Northern States. Ovate to narrow ovate in shape; rounded to slightly pointed tip; slightly tapered base; slightly curved downward midrib; downward curved sides; undulate margin; wavy to crenate edge; almost flat surface when matured in medium to high temperatures but slightly bullate when air temperatures are low; small to medium size midrib and veins; thin to medium in blade thickness.

PETIOLE

Outside or convex surface of petiole solid light to medium purplish red ranging from 6 A 6 to 6 L 6, according to location and season; inside or concave surface usually lighter purple at any point or any season and an occasional plant may have orange-red (4 K 12) stripe in center of concave surface. Medium in length, 5¼ to 6¾ inches (13 to 17 cm.) in average length with longest petioles on crops matured under higher temperatures; slightly shorter than the blade when matured under high temperatures and much shorter than the blade when matured under low temperatures; slender, usually 20 to 30 times as long as wide; five thirty-seconds to eight thirty-seconds of an inch (4 to 6 mm.) in average width at midlength with a slight gradual increase toward the base and a decrease

[16] For discussion of the effect of environment on plant characters see p. 5.

[17] References are to plate, column, and row, given in A Dictionary of Color (*17*); e. g., 22 L 4 refers to plate 22, column L, and row 4. Capitalized color names preceding references are also from A Dictionary of Color.

toward the blade; from 1.04 to 1.2 times as wide as thick. Majority quite erect, held at an angle of 65° to 80° with the horizontal.

NECK

Average diameter at the base of adherent turgid petioles (neck) varies from thirteen-sixteenths to 1 3/16 inches (2 to 3 cm.).

ROOT

(Pls. 1, 2, 3, *C* and 4)

Grows with one-third to two-thirds of the root above ground at maturity; when three-fourths to 1 inch (1.9 to 2.5 cm.) in diameter the roots are nearly round, but as they increase in diameter they become relatively flatter; at an average diameter of 2½ to 3 inches (6.3 to 7.6 cm.) the average depth varies from 1½ to 1⅞ inches (3.7 to 4.8 cm.) with a diameter-to-depth ratio of 1.55 to 1.85; shoulder square to slightly rounded; base square to slightly rounded and occasionally concave; taproot relatively small and slender and frequently split by cracking of lower half of root; side roots few and fibrous and limited to lower one-third of root in two very shallow furrows on opposite sides; average weight (2½ to 3 inches in diameter) from 3 to 5 ounces (85 to 140 gm.), 45 to 60 percent of total plant weight.

Skin of young roots usually medium to dark purple above ground (approximately 7 H 1 to 7 H 6) when moist, but as the rough corky area around the shoulder develops, it becomes orange or purplish tan (13 B 7 to 14 K 8 to 7 C 10). As the ground line is approached, more of the dark purplish red (7 H 4) is exposed. On marketable size roots the underground portion is usually brighter purple (6 L 7 to 7 E 6) than above ground, although near the taproot it may be darker (48 L 3).

The cross-section shape is roughly circular but somewhat lobed or objectionably irregular on mature roots; usually 10 to 14 easily distinguished zones of lighter and darker colors; in the spring-grown crop the lighter zones are fairly distinct and vary in width from slightly narrower to slightly wider than the colored, whereas in the fall-grown crop the lighter zones are somewhat indistinct and narrower than the darkest zones.

The freshly cut flesh color of spring-grown crops is alternately zoned with nearly white (49 A 2 to 49 A 5) and various shades of purple (51 G 8, 53 L 3, 53 K 9 to 53 K 12). (See pl. 30 and p. 9.) In the fall-grown crop or when more uniformly colored roots are produced, the nearly white zone is greatly reduced in width or eliminated entirely, and the lightest colored zone is about 51 H 9 and other darker zones about 53 K 12, 54 L 4, and 7 H 4.

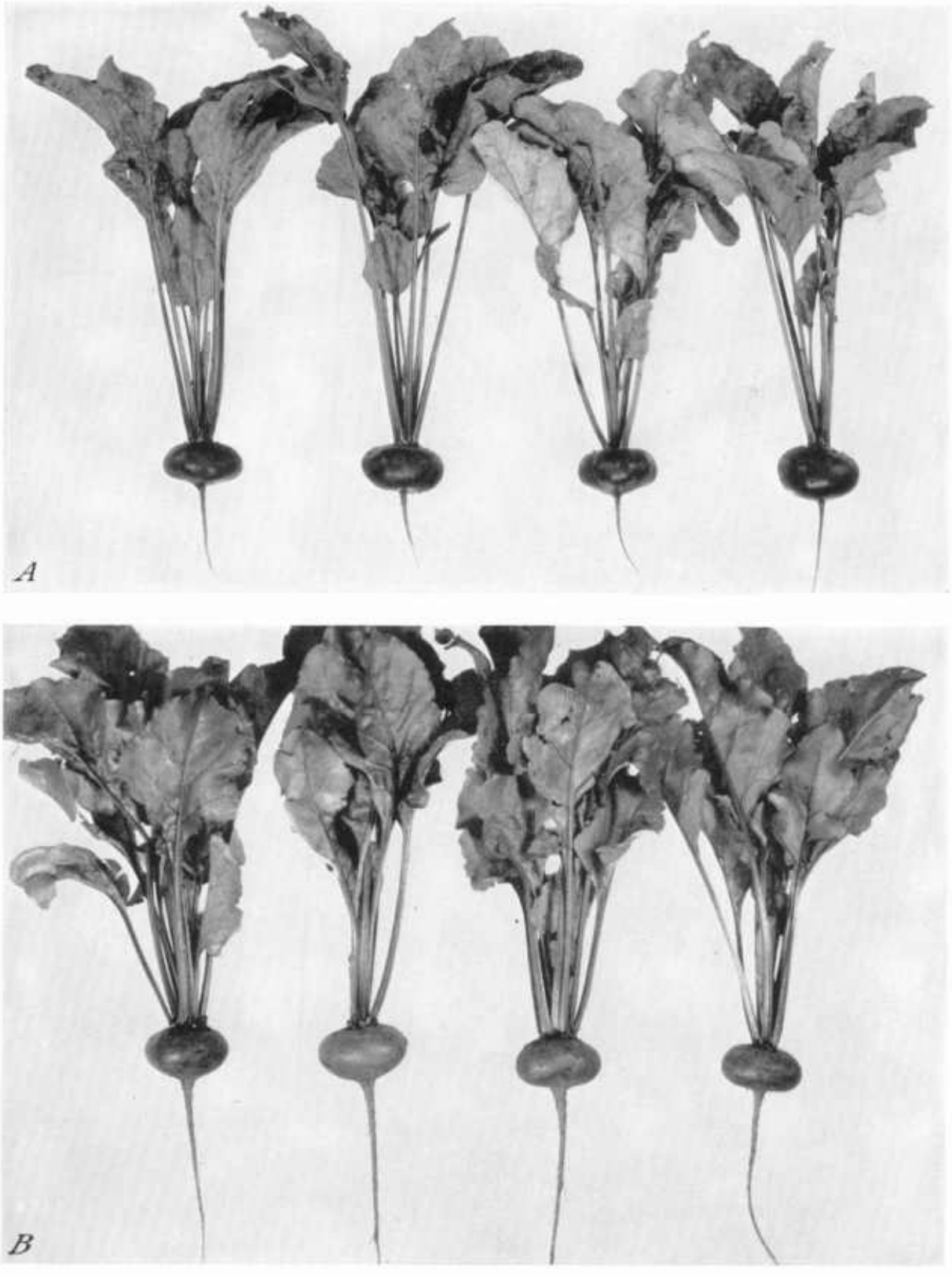
SYNONYMS

Dark Red Egyptian, Dark Red Egyptian Turnip, Earliest Dark Red Egyptian, Early Dark Egyptian, Early Dark Red Egyptian, Early Dark Red Flat Egyptian, Early Egyptian, Early Egyptian Blood Turnip, Early Egyptian Dark Turnip, Early Egyptian Turnip, Early Flat Egyptian, Early Flat Red Egyptian, Early Large Egyptian, Egyptian, Egyptian Blood Turnip, Egyptian Dark Red, Egyptian Dark Red Turnip, Egyptian Early Dark Red, Egyptian Extra Early, Egyptian Turnip, Egyptian Turnip Rooted, Extra Early Dark Egyptian, Extra Early Dark Red Egyptian, Extra Early Dark Red Flat Egyptian, Extra Early Egyptian, Extra Early Egyptian Blood Turnip, Extra Early Egyptian Turnip, Extra Early Egyptian Flat, Extra Early Egyptian Red Turnip, Extra Early Flat Egyptian, Improved Early Egyptian, Improved Egyptian, Improved Extra Early Egyptian.

HISTORY

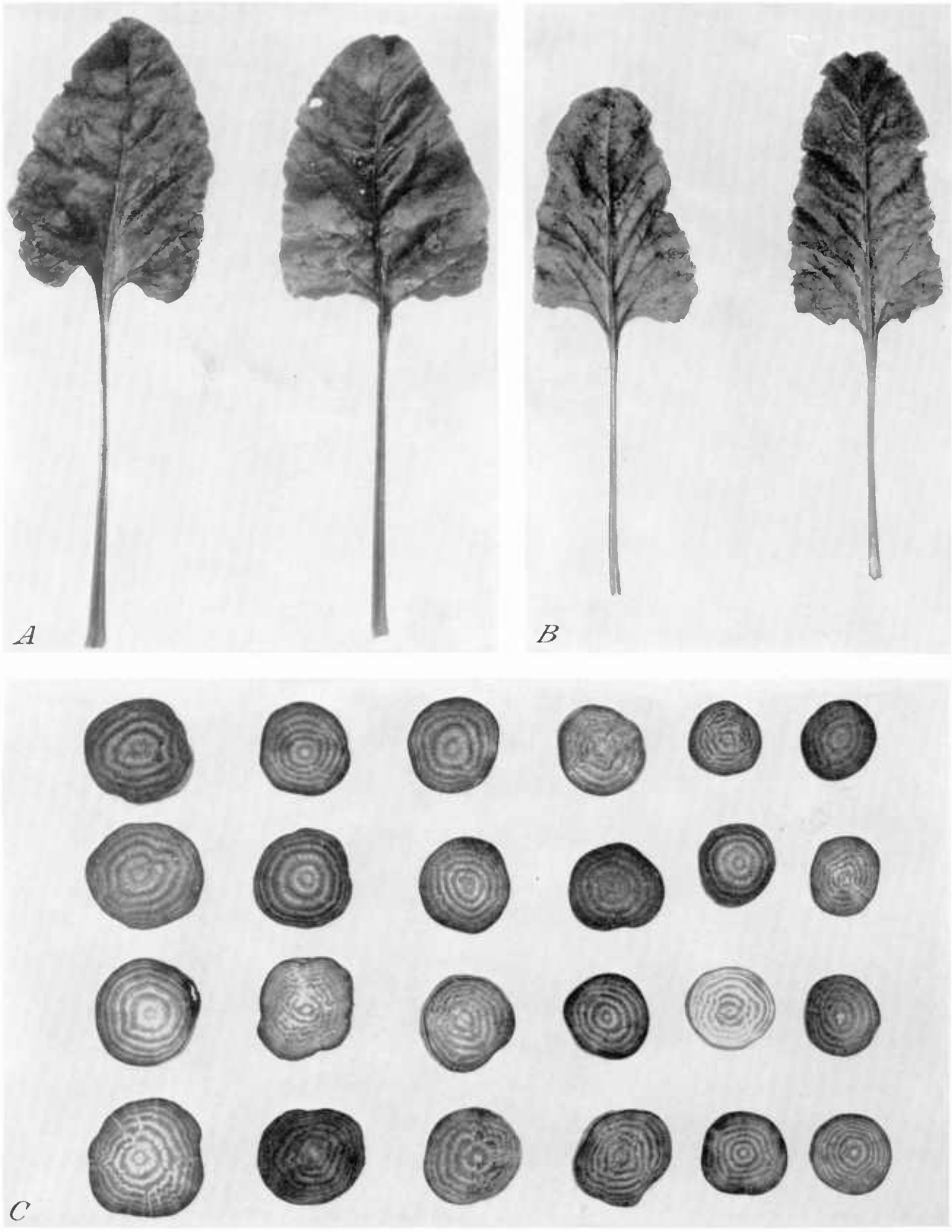
This variety first reached the United States through the German firm of Ernst Benary in 1868 or 1869 and was commonly listed by American seedsmen in 1872 as Extra Early Egyptian. It was first listed by B. K. Bliss & Sons in 1869 as Dark Red Egyptian.

FLAT EGYPTIAN BEET



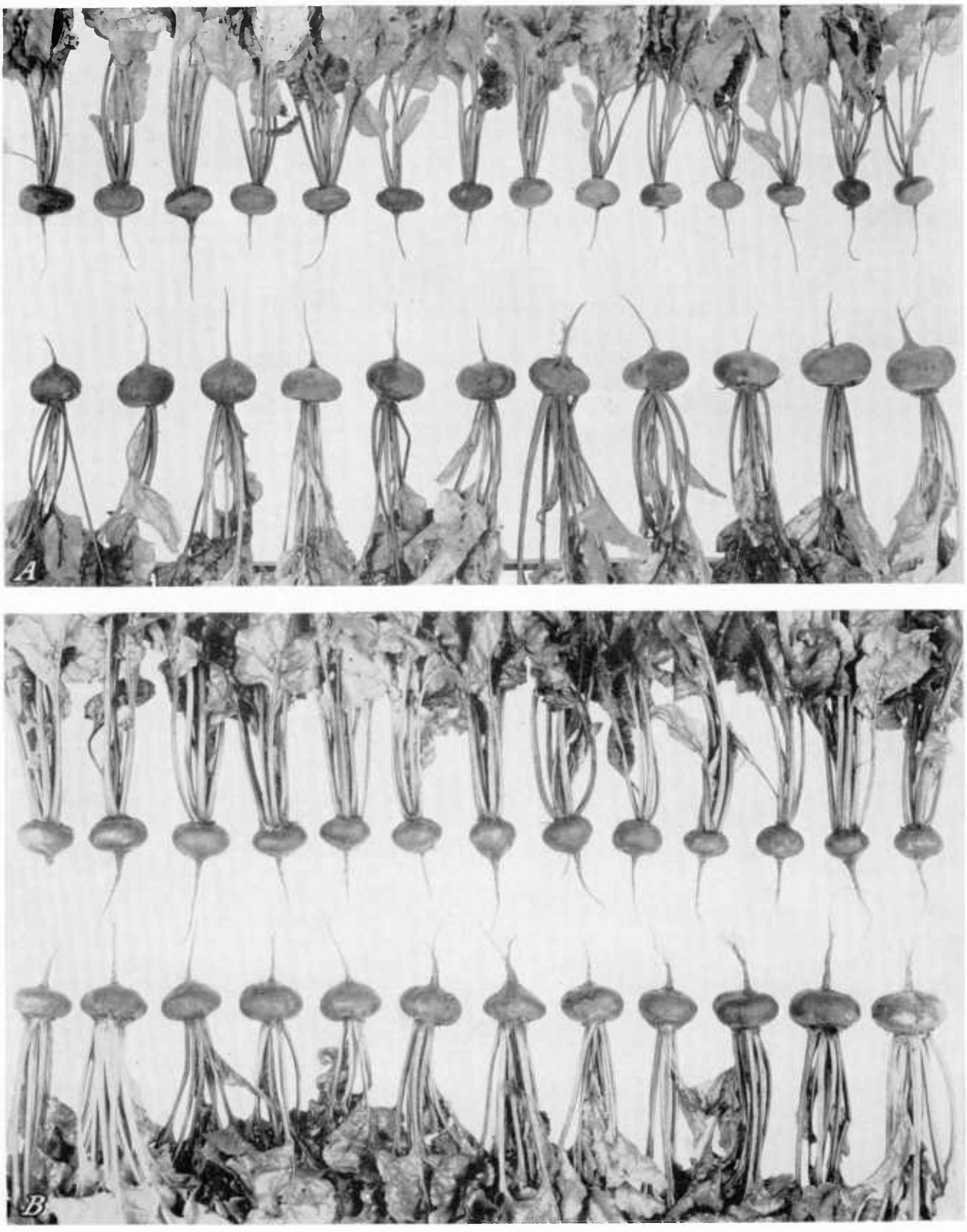
Acceptable range in type of prime marketable roots of Flat Egyptian beet grown as a spring crop at (A) *the Arlington Experiment Farm, Arlington, Va., and* (B) *at Davis, Calif.* × ⅕.

FLAT EGYPTIAN BEET



Seasonal effect on leaf type of Flat Egyptian beet grown at the Arlington Experiment Farm (A) in spring of 1932 and (B) in spring of 1933. C, Cross section of random sample of fall-grown mature roots. Note the lobed or irregular outline of mature roots. × ¼.

FLAT EGYPTIAN BEET



Random sample of usable roots of good strain of Flat Egyptian harvested (A) *July 22 and* (B) *November 12, 1935.* × 1/6.5. *Note difference in size of foliage and taproot and the greater taper of base of fall-grown crop.*

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CROSBY EGYPTIAN

BRIEF CHARACTERIZATION

Recommended for home, market garden, or shipping use as a fresh bunched vegetable, but not for canning.

Early maturing with medium-size foliage that retains well its dark-green color; has smooth, fairly deep but flattened, medium purplish-red roots with concentric zones of narrow white and broad dark purplish-red flesh.

ADAPTABILITY AND USE

Very widely adapted and the most important variety for bunching purposes. Reaches a marketable diameter a few days earlier than the rounder Early Wonder and, therefore, is preferred by the market gardener for the early market. Not used for canning because the purple color fades badly in processing, leaving pale or light-colored zones in the canned product.

SEASON

Early maturing, the majority of roots reaching 2 inches (5 cm.) in diameter in 45 to 55 days from date of seedling emergence from soil when grown as an early-spring or early-fall crop in the Northern States, and in 65 to 75 days as a late-winter to early-spring crop in the Southern States and California and as a late-fall crop in the Northern States. To reach 2½ to 3 inches (6.3 to 7.6 cm.) in diameter requires 50 to 60 days from date of seedling emergence when grown as an early-spring or early-fall crop in the Northern States and 75 to 90 days as a late-winter to early-spring crop in the Southern States and California and as a late-fall crop in the Northern States.

PLANT [18]

(Pl. 5)

Medium size; when roots reach 2½ to 3 inches (6.3 to 7.6 cm.) in diameter the average plant weight ranges from 7 to 10.5 ounces (200 to 300 gm.), depending mainly upon amount of foliage; usually 12 to 14 inches high (30 to 35 cm.) under ordinary conditions with a spread of 16 to 19.5 inches (40 to 50 cm.), or 1.25 to 1.7 times as wide as tall.

LEAVES

(Pls. 5 and 9, B and 9, C)

Few to medium in number, average between 12 and 18 with seldom less than 10 or more than 19; average weight ranging from 4.5 to 6.1 ounces (125 to 175 gm.) under average conditions; constitute from 45 to 55 percent of the total plant weight.

[18] For discussion of the effect of environment on plant character see p. 5.

BLADE

Young growth typically light green in color, about Parrot Green (21 L 6), but darkening to Calla Green (22 L 4) and Cedar Green (23 L 5) with increased age; retains green color longer than Flat Egyptian before becoming stippled and suffused with reddish purple (54 L 4, 55 H 6, or 56 L 3). Medium size, average length ranging from 6¾ to 8¼ inches (17 to 21 cm.); average width ranges from 4¾ to 5¾ inches (12 to 15 cm.); length to width ratio ranges from 1.27 to 1.60 with the narrowest leaves, relatively speaking, being produced in the fall-grown crop in the Northern States. Ovate to narrow ovate in shape; rounded to slightly pointed tip; square to slightly tapered base; straight to slightly curved downward midrib; downward curved sides; undulate to crinkled margin; wavy to slightly crenate, medium frilled edge; slightly undulate or bullate surface during high temperatures but medium to much bullate during low temperatures; medium size midrib and veins; medium thick blades.

PETIOLE

Outside or convex surface of petiole solid light to medium purplish red, ranging from 6 A 6 to 6 L 6; inside or concave surface usually lighter purplish red. Medium in length, 5¾ to 8 inches (15 to 20 cm.) in average length, with longest petioles on crops matured under higher temperatures; equal or slightly shorter in length than the blade; usually 20 to 30 times as long as wide; three-sixteenths to five-sixteenths of an inch (5 to 8 mm.) in average width at midlength with a slight increase toward the base and a decrease toward the blade; from 1.05 to 1.20 times as wide as thick. Majority slightly spreading in habit, held at an angle of 55° to 75° with the horizontal.

NECK

Average diameter at the base of adherent turgid petioles (neck) varies from 1 1/16 to 1 7/16 inches (2.7 to 3.7 cm.).

ROOT

(Pls. 1 and 5 to 8)

Grows with one-fourth to one-half of root above ground at maturity; when three-fourths to 1 inch (1.9 to 2.5 cm.) in diameter the roots are top-shaped (square to slightly rounded shoulder and tapered base), but as they mature the sides fill out and the base becomes rounded or flattened, resulting in a medium to deep oblate form; at an average diameter of 2½ to 3 inches (6.3 to 7.6 cm.) the average depth ranges from 1¾ to 2½ inches (4.5 to 6 cm.) with a diameter-to-depth ratio of 1.25 to 1.50; taproot small to medium in size; side roots few and fibrous and limited to lower one-third of root in two very shallow depressions on opposite sides of the root; average weight (2½ to 3 inches in diameter) ranges from 3.9 to 5.6 ounces (110 to 160 gm.), 45 to 55 percent of total plant weight.

Skin of young roots usually medium to dark purple (approximately 7 H 1 to 7 H 6) above ground when moist, but as the corky area around the shoulder develops, it becomes orange or purplish tan (13 B 7 to 14 K 8 to 7 C 10). At the ground line and beneath on marketable-size roots the moist skin color varies from medium to dark reddish purple (6 L 7 to 7 E 6 to 7 H 6).

In cross section the root is approximately circular in outline; usually 10 to 14 easily distinguished zones of lighter and darker colors; in the spring-grown crop the lighter zones are distinct and equal or slightly wider than the darker, whereas in the fall-grown crop the lighter zones are indistinct and slightly narrower than the darkest zones.

The freshly cut flesh color of spring-grown crops is alternately zoned with nearly white (49 A 2 to 49 A 5) and various shades of purple (51 G 8, 53 L 3, 53 K 9 to 53 K 12). (See pl. 30 and p. 9.) In the fall-grown crop or when more uniformly colored roots are produced the nearly white zone is greatly reduced in width or eliminated entirely, with the lightest colored zone about 51 H 9 and other darker zones about 53 K 12, 54 L 4, and 7 H 4.

SYNONYMS

Arlington Strain Crosby's Egyptian, Crosby, Crosby's Dark Red Egyptian, Crosby's Early, Crosby's Early Blood Turnip, Crosby's Early Dark Red Egyptian, Crosby's Early Egyptian, Crosby's Early Egyptian Red Turnip, Crosby's Early Egyptian Turnip, Crosby's Egyptian Arlington Strain, Crosby's Egyptian Blood Turnip, Crosby's Egyptian Extra Early, Crosby's Egyptian Turnip, Crosby Extra Early, Crosby's Extra Early Egyptian, Crosby's Extra Large Egyptian, Crosby's Improved, Crosby's Improved or Egyptian, Crosby's Improved Egyptian, Crosby's Improved Extra Early Egyptian, Crosby's Original Egyptian, Dark Red Egyptian, Dark Red Egyptian Crosby's, Early Blood Red Market, Early Crosby, Early Crosby's Egyptian, Egyptian Crosby's, Egyptian Crosby's Improved, Extra Early Crosby's Egyptian, Improved Crosby's Egyptian, New Crosby's Egyptian.

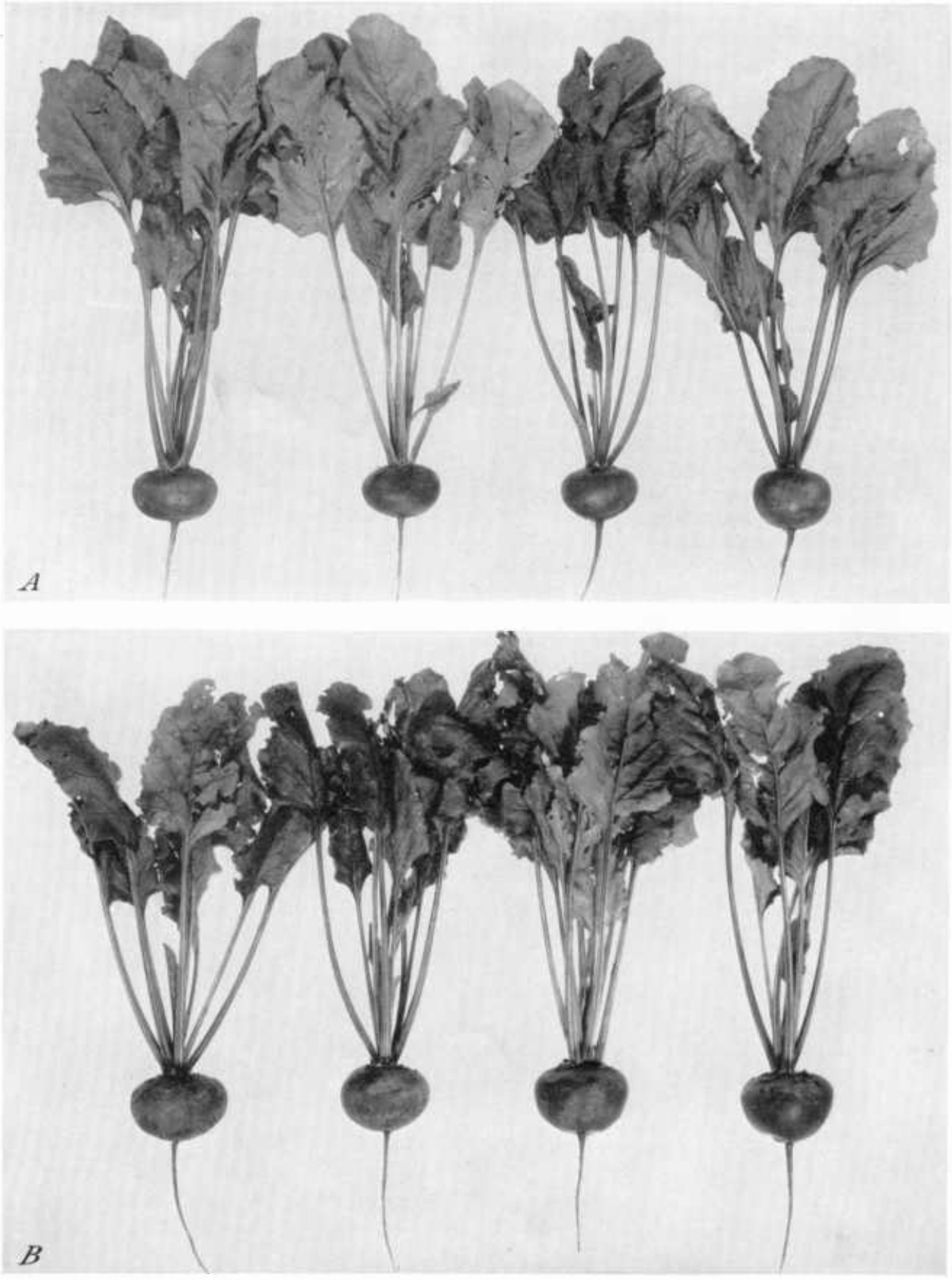
SIMILAR VARIETY

Asgrow Wonder has the same shape of root and color of skin as Crosby Egyptian, but the neck and foliage are usually larger and the flesh color is redder with less pronounced zoning.

HISTORY

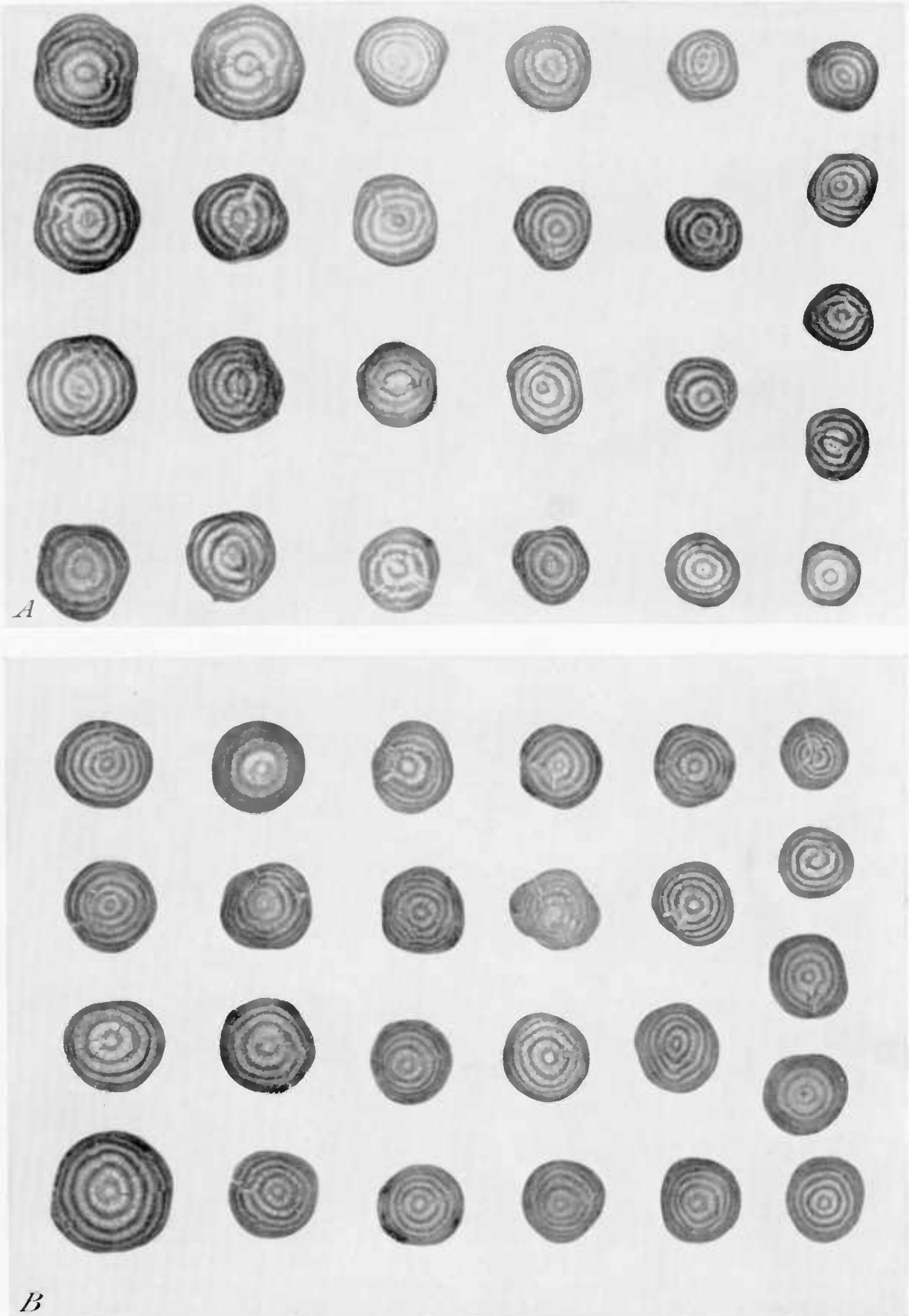
Originated by Josiah Crosby, an Arlington, Mass., market gardener who selected to retain the earliness, increase the depth, and remove the roughness of Flat Egyptian. It was probably first cataloged in 1885 by James J. H. Gregory, of Marblehead, Mass.

CROSBY EGYPTIAN BEET



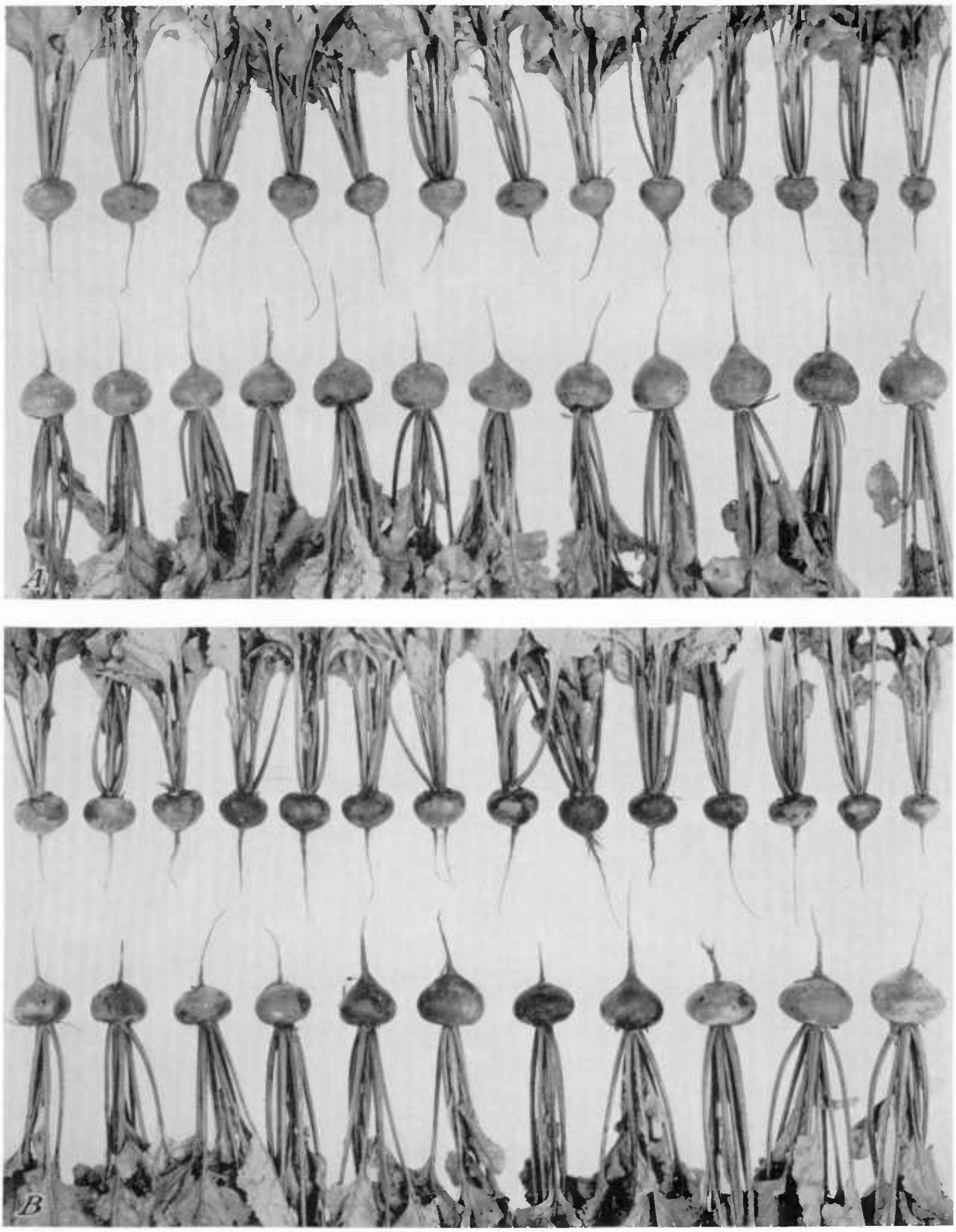
Acceptable range in type of Crosby Egyptian beet grown as a spring crop at the Arlington Experiment Farm, (A) *in 1934 and* (B) *in 1933.* × ⅕. A *is less mature than* B.

CROSBY EGYPTIAN BEET



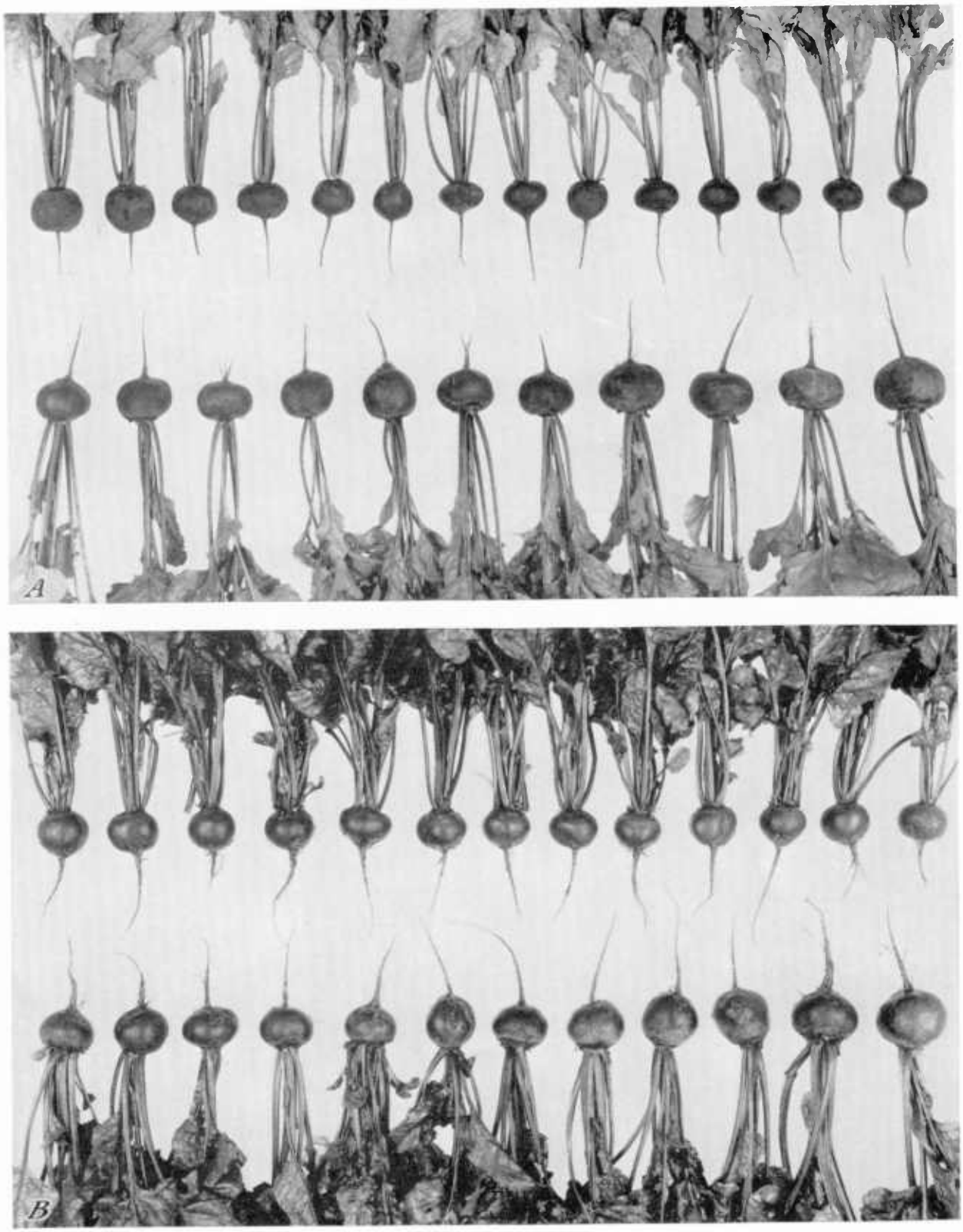
Difference in quantities of white flesh and depth of color in dark zones of a random sample of a good strain of Crosby Egyptian harvested (A) *July 23, 1935, and* (B) *November 14, 1935, at Beltsville, Md.* × ¼.

CROSBY EGYPTIAN BEET



Random samples of usable roots grown in spring of 1935 at Beltsville, Md. (A), From New England-grown seed of originator's stock and (B) from California-selected stock. × 1/6.5. Note tendency toward tapered bases and square crowns.

CROSBY EGYPTIAN BEET



Random samples of usable roots of the same strain of Crosby Egyptian beet grown at Beltsville, Md., in 1935, showing heavier taproots and foliage and rounder crowns or shoulders on (B) *late fall-grown than on* (A) *late spring-grown roots.* × 1/6.5.

LIGHT RED CROSBY

BRIEF CHARACTERIZATION

Recommended only for those individuals and markets that prefer a light-red color in the skin and flesh of the root.

Early maturing with medium-sized foliage that retains well its dark-green color; has smooth, fairly deep but flattened orange-red roots with concentric zones of equal width of white and orange-red flesh.

ADAPTABILITY AND USE

Widely adapted but limited in use because of its color; preferred, however, in some southern and Pacific coast localities. The bright-red color of freshly washed or moist roots is very attractive, but the color of the cooked flesh is light red or pink and unattractive to most individuals. Grows slightly faster than Crosby Egyptian and attains a much greater size with less fiber in the large roots.

SEASON

Same season or 1 or 2 days earlier than Crosby Egyptian.

PLANT [19]

(Pls. 9, A and 10)

Same size and habit as Crosby Egyptian.

LEAVES

Same size and number as Crosby Egyptian.

BLADES

Same size, shape, and character as Crosby Egyptian, but with midrib and veins more orange red in color.

PETIOLES

Same size and shape as Crosby Egyptian, but color of concave surface of petiole lighter and more orange in color with orange-red (5 F 10) stripes along each side.

NECK

Same size as Crosby Egyptian.

ROOT

(Pls. 9, A and 10)

Same size and shape as Crosby Egyptian, but more orange red in color.

Skin of young roots usually medium red (4 L 3 to 5 L 4) above ground when moist, but as the corky layer above ground develops it becomes orange tan (13 J 9 to 14 K 8). At the ground line and underneath on marketable-size roots the moist-skin color varies from slightly orange red to dark red (5 L 10 to 5 L 6).

The freshly cut flesh of spring-grown crops is alternately zoned with white or nearly white (2 E 2 to 3 G 3) and various shades of vermilion or bright red (3 J 10, 3 L 6, 4 L 6, and 5 L 6). In the fall-grown crop or when more uniformly colored roots are produced, the white zones are greatly reduced in width or eliminated entirely and the proportion of the darker colors increased. (See pl. 30 and p. 9.)

SYNONYMS

Bright Red Crosby, Crosby Egyptian, Egyptian Crosby's, Ferry's Crosby, Strawberry.

SIMILAR VARIETY

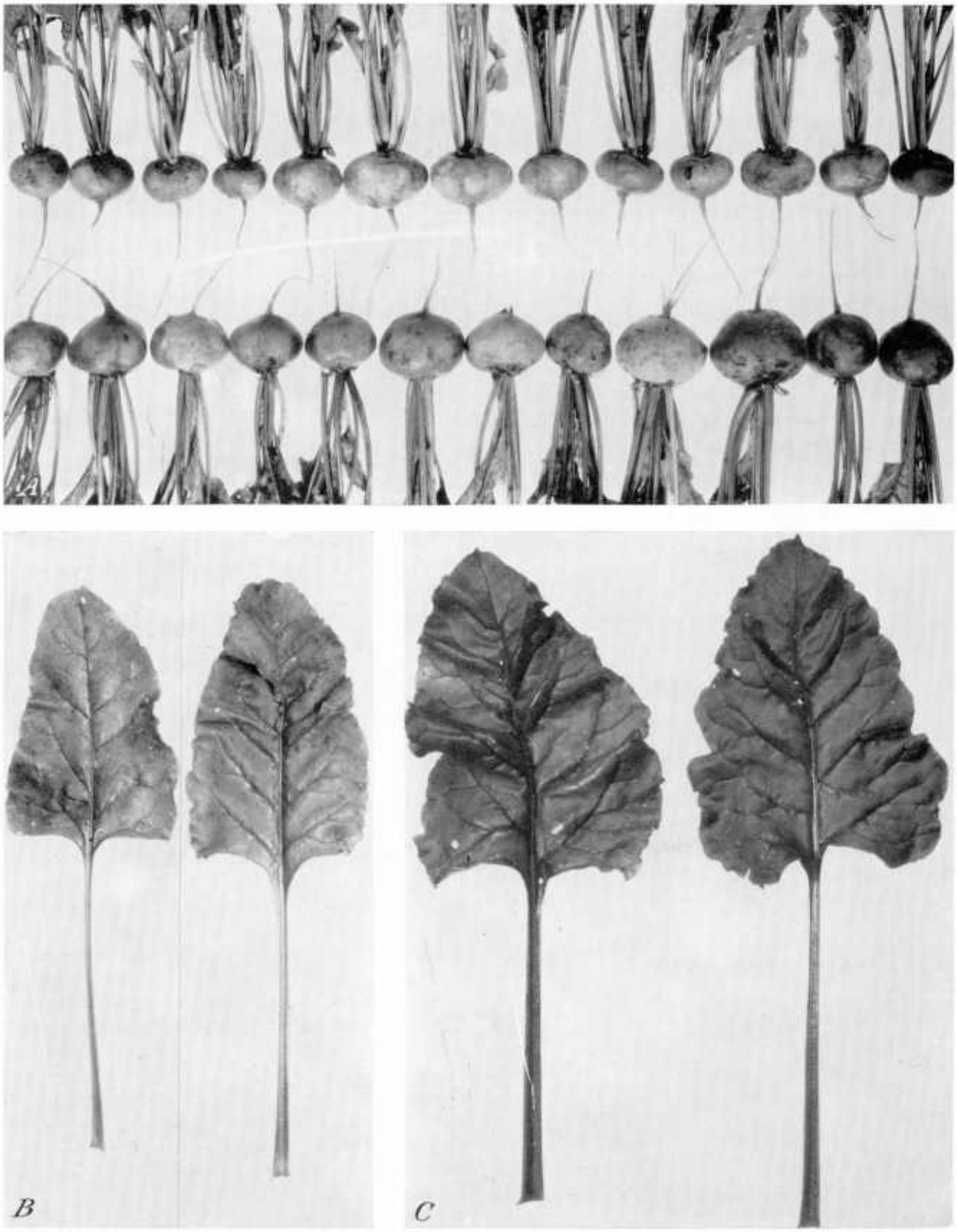
Eclipse has the same skin, flesh, and foliage colors as Light Red Crosby, but the roots are medium top to slightly oval in shape and the foliage and neck larger.

HISTORY

The first definite reference to a light-red or vermilion strain of Crosby beet is in the 1904 catalog of D. M. Ferry & Co., where Crosby's Egyptian is described: "The color in our stock, a bright rich vermilion, is distinct and very attractive." This strain is reported to have been developed during 1894 and 1895 by W. W. Tracy, of the D. M. Ferry Co., from Crosby Egyptian and was probably first listed for sale in their 1896 wholesale catalog, as the description points out that it is larger, lighter-colored, and more nearly spherical than Extra Early Egyptian. The confusion resulting from two distinctly different stocks under the same name was continued until 1931, when the Ferry-Morse Seed Co. listed the light-red or vermilion strain as Ferry's Crosby. The name Light Red Crosby has been selected as being more descriptive and having the right of priority over Ferry's Crosby.

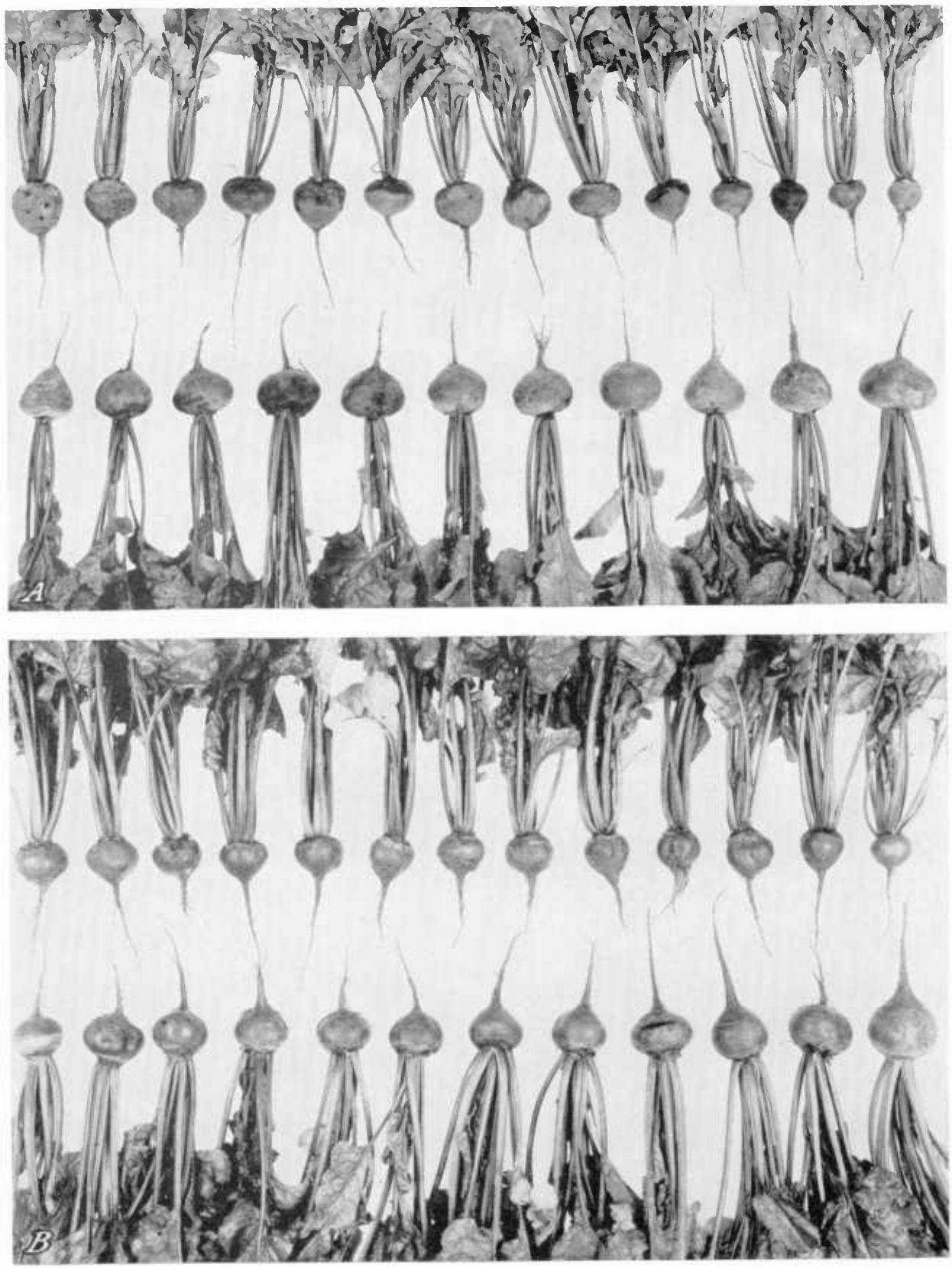
[19] For discussion of the effect of environment on plant characters see p. 5.

LIGHT RED CROSBY AND CROSBY EGYPTIAN



A, *Random sample of uniform strain of Light Red Crosby beet grown at Beltsville, Md., spring of 1933.* × 1/6.5. *Representative leaves of Crosby Egyptian beet grown* (B) *in 1933 and* (C) *in 1932 at the Arlington Experiment Farm, showing variation in leaf type due to environment.*

LIGHT RED CROSBY



Random sample of usable roots of a good strain of Light Red Crosby beet grown at the Arlington Experiment Farm in (A) *spring and* (B) *fall of 1935.* × 1/6.5. *Note heavier foliage and taproots and more tapering bases of fall-grown roots. Compare with plate 8.*

EARLY WONDER

BRIEF CHARACTERIZATION

Valuable for home, market garden, or shipping use as a fresh bunched vegetable, but not for canning.

Early maturing with medium-sized foliage that retains well its dark-green color; has smooth, nearly round, medium purplish-red roots with concentric zones of narrow white and broad dark purplish-red flesh.

ADAPTABILITY AND USE

As well adapted as Crosby Egyptian and with the same limitations for canning use but preferred in some shipping sections because of its greater depth. Some strains of this variety have less white flesh than Crosby, a great advantage in some seasons that more than counterbalances the disadvantage of slightly later maturity.

SEASON

Same season or 1 or 2 days later than Crosby Egyptian.

PLANT,[20] LEAVES, BLADES, PETIOLES, AND NECK

(Pls. 11 and 12)

Same size, character, and habit as Crosby Egyptian.

ROOT

(Pls. 1, 11, and 12)

Grows with one-third to one-half of root above ground at maturity; when three-fourths to 1 inch (1.9 to 2.5 cm.) in diameter the roots are oval or egg-shaped, but as they mature they become rounder; at an average diameter of 2½ to 3 inches (6.3 to 7.6 cm.) the average depth varies from 2¼ to 2¾ inches (5.5 to 6.8 cm.) with a diameter to depth ratio of 1.05 to 1.30; shoulder rounded; base rounded; taproot small to medium in size; side roots few and fibrous and limited to lower one-fourth of root in two very shallow depressions on opposite sides of the root; average weight (2½ to 3 inches in diameter) ranging from 5.3 to 7 ounces (150 to 200 gm.); 50 to 60 percent of total plant weight.

The above- and below-ground moist-skin color is the same as for Crosby Egyptian, although because of the greater area of the smooth below-ground surface visible in the bunched article, it appears sometimes to be lighter and brighter in color.

The freshly cut flesh color is the same as for Crosby Egyptian. Most seed producers are attempting to reduce the amount of white zoning and to increase as much as possible the amount of the red in the colored zones.

SYNONYMS

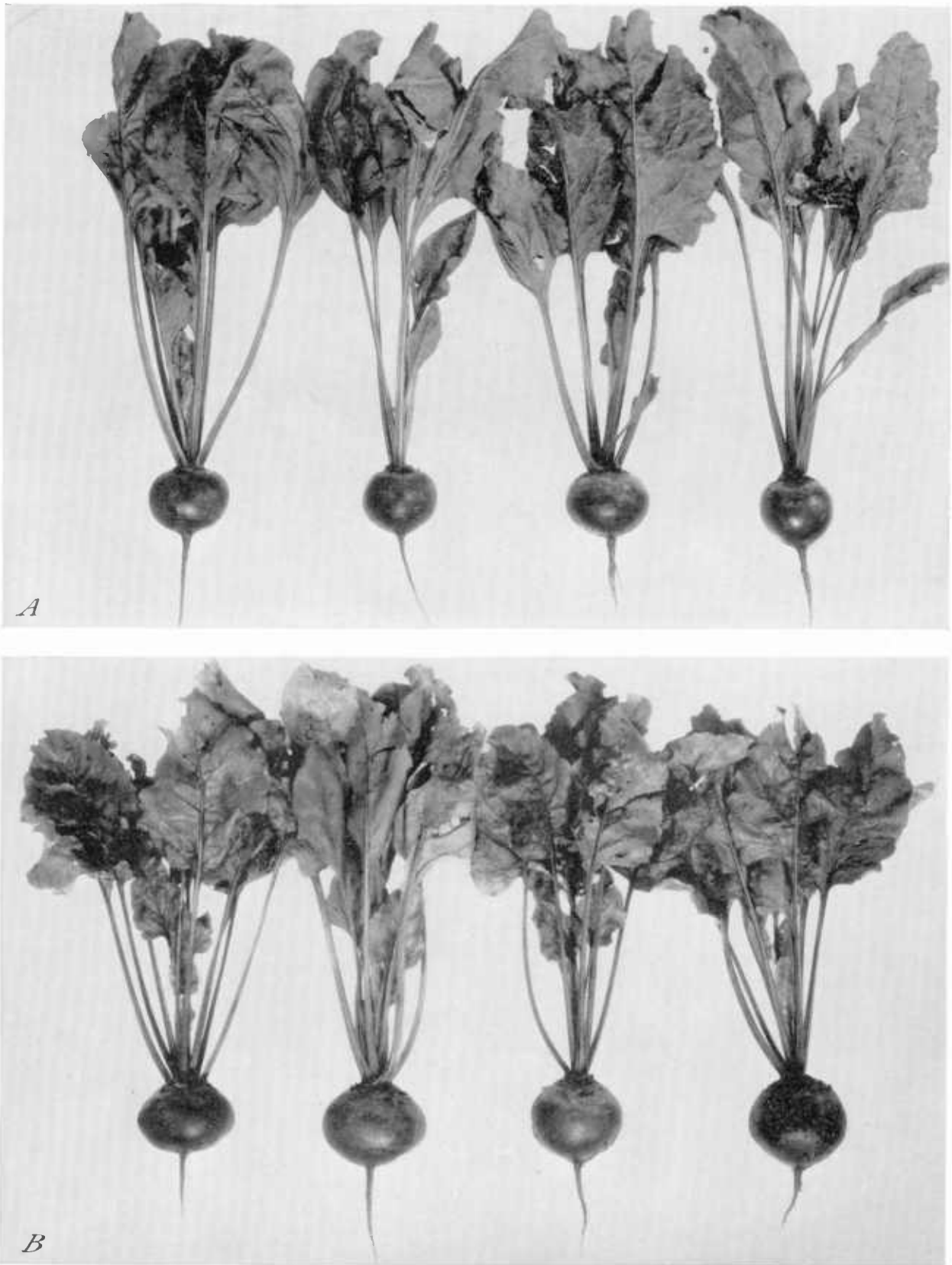
Boston Crosby; Nuttings Gem.

HISTORY

The name Early Wonder beet appeared for the first time in 1911 in the seed catalogs of F. H. Woodruff & Sons and of S. D. Woodruff & Sons. In the 1914 catalog of the latter firm it was listed as "Early Wonder, or Arlington Strain of Crosby's Egyptian Beet," thus establishing the synonymy and the source of seed. This strain was reported to be deeper and more nearly round than other stocks of Crosby Egyptian. Constant selection toward this round ideal by a few beet-seed producers has resulted in the nearly round type herein proposed as the ideal for Early Wonder as contrasted with the oblate form for Crosby Egyptian. A survey questionnaire indicates that this is the opinion of the majority of American beet-seed producers, although some consider the names synonyms and a few hold the reverse opinion as to root shapes under the two names.

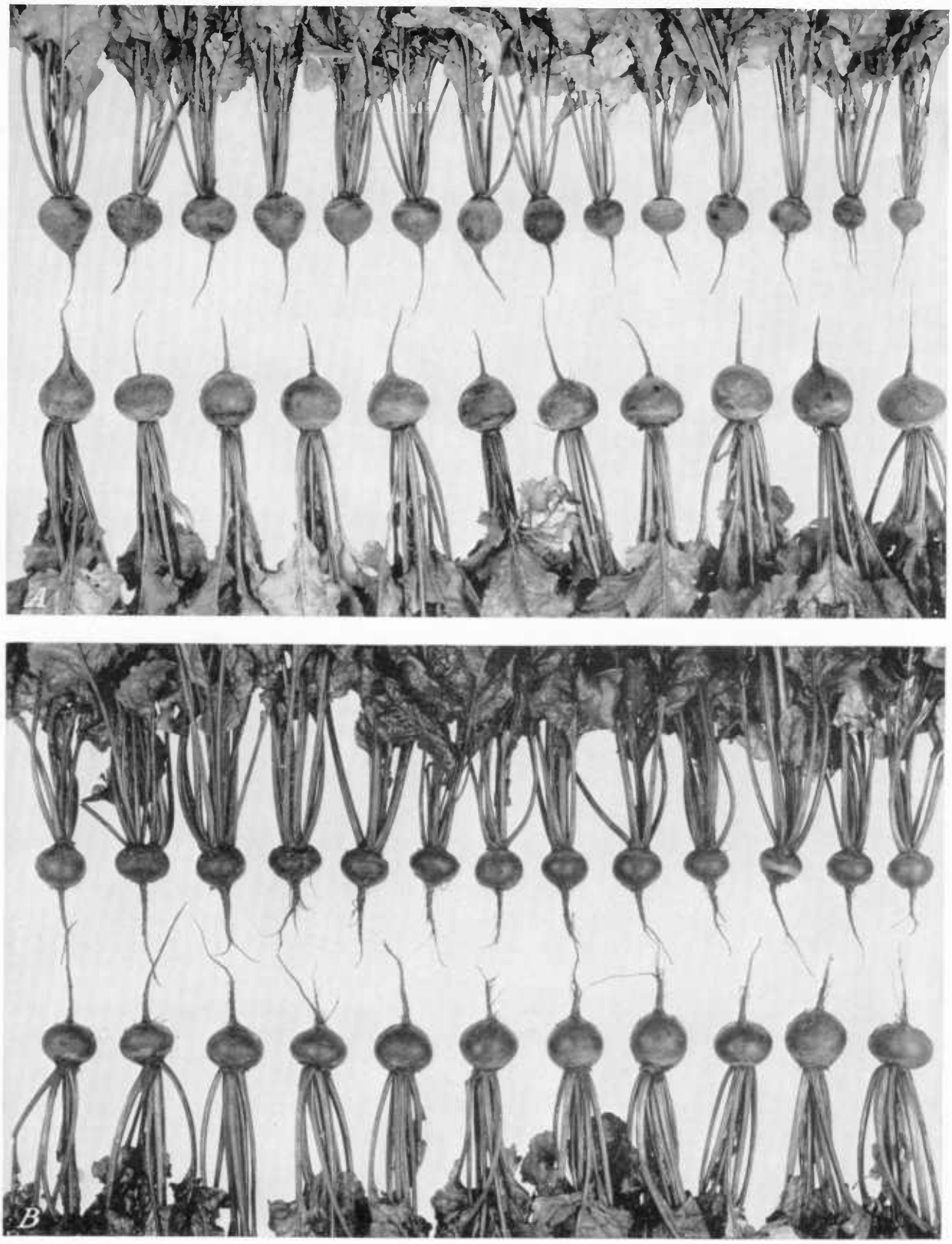
[20] For discussion of the effect of environment on plant characters see p. 5.

EARLY WONDER BEET



Acceptable range in type of Early Wonder beet grown as a spring crop at the Arlington Experiment Farm in (A) *1934 and* (B) *1933.* × ⅛. A *is less mature than* B. *Compare with plate 5.*

EARLY WONDER BEET



Random samples of usable roots of the same strain grown at Beltsville, Md., during 1935, showing heavier foliage and taproots and flatter small roots in the fall-grown crop (B) *than in the late spring crop* (A). × 1/6.5.

DETROIT DARK RED

BRIEF CHARACTERIZATION

The most important and most widely adapted variety; recommended for home use, market garden, shipping, or canning.

Second early or midseason in maturity with medium-size foliage, retaining for a long period its dark-green color; has smooth, round to slightly oval, maroon-red roots with concentric zones of narrow or interrupted light-red and broad dark-red flesh.

ADAPTABILITY AND USE

Grows well on practically all soil types and in all locations. Detroit Dark Red and Morse Detroit comprise the bulk of the crop for canning purposes and are extensively used in home gardens, market gardens, and carlot shipping sections. Detroit Dark Red produces greater tonnage for canning purposes in the Northeastern States than Morse Detroit.

SEASON

Midseason in maturity, the majority of roots reaching 2 inches (5 cm.) diameter in 45 to 60 days from date of seedling emergence from the soil when grown as an early-spring or early-fall crop in the Northern States, and in 65 to 75 days as a late-winter to early-spring crop in the Southern States and California and as a late-fall crop in the Northern States. To reach 2½ to 3 inches (6.3 to 7.6 cm.) in diameter required 60 to 70 days from date of seedling emergence, when grown as an early-spring or early-fall crop in the Northern States, and 80 to 95 days as a late-winter to early-spring crop in the Southern States and California and as a late-fall crop in the Northern States.

PLANT [21]

(Pls. 13 to 19)

Medium size; when roots reach 2½ to 3 inches (6.3 to 7.6 cm.) in diameter the average plant weight ranges from 8.2 to 12.3 ounces (250 to 350 gm.) depending mainly upon amount of foliage; usually 12 to 14 inches (30 to 35 cm.) high, but crops grown during winter in the South and the late-fall crop in the Northern States sometimes attain an average height of only 10 inches (25 cm.); average spread ranges from 16 to 19½ inches (40 to 50 cm.), or 1.25 to 1.7 times as wide as tall.

LEAVES

(Pls. 13, 14, A, 14, B, and 14, C)

Few in number, average between 10 and 15 with seldom less than 8 or more than 18; average weight per plant ranges from 4.5 to 6.1 ounces (125 to 175 gm.) under average conditions; constitute from 40 to 55 percent of total plant weight.

BLADES

Young growth typically light green in color, about Parrot Green (21 L 6), but darkening to Calla Green (22 L 4) and Cedar Green (23 L 5) with increased age; retains green color longer than other varieties (except Morse Detroit), but under unfavorable growth conditions becomes heavily stippled and diffused with reddish purple (54 L 4, 55 H 6, or 56 L 3). Medium size, average length ranges from 6¼ to 7½ inches (16 to 19 cm.); average width ranges from 4½ to 6¼ inches (11 to 16 cm.); length to width ratio varies from 1.3 to 1.6. Ovate to elliptical in shape; rounded to slightly pointed tip; slightly tapered base; midrib slightly to much curved downward; sides of leaf flat or slightly ascending; undulate to wavy or crinkled margin; slightly wavy to crenate, frilled edge; slightly undulate surface in high temperatures, but medium to much bullate during low temperatures; medium size midrib and veins; medium to thick blades.

PETIOLE

Outside or convex surface of petiole light to medium purplish red ranging from 6 A 6 to 6 K 6 with light greenish-yellow (19 I 2) stripes on the bundle ridges; inside or concave surface usually slightly lighter reddish purple with occasional plant with reddish-orange (5 C 11) center and greenish-yellow (12 I 2) edges. Medium length, 5¼ to 7½ inches (13 to 19 cm.) in average length with longest petioles being produced under high temperature and abundant moisture conditions; slightly shorter than blade under high temperatures and much shorter than blade under low temperature conditions; slender, 20 to 30 times as long as wide, three-sixteenths to five-sixteenths of an inch (5 to 8 mm.) in average width at midlength with a slight gradual increase toward the base and a gradual decrease toward the blade; slightly thicker than wide. Majority slightly spreading, held at an angle of 50° to 75° with the horizontal.

[21] For discussion of the effect of environment on plant characters see p. 5.

NECK

Average diameter at the base of adherent turgid petioles (neck) varies from 1 to 1⅜ inches (2.5 to 3.5 cm.).

ROOT

(Pls. 1, 13, 15 to 20)

Grows with one-half to two-thirds of the root above ground when mature; when three-fourths to 1 inch (1.9 to 2.5 cm.) in diameter the roots are long top or ovate in shape, but as they increase in diameter the lower half fills out, and the roots become more oval or round; when the roots are 2½ to 3 inches (6.3 to 7.6 cm.) in diameter, the shape is nearly round to slightly oval, the average depth varies from 2⅜ to 3⅛ inches (6 to 8 cm.) with a diameter to depth ratio of 0.90 to 1.06; shoulders round to slightly sloping; base rounded to slightly tapered; taproot small to medium in size; side roots few and fibrous and limited to lower one-third of root in two very shallow furrows on opposite sides of the root; average weight (2½ to 3 inches in diameter) ranges from 5.3 to 8.8 ounces (150 to 250 gm.); 45 to 60 percent of total plant weight.

Skin of young roots usually purplish red (6 L 6) above ground when moist, but as the corky area around the shoulder develops it becomes orange red to orange tan (6 L 10 to 14 K 8). At the ground line and beneath on marketable-size roots the moist-skin color varies from dark-purplish red to maroon red (6 L 6 to 7 L 6) and darker.

In cross section the root is approximately circular in outline; usually 10 to 14 easily distinguished zones of lighter and darker color; in the spring-grown crop the lighter zones are usually narrower than the darker and indistinct or interrupted in character, whereas in the fall crop the lighter zones are very narrow and are interrupted in character or very indistinct.

The freshly cut flesh color of spring-grown crops is alternately zoned with purplish pink (3 F 4) and various shades of purplish red (4 L 6, 5 L 6, and 6 L 6). In the fall-grown crop or when more uniformly colored roots are produced, the lightest zone becomes 6 L 7 to 6 L 9 and the darkest 7 L 4 to 7 L 6.

SYNONYMS

Detroit, Detroit Blood, Detroit Blood Red, Detroit Blood Turnip, Detroit Dark Blood Turnip, Detroit Dark Red Blood, Detroit Dark Red Blood Turnip, Detroit Dark Red Turnip, Detroit Early Dark Red, Detroit Early Dark Red Turnip, Detroit Red, Detroit Red Turnip, Early Detroit, Extra Early Detroit Dark Red, Improved Detroit Dark Red.

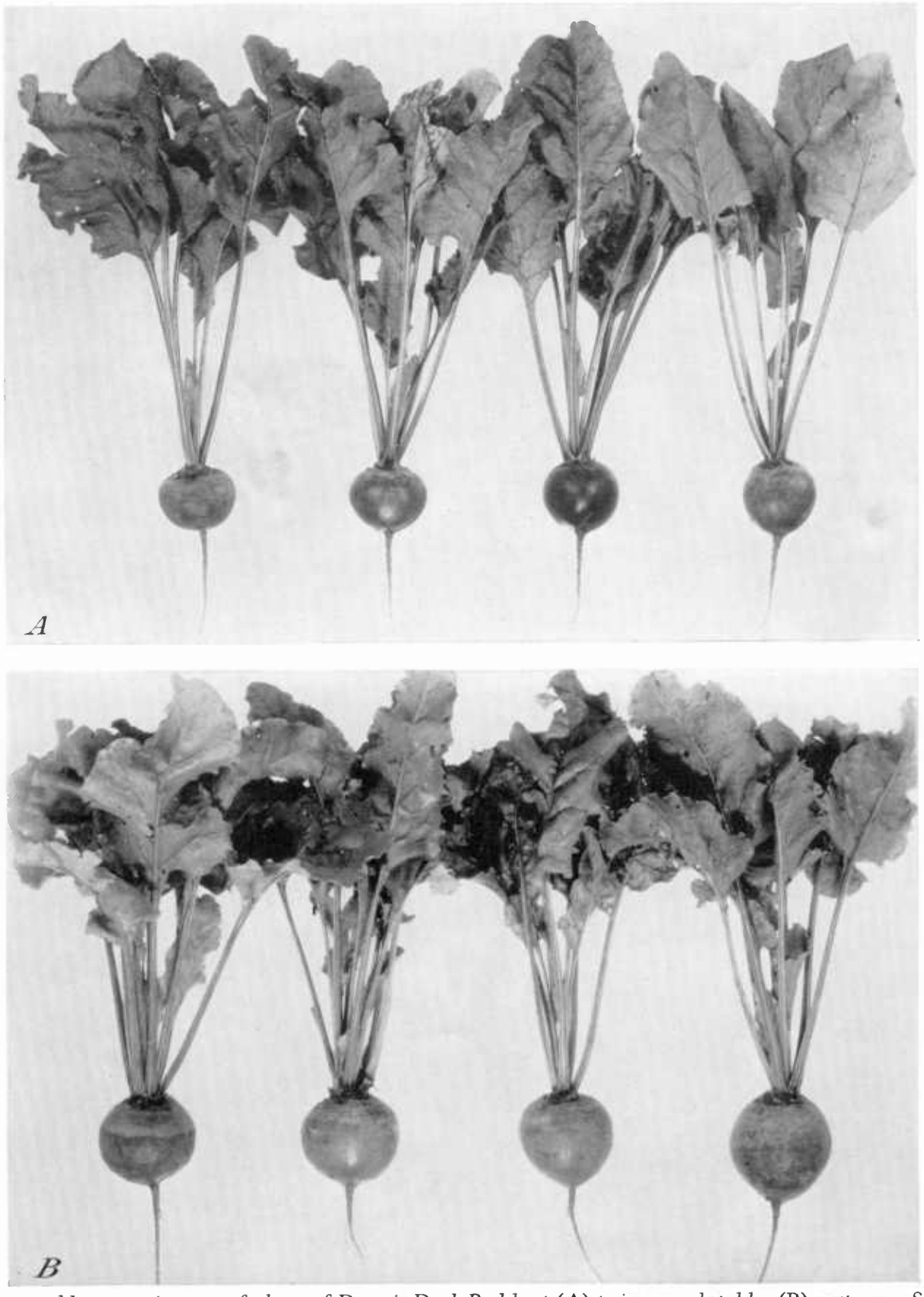
SIMILAR VARIETY

Good for All has the same skin and flesh color and root shape as Detroit Dark Red but is much smaller in all respects; the leaves are narrower and smoother, and the flesh has less zoning.

HISTORY

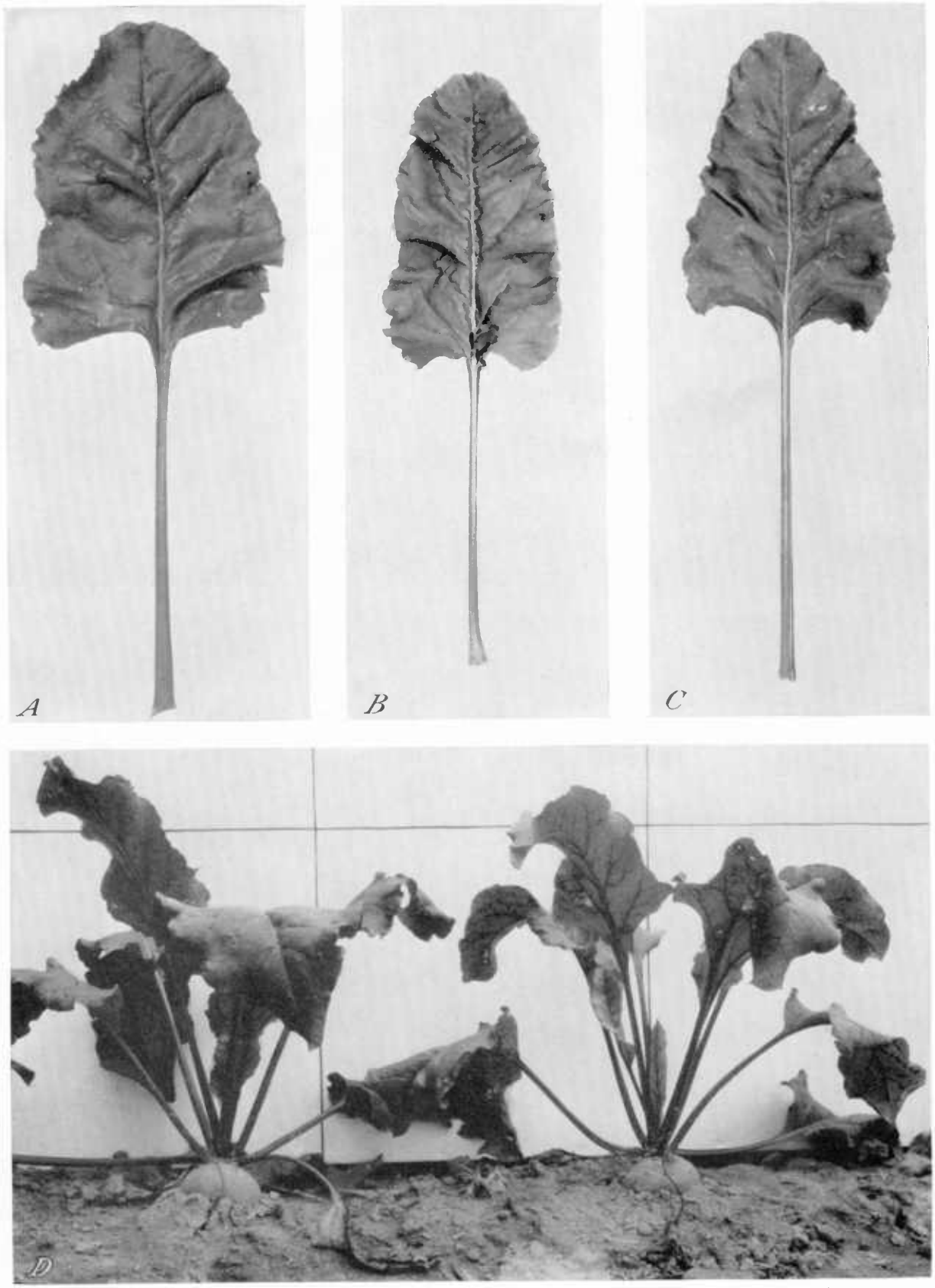
The original selections from Early Blood Turnip were made by a Mr. Reeves, Port Hope, Ontario, Canada. Further selections and improvements were made by D. M. Ferry & Co., who first listed it in their 1892 catalog as Detroit Dark Red Turnip beet.

DETROIT DARK RED BEET



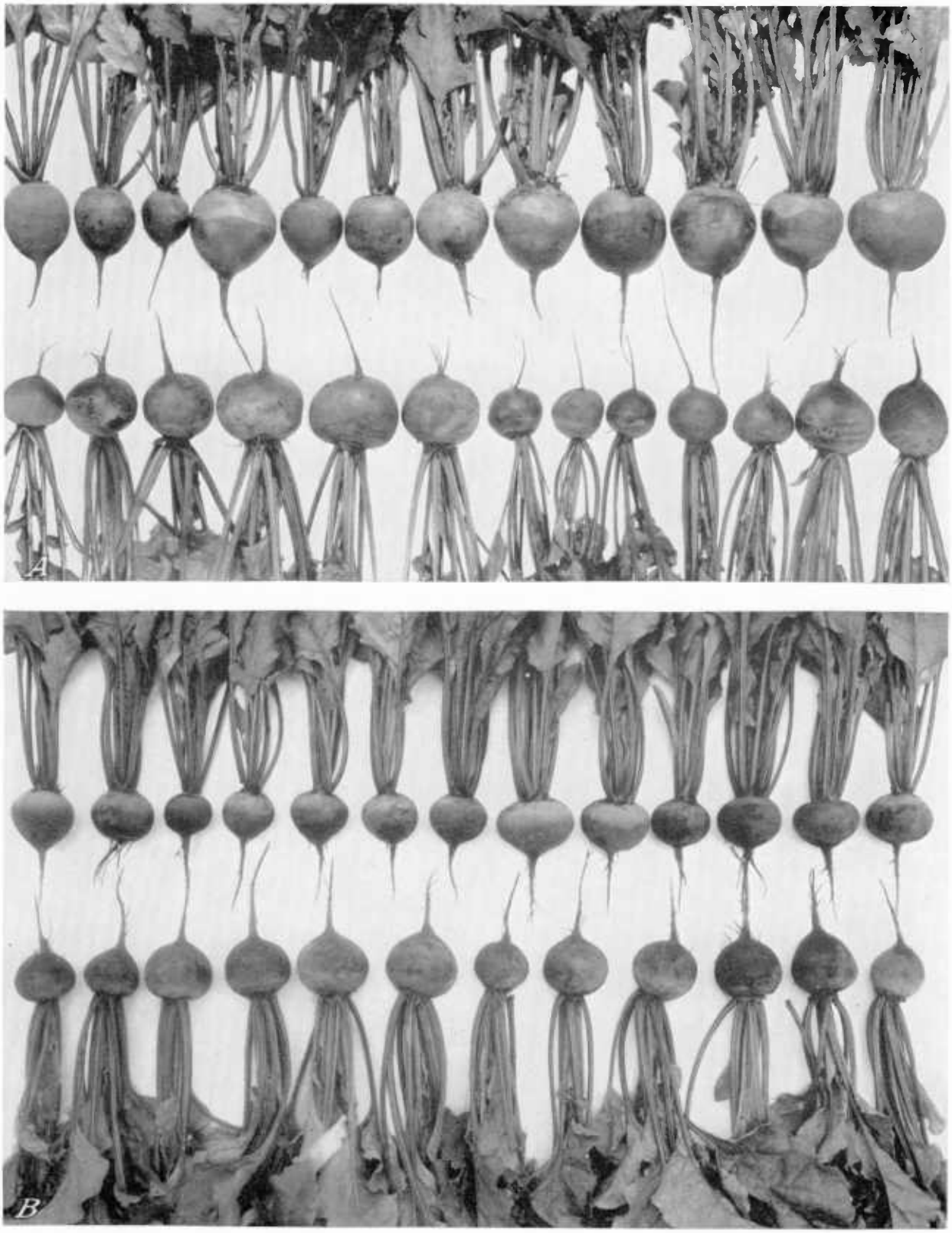
Acceptable range in type of plant of Detroit Dark Red beet (A) *prime marketable*; (B) *mature. Spring-grown at the Arlington Experiment Farm.* × ⅛.

DETROIT DARK RED BEET



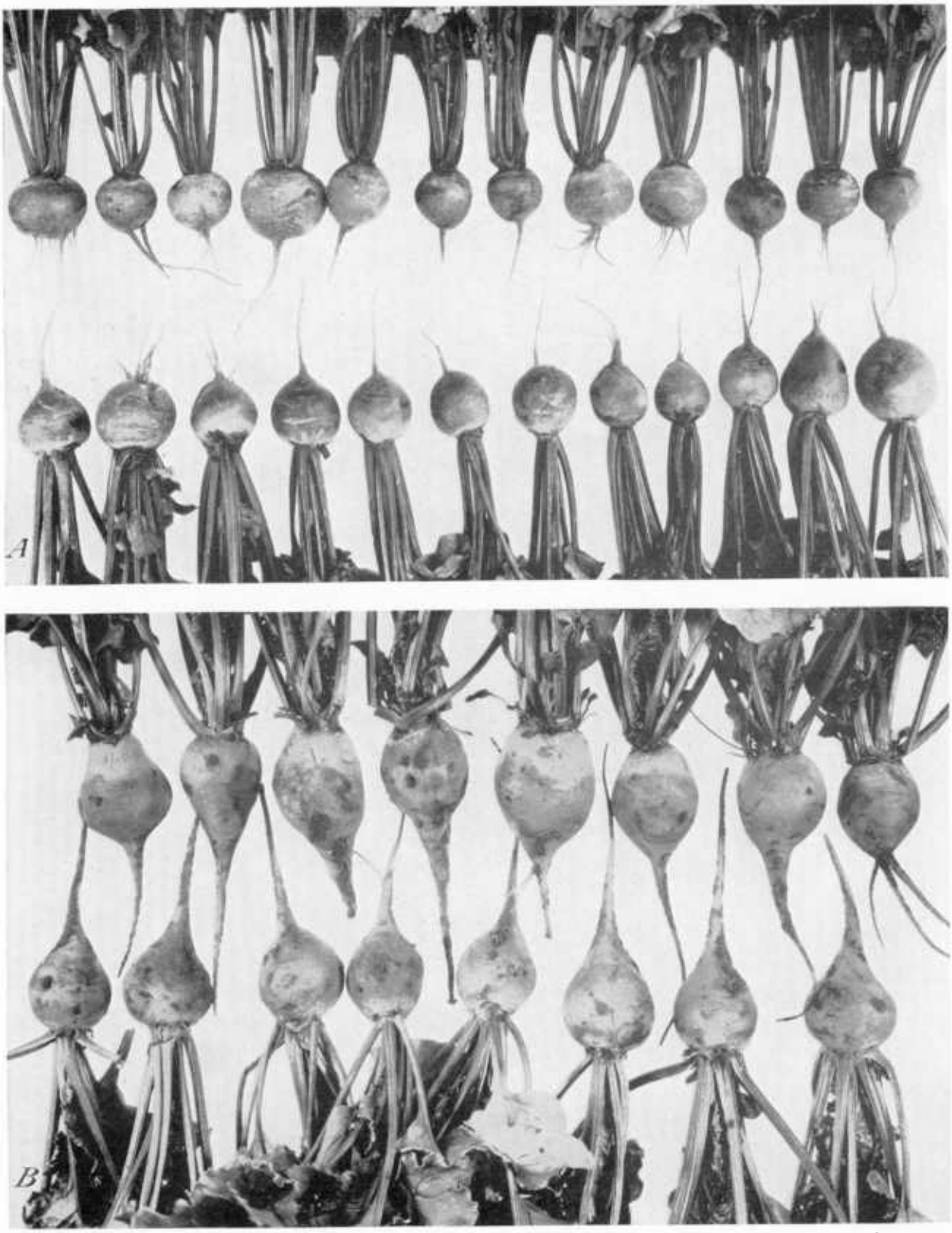
Representative leaves of Detroit Dark Red beet, showing variation in size and shape of spring crops (A) *1932,* (B) *1933, and* (C) *1934. D illustrates habit of growth of mature full-grown plants; cross lines on background are 1 foot apart. All grown at the Arlington Experiment Farm. Compare with plate 22,* D.

DETROIT DARK RED BEET



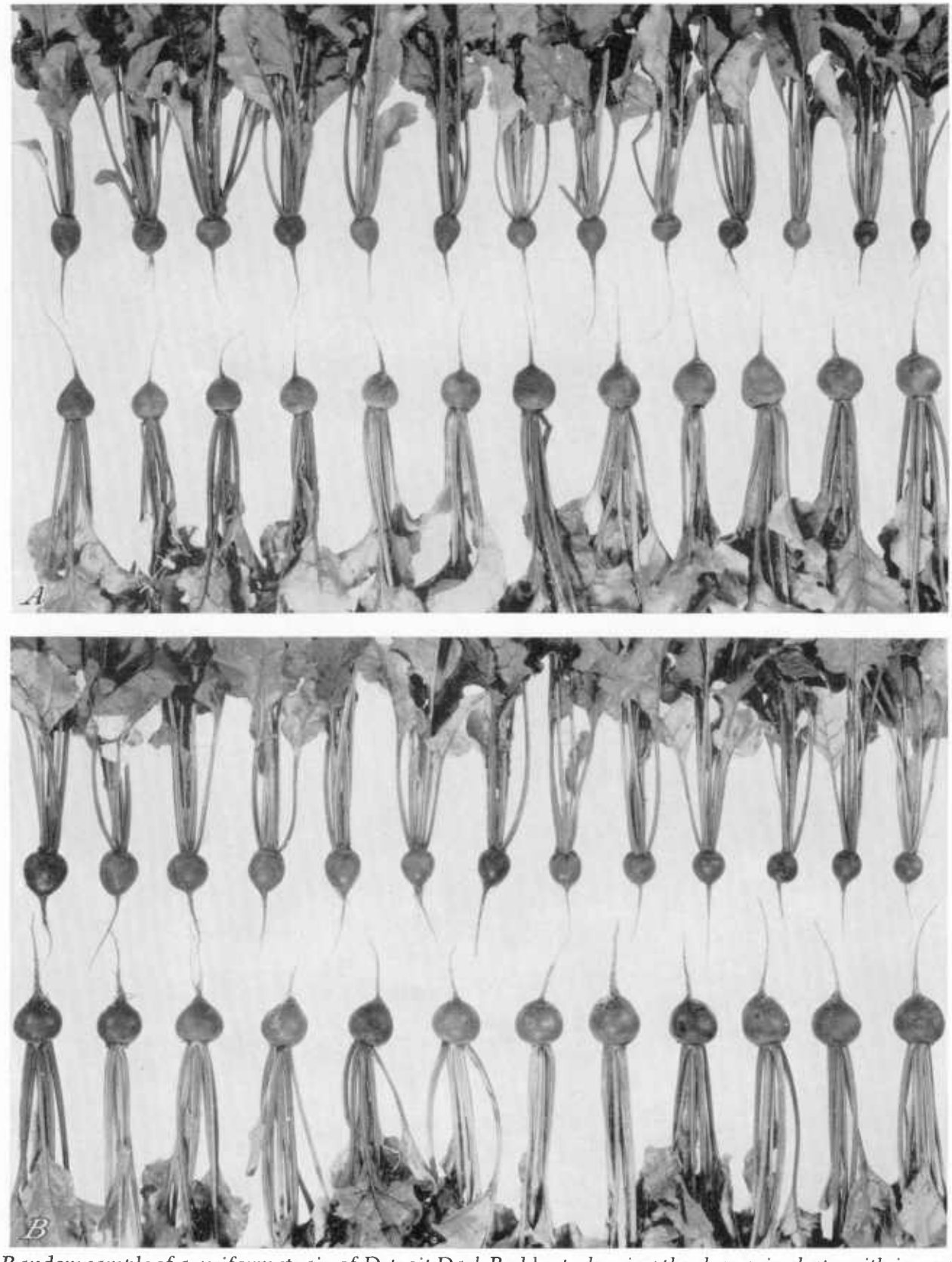
Random sample of marketable roots of uniform strain of Detroit Dark Red beet grown in spring of 1933 at (A) *the Arlington Experiment Farm, and* (B) *Norfolk, Va.* × 1/6.5. *Compare with plate 16.*

DETROIT DARK RED BEET



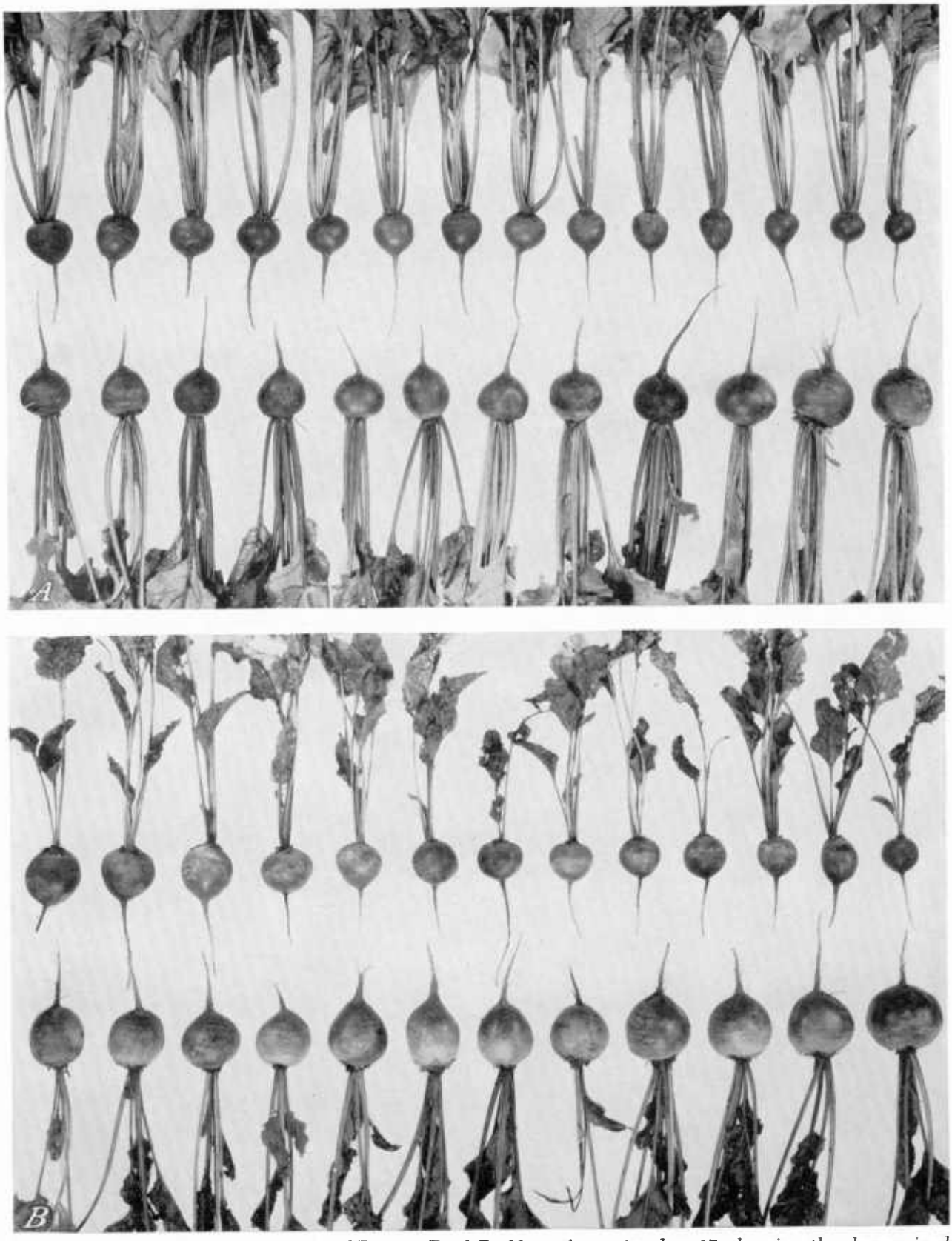
Random sample of marketable roots of same strain of Detroit Dark Red beet shown in plate 15 grown in spring of 1933 at (A) *Baton Rouge, La.,* (× ⅛) *and* (B) *Davis, Calif.* (× ¼). *Note heavy taproots and tapering bases and crowns of California-grown roots, grown under unfavorable conditions.* *See page 8 for explanation.*

DETROIT DARK RED BEET



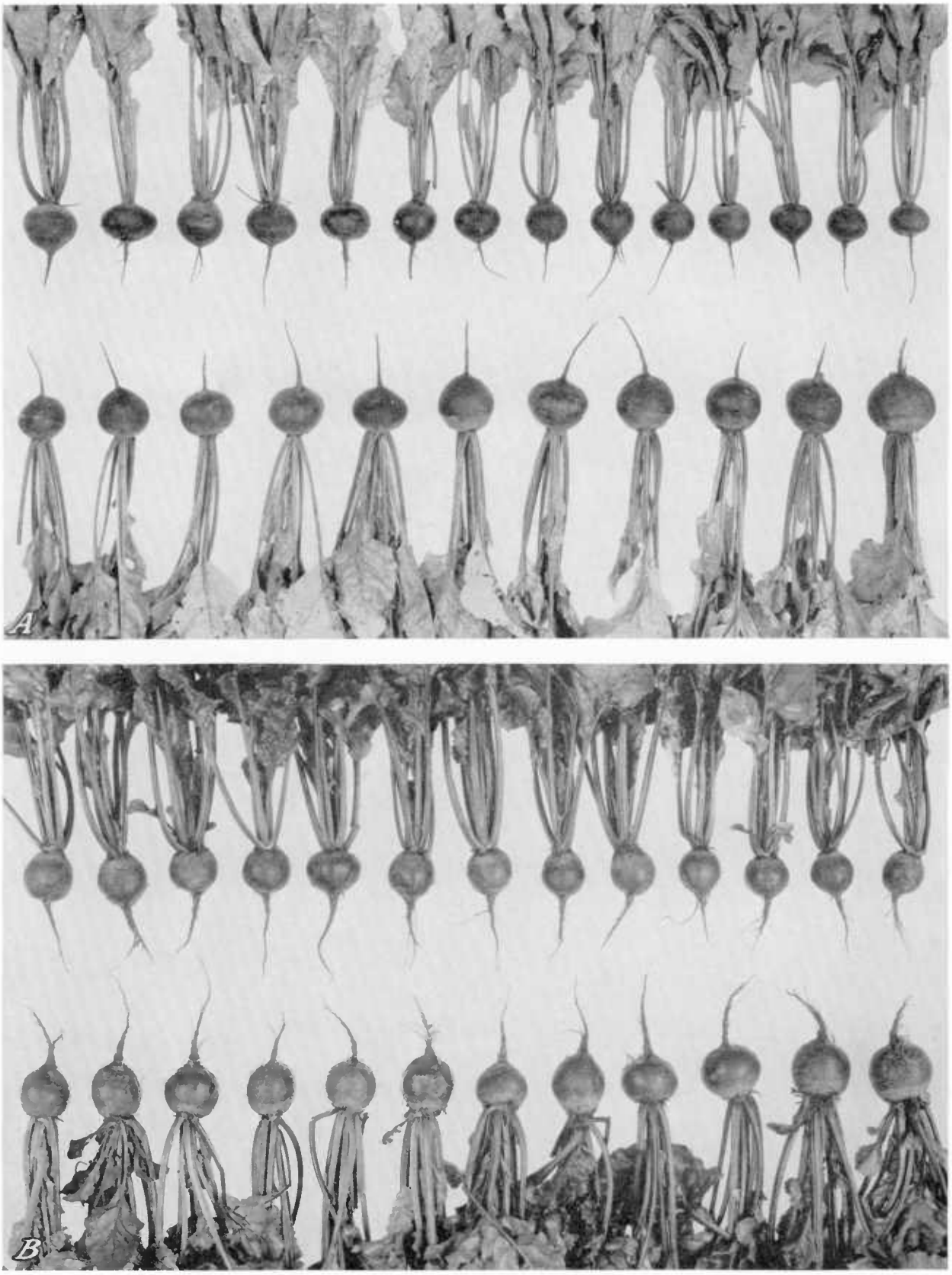
Random sample of a uniform strain of Detroit Dark Red beet, showing the change in shape with increase in diameter and age. × 1/6.5. *A was pulled June 15 and B June 19. Compare with plate 18. Note more oval shape of small roots than in plates 23 and 24.*

DETROIT DARK RED BEET



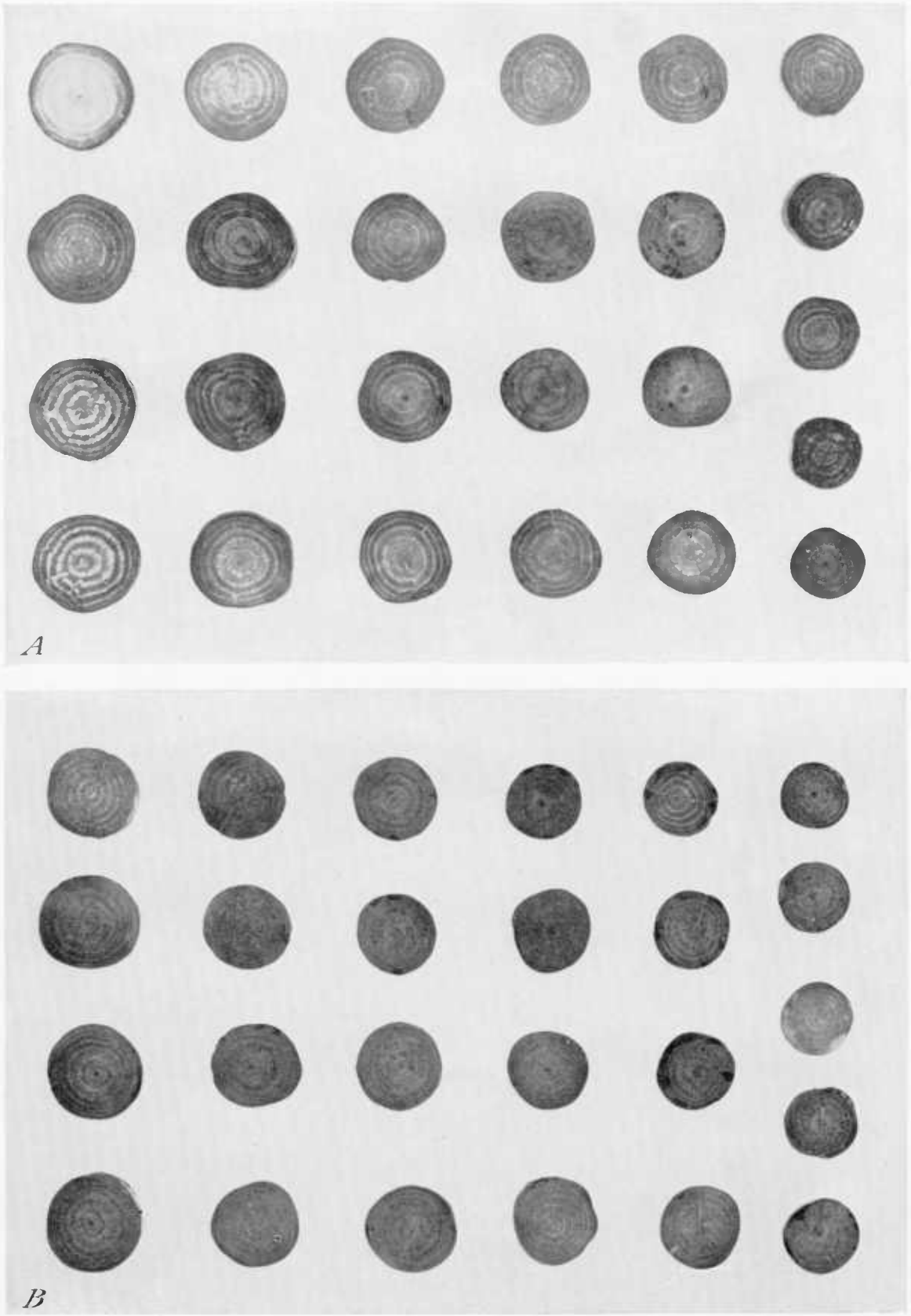
Random sample of the same strain of Detroit Dark Red beet shown in plate 17, showing the change in shape with increase in diameter and age. × 1/6.5. *A was pulled June 22 and B July 16.*

DETROIT DARK RED BEET



Random samples of usable roots of the same strain of Detroit Dark Red beet as shown in plates 15 and 16 grown at Beltsville, Md., in 1935, showing heavier taproots and foliage and more oval shape of roots of fall-grown (B) *than of late spring-grown* (A).

DETROIT DARK RED BEET



Cross sections that show the difference in quantities of white or light-colored flesh and depth of color in dark zones of a uniform strain of Detroit Dark Red beet, grown in spring and fall. Harvested (A) July 23, 1935, and (B), November 14, 1935, at Beltsville, Md. × ¼. Compare with plate 26.

MORSE DETROIT

BRIEF CHARACTERIZATION

A strain of Detroit Dark Red that has smaller foliage, flatter roots, darker purplish-red skin, with slightly more purple in the colored flesh.

ADAPTABILITY AND USE

The roots attain a nearly round shape at a smaller diameter than Detroit Dark Red and are, therefore, preferred for canning whole. They do not attain as large size (therefore not as large tonnage per acre) in the Northeastern States as Detroit Dark Red and are not as valuable for the production of diced or sliced canned beets. In bunched-beet shipping sections where small foliage and small round roots are desired, Morse Detroit is especially valuable.

SEASON

Requires the same number of days to reach the 2- and 3-inch diameters as Detroit Dark Red, but does not increase as rapidly beyond 3 inches and does not attain as large size.

PLANT [22]

(Pls. 21, 22, *D*, and 23 to 25)

Small to medium in size, from 1 to 3 inches shorter, more spreading in habit, and slightly smaller in weight than Detroit Dark Red.

LEAVES

(Pls. 21, *A*, 22, *B*, and 22, *C*)

Usually one to three more leaves per plant at 2½ to 3 inches in diameter, but 15 to 25 percent less in weight and a slightly greater percentage of the total plant weight than Detroit Dark Red.

BLADES

Same color, slightly shorter, relatively narrower, more pointed tip, more ascending sides, more frilled edge, and more bullate surface than Detroit Dark Red.

PETIOLE

Same color on convex side as Detroit Dark Red, but concave side does not have orange-red channels sometimes found in that variety. Same shape, but one-half to 1 inch shorter.

[22] For discussion of the effect of environment on plant characters see p. 5.

NECK

Fifteen to 25 percent smaller than Detroit Dark Red.

ROOT

(Pls. 1, 23 to 26)

Grows with one-fourth to one-third of the root above ground when mature; when three-fourths to 1 inch (1.9 to 2.5 cm.) in diameter, the roots are short top or nearly round in shape; but as they increase in diameter they become round and then slightly oblate; when they are 2½ to 3 inches (6.3 to 7.6 cm.) in diameter, the average depth ranges from 2¼ to 2¾ inches (5.5 to 6.8 cm.) with a diameter-to-depth ratio of 1.00 to 1.35; shoulder square to slightly rounded; base slightly rounded to slightly tapered; taproot small in size; side roots few and fibrous and limited to lower one-fourth of root from two shallow furrows on opposite sides of root; average weight (2½ to 3 inches in diameter) ranges from 6.3 to 7 ounces (180 to 200 gm.); 50 to 60 percent of total plant weight.

The above- and below-ground moist-skin color is the same as Flat Egyptian, i. e., slightly darker purple than Detroit Dark Red.

Lighter-colored zones in the spring- and fall-grown crops, narrow and of interrupted type, but more definite because of color contrast than in Detroit Dark Red.

The freshly cut flesh color of spring-grown crop is alternately zoned with pinkish purple (41 E 3) and various shades of reddish purple (4 K 6, 5 K 6, and 6 K 6). In the fall-grown crop or when more uniformly colored roots are produced, the lightest zone becomes 4 K 6 and the darkest 7 H 4 to 7 H 6, being slightly more purple than Detroit Dark Red.

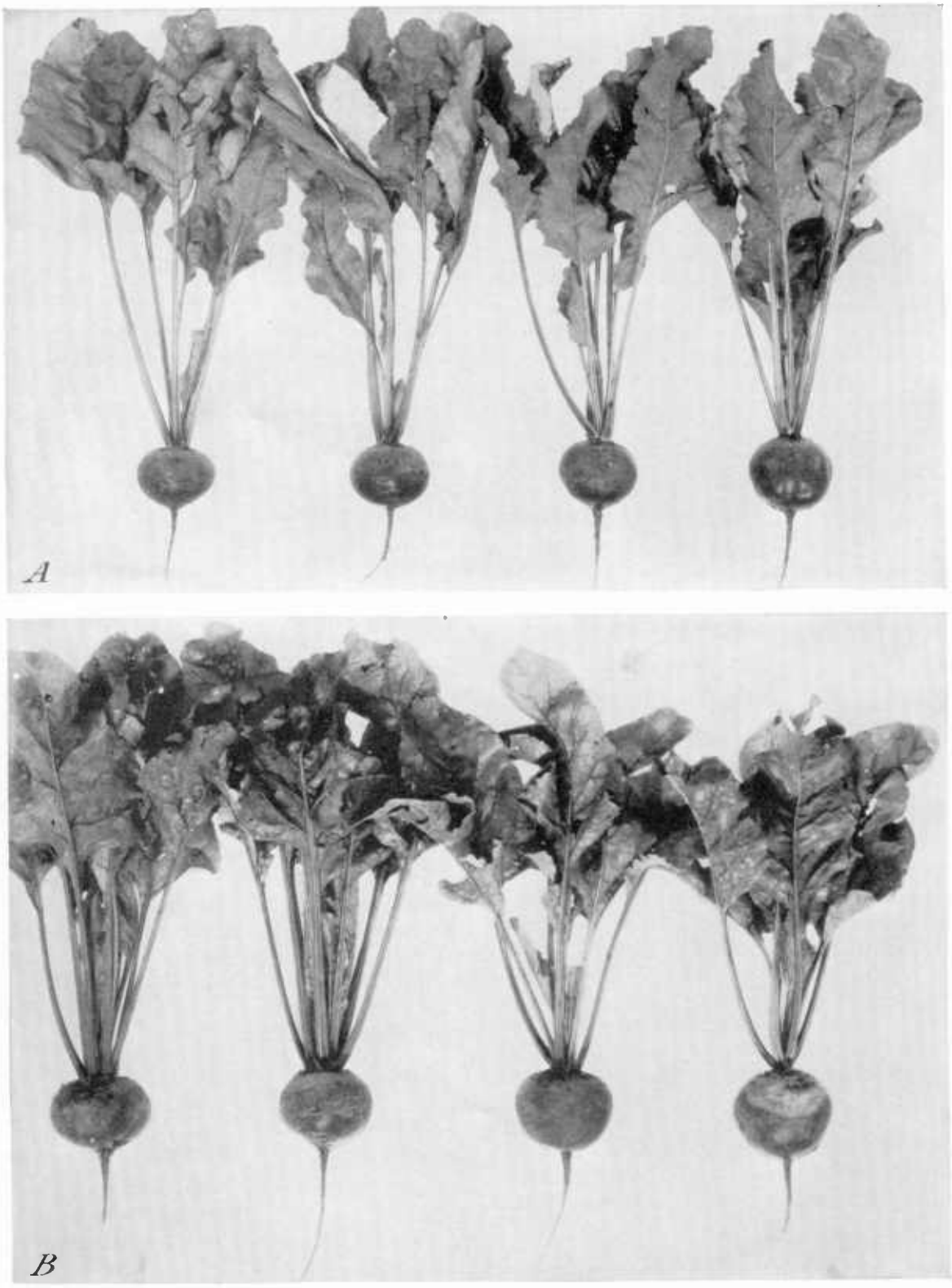
SYNONYMS

Improved Detroit; Short Top Detroit.

HISTORY

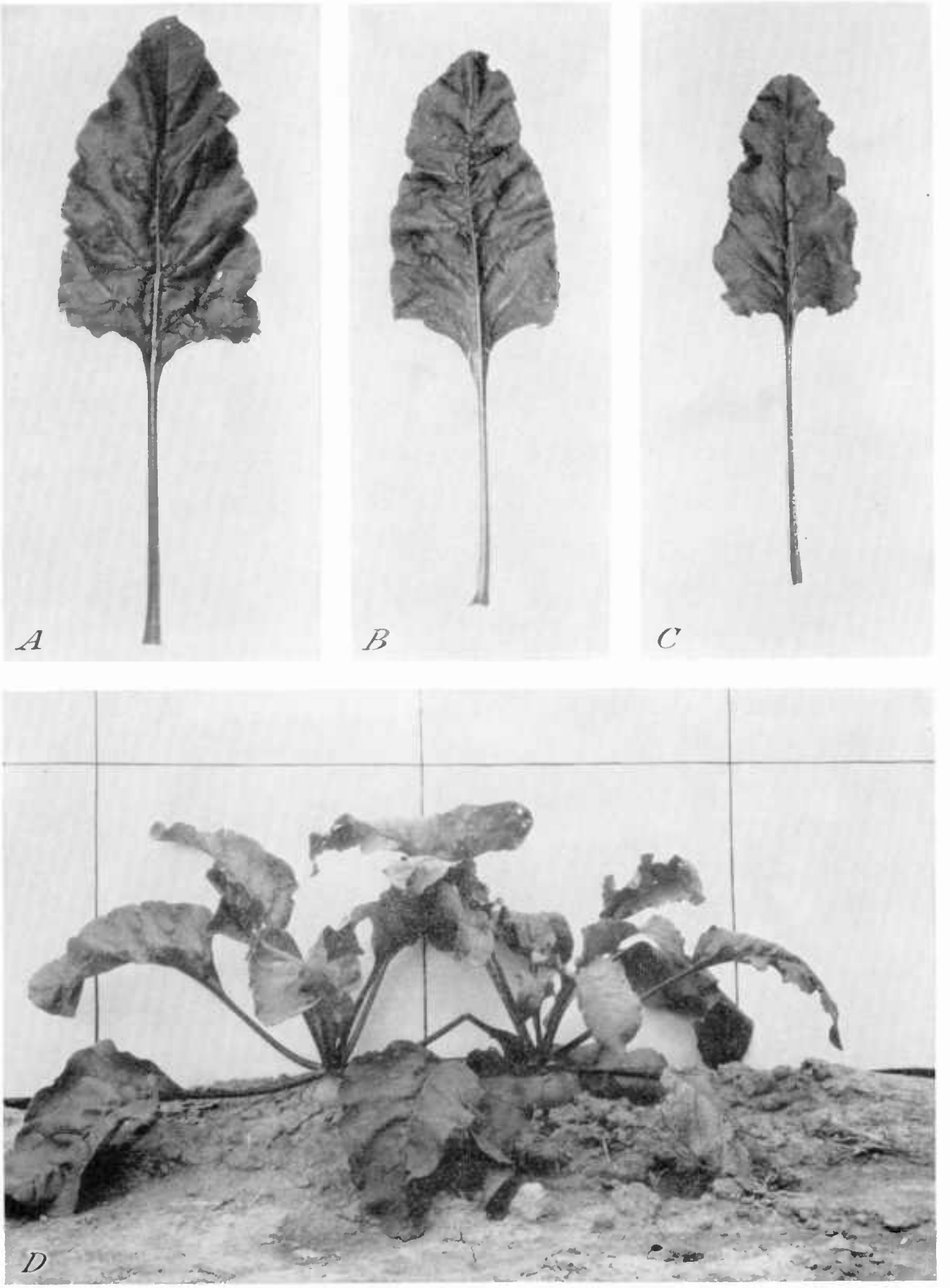
First offered for sale in the 1928 Contract Price List of C. C. Morse & Co. as Morse's Improved Detroit. Is the result of inbreeding and selection from Detroit Dark Red.

MORSE DETROIT BEET



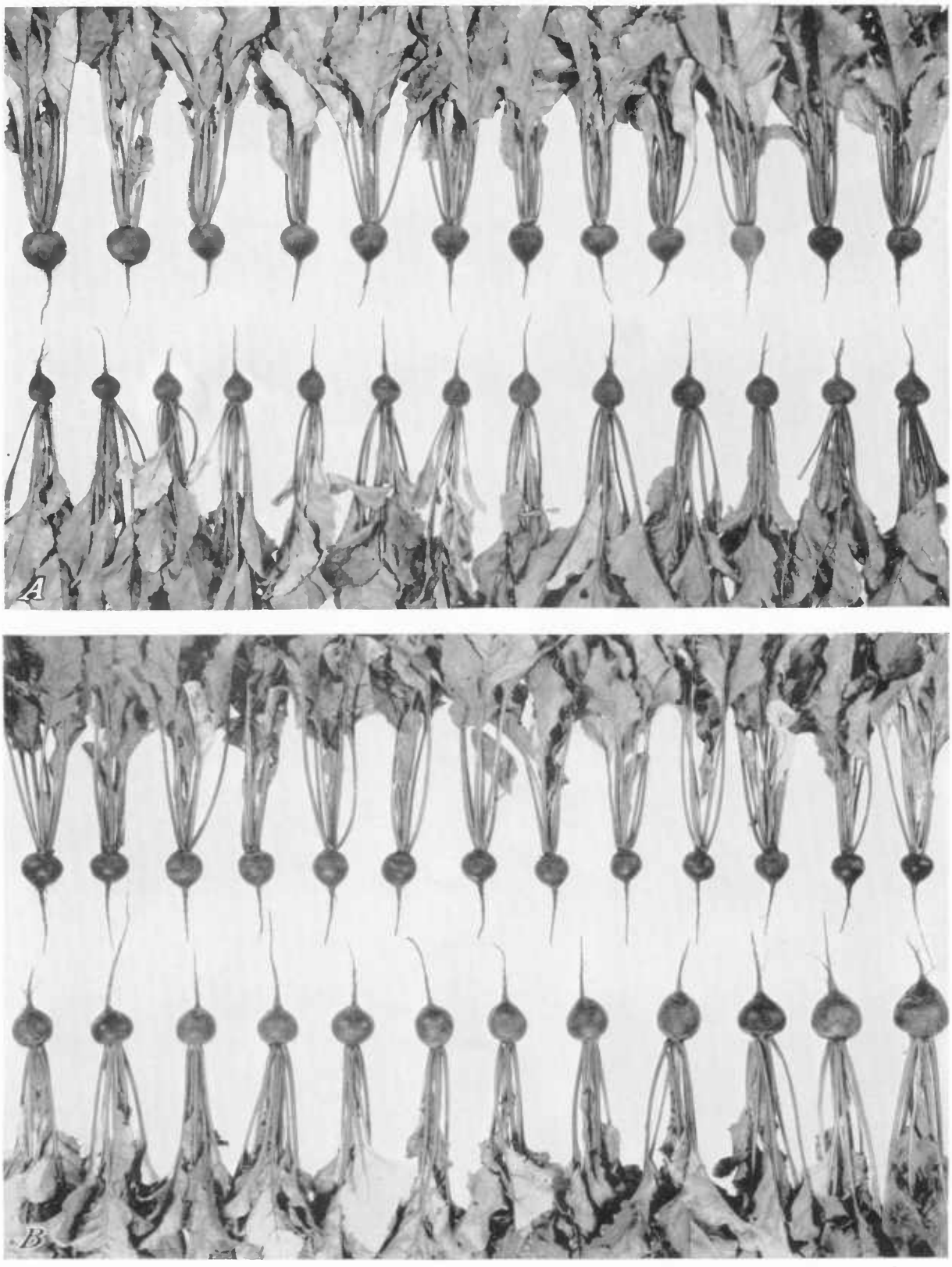
Acceptable range in type of plant of Morse Detroit beet (A) *prime marketable* (B) *mature.* × ⅓. *Spring-grown at the Arlington Experiment Farm.*

MORSE DETROIT BEET



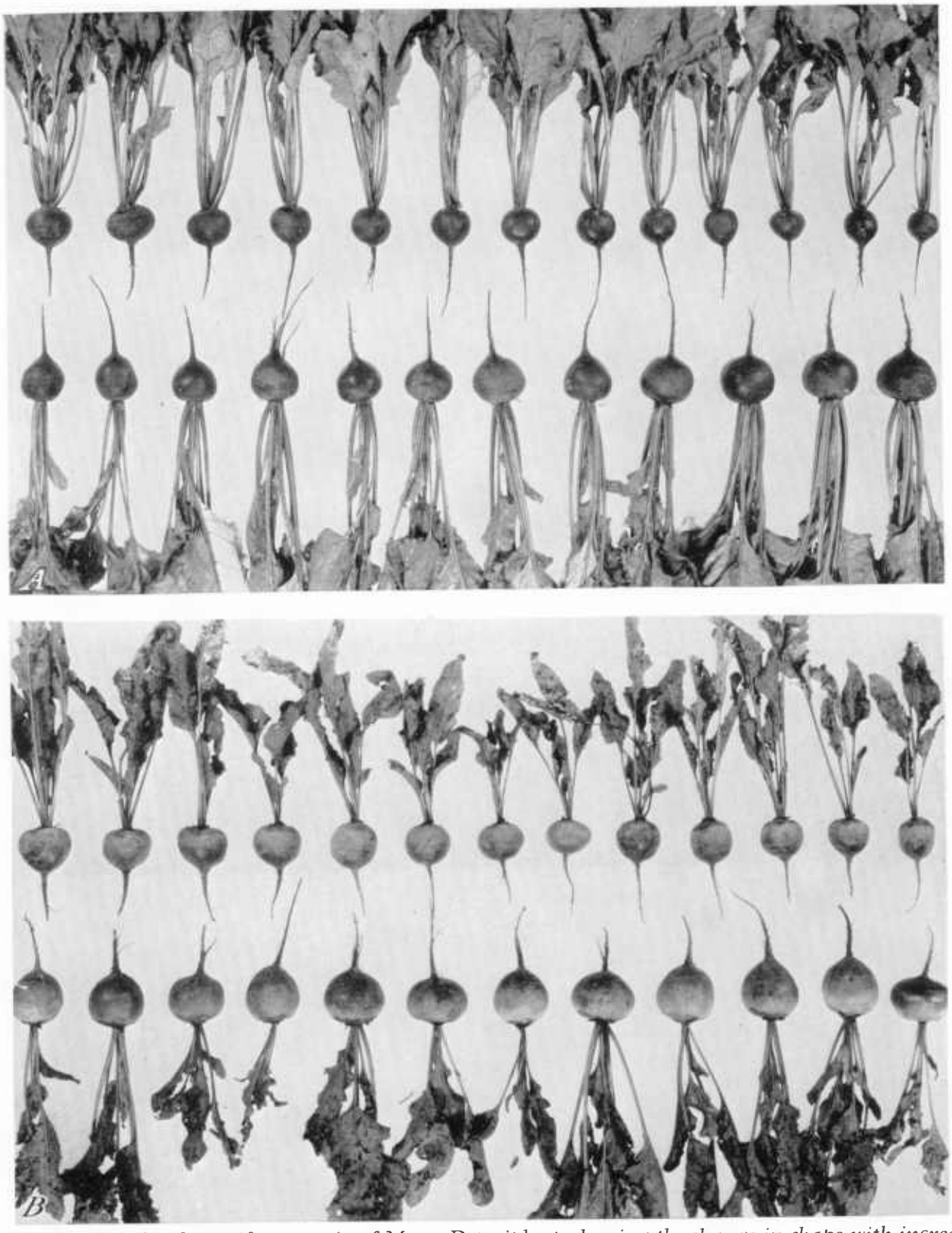
Representative leaves of Morse Detroit beet, showing variation in size and shape of spring crops (A) *of 1932,* (B) *of 1933,* (C) *of 1934, grown at the Arlington Experiment Farm.* D, *Habit of mature plants in the field at Arlington farm in the fall; cross lines on background are 1 foot apart. Compare with plate 14,* D.

MORSE DETROIT BEET



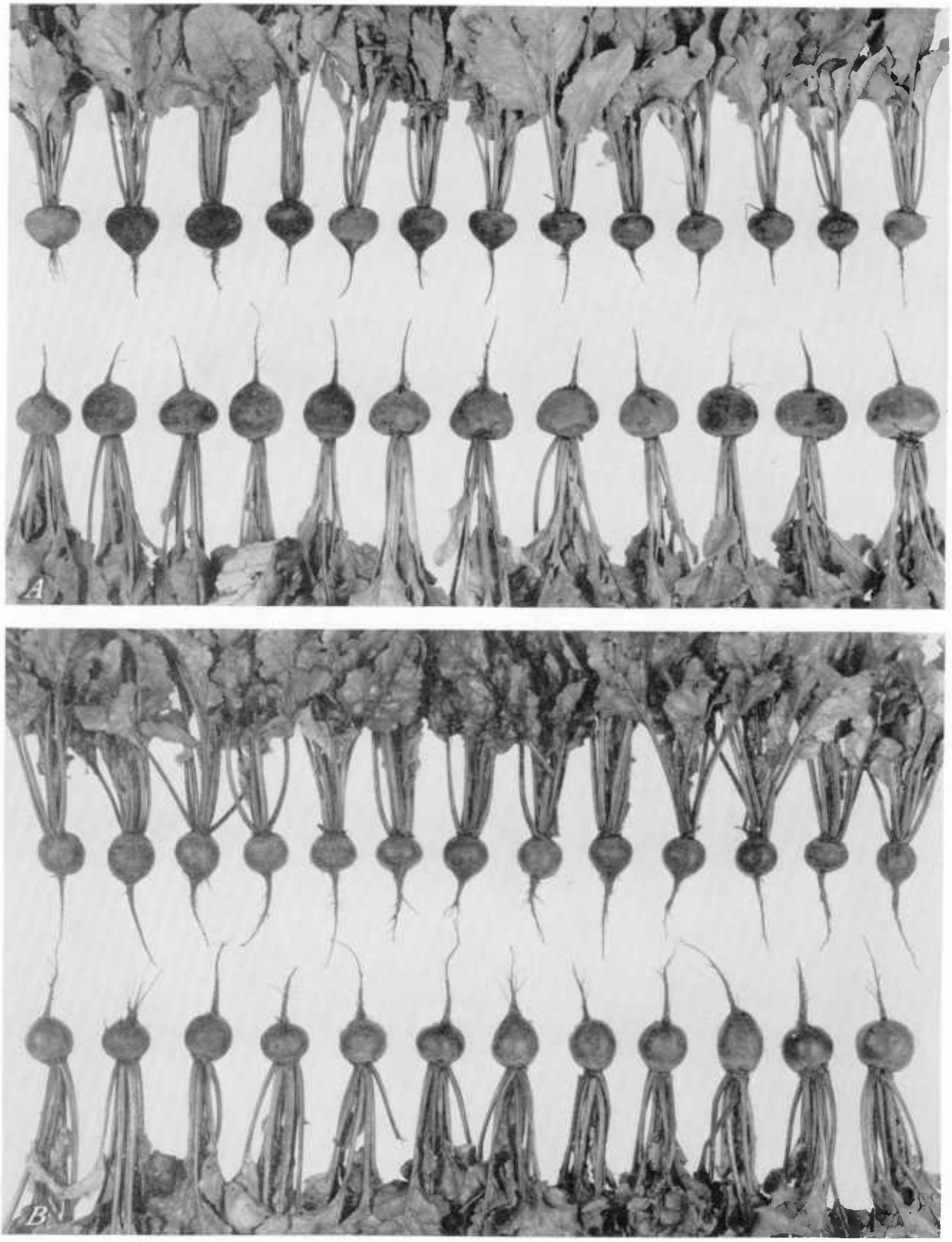
Random sample of a uniform strain of Morse Detroit beet, showing the change in shape with increase in diameter and age: A, Pulled June 15; B, June 19. × 1/6.5. Compare with plate 24. Note the rounder shape of the smaller young roots as compared with plates 17 and 18.

MORSE DETROIT BEET



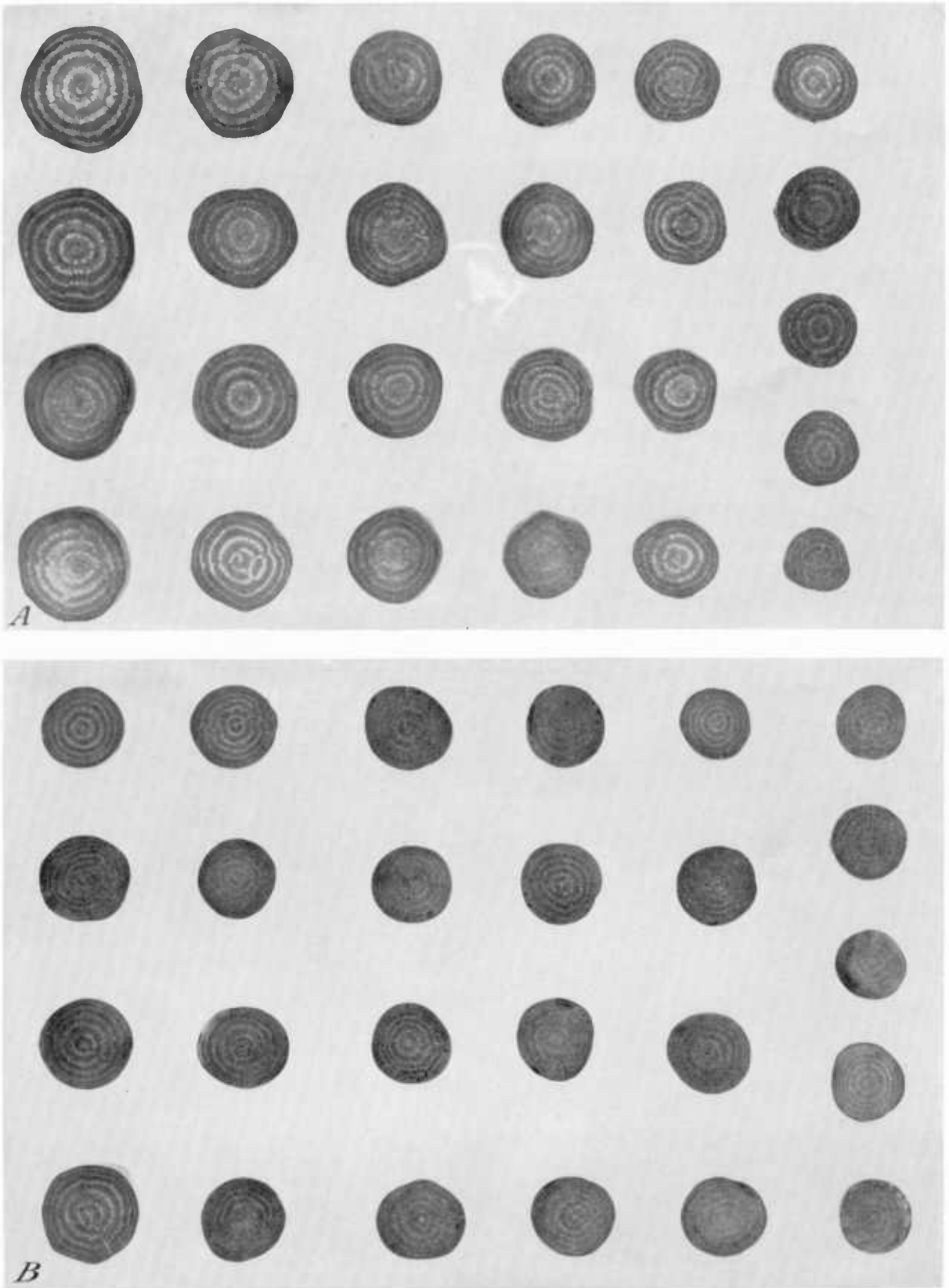
Random sample of a uniform strain of Morse Detroit beet, showing the change in shape with increase in diameter and age: A, Pulled June 22; B, July 16. × ⅛.5. Compare with plate 23. Note the more oblate form of the older roots as compared with plate 18.

MORSE DETROIT BEET



Random samples of usable roots of Morse Detroit beet grown at Beltsville, Md., in 1935, showing heavier taproots and foliage and rounder crowns or shoulders on fall-grown (B) *than on late spring-grown* (A) *roots.* × 1/6.5.

MORSE DETROIT BEET



Cross sections that show the difference in quantities of white or light-colored flesh and depth of color in dark zones of a uniform strain of Morse Detroit beet harvested (A) *July 23, 1935, and* (B) *November 14, 1935, at Beltsville, Md.* × ¼. *Compare with plate 20 and note the more definite lighter zones in this plate.*

OHIO CANNER

BRIEF CHARACTERIZATION

Especially valuable for canning because of its uniformly dark-red colored flesh.

Midseason to late in maturity, with medium size, erect foliage, and short top to deep oblate-shaped roots with purplish-red skins and almost solidly colored dark-red flesh.

ADAPTABILITY AND USE

Ohio Canner is primarily a variety for canning, although it is also useful for home and market gardens. Its uniformly dark-red flesh color is responsible for its increased use by the canning industry. It grows more slowly than Detroit Dark Red and is more susceptible to cercospora leaf spot.

SEASON

Requires from 5 to 10 days longer than Detroit Dark Red to reach the same diameter.

PLANT [23]

Medium-sized plant, only slightly shorter and smaller than Detroit Dark Red when roots are of the same diameter; slightly more erect in habit.

LEAVES

Usually two to three more leaves per plant, 15 to 20 percent less in weight and a slightly greater percentage of the total plant weight than Detroit Dark Red.

BLADES

Broader, more oval blade than Detroit Dark Red. More of the older leaves turn red at an earlier date than in either Detroit Dark Red or Morse Detroit.

PETIOLE

Same shape and color as Morse Detroit, but slightly shorter.

[23] For discussion of the effect of environment on plant characters see p. 5.

NECK

Usually slightly larger than Detroit Dark Red.

ROOT

(Pl. 27)

When small the roots are top-shaped, but when mature should be deep oblate to round with medium-size taproot.

The above- and below-ground moist-skin color is the same as that of Morse Detroit.

Has less light-colored flesh in the interrupted zones than either Detroit Dark Red or Morse Detroit; same color but more intense than that in Detroit Dark Red.

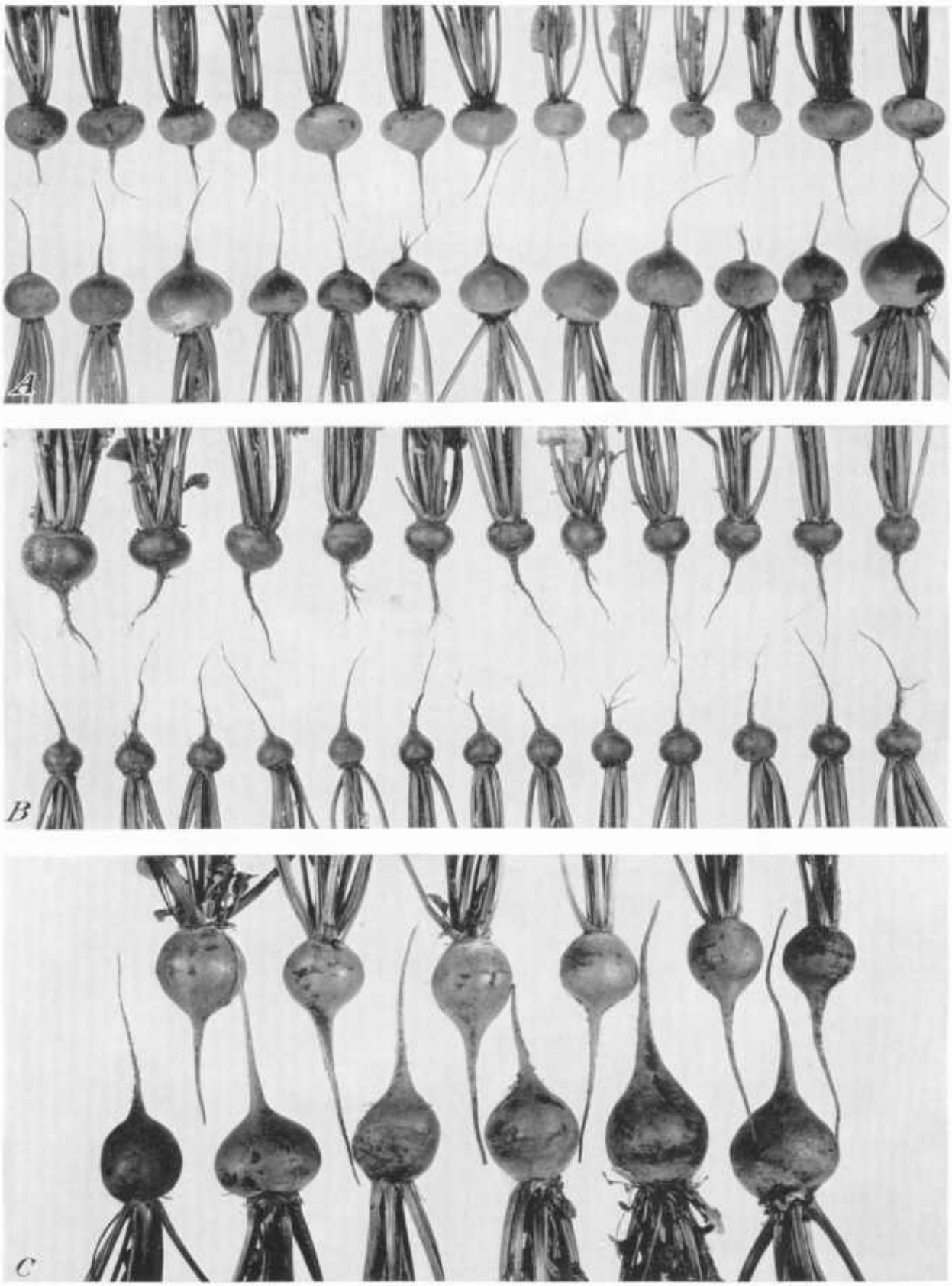
SIMILAR VARIETY

Perfected Detroit has the same skin, flesh, and foliage colors as Ohio Canner, but the neck and foliage are larger and the root faster growing and deeper (more nearly round) in shape with slightly more distinct zoning. As compared with Detroit Dark Red, it has a larger neck and foliage with darker skin, less marked zoning, and shorter or more nearly round roots.

HISTORY

The Ohio Canner variety of table beet was bred at the Ohio Agricultural Experiment Station and was first described in the 1932 January–February Bimonthly Bulletin of that station. It was listed in numerous seed catalogs in 1934.

OHIO CANNER BEET



Random sample of roots of same strain of Ohio Canner beet grown (A) *in spring and* (B) *in fall at the Arlington Experiment Farm* ($\times$ $\frac{1}{6.5}$); (C) *in spring of 1933 at Davis, Calif.* ($\times$ $\frac{1}{4}$). *Note the rounder crowns and heavier taproots in the Arlington farm fall-grown and in the California crop, grown under unfavorable conditions.*

LONG DARK BLOOD

BRIEF CHARACTERIZATION

Requires a deep, sandy loam soil for best results and is used mainly in home gardens. Late maturing, with tall, dark-red foliage and long, slender, fairly smooth, dark purplish-red roots that grow partly above ground; concentric zones of narrow white or light-red and broad dark-red flesh.

ADAPTABILITY AND USE

Still grown to a limited extent on Long Island for the New York City markets and in a few home gardens. Requires a deep, sandy loam soil, a regular supply of moisture, and a long growing season for the production of long, smooth, slender roots.

SEASON

Midseason to late in maturity, the majority of roots reaching 1½ inches (3.7 cm.) in 50 to 70 days from date of emergence of seedlings from soil when grown as an early-spring or early-fall crop in the Northern States, and in 70 to 90 days as a late-winter to early-spring crop in the Southern States and California. To reach 2 to 2½ inches (5 to 6.3 cm.) in diameter required 60 to 80 days from date of seedling emergence when grown as an early-spring or early-fall crop in the Northern States, and 80 to 100 days as a late-winter to early-spring crop in the Southern States and California and as a late-fall crop in the Northern States.

PLANT [24]

Large; when roots reach 2 to 2½ inches in diameter (5 to 6.3 cm.) the average weight ranges from about 17.5 ounces to 24.5 ounces (500 to 700 gm.), depending on the length of the root and the condition of the foliage; usually 18 to 24 inches (45 to 60 cm.) high when grown as an early-spring crop in the Northern States, but only 14 to 19.5 inches (35 to 50 cm.) when grown as a fall crop in the Northern States or as a late-winter to early-spring crop in the Southern States and California; average spread of plant ranges from 1.2 to 1.7 times the height, with the relatively wider plants produced in the fall in the Northern States and during the coolest seasons in the Southern States and California.

LEAVES

(Pl. 28)

Numerous, average about 20, but may range from 15 to 30, depending on weather conditions prior to harvest; average weight about 10 ounces (300 gm.), but may range from 8 to 17 ounces (230 to 500 gm.), and on certain leafy individuals may weigh as much as 28 ounces (800 gm.); constitute from 40 to 60 percent of the total plant weight.

BLADE

Young growth typically light green in color, about Calla Green (22 L 4), but darkening to Art Green (22 L 7) and Cedar Green (23 L 5) with increased age and relatively soon turning to a solid reddish purple and changing through 54 L 4 to 55 H 6 and 56 L 3 as the color spreads outward from midrib and veins and the leaves attain maturity. Large, average length of 6¼ to 10 inches (16 to 25 cm.) with largest leaves produced in Virginia; average width of 4¾ to 5¾ inches (12 to 15 cm.) with a length to width ratio of 1.7 to 1.9. Narrow ovate in shape with rounded or slightly mucronate tip; slightly tapered base; slightly downward curved midrib; almost flat across the midrib; slightly undulate margin; entire to slightly wavy edge; smooth to slightly bullate surface; medium to large midrib and veins, and thick, leathery blades.

PETIOLE

Outside or convex surface of petiole bright to dark purplish red ranging from 53 L 3 to 54 L 4 to 54 L 12 to 55 L 12 from base to blade and as the plant matured; inside or concave surface of petiole usually lighter purple than convex at any point or stage of development with some plants having orange or gold stripes (13 L 12) along the margins. Long, average length ranging from 7 to 10¾ inches (18 to 27 cm.) or slightly longer than the blade and 20 to 30 times as long as wide (at midlength); wide, averaging five-sixteenths to six-sixteenths of an inch (8 to 10 mm.) in width at midlength and slight gradual increase toward base and decrease toward blade; from 1.04 to 1.20 times as wide as thick. Majority quite erect, held at an angle of 65° to 80° with the horizontal.

NECK

Neck at base of adherent turgid petioles ranges from 1 to 2 inches (2.5 to 5 cm.) in diameter and seven-eighths to 2⅜ inches (2.2 to 6.0 cm.) in length, usually increasing in diameter toward the base.

[24] For discussion of the effect of environment on plant characters see p. 5.

ROOT

(Pl. 29)

Grows 1 to 3 inches (2.5 to 8 cm.) of root above ground; when 1½ inches in diameter (3.8 cm.) the roots are long wedge-shaped, but as they reach 2½ inches (6 cm.) in diameter the long portion of the root increases in diameter so there is a gradual taper toward the long-pointed base from the short-tapered shoulder; side roots many, varying in size and character from small, fibrous to large, fleshy, depending upon soil type and season, emerging from two shallow depressions on opposite sides of the root, which depressions and accompanying side roots extend above the ground line; average length ranges from 5¾ to 16 inches (15 to 40 cm.), depending on location and length of growing season, although 8 to 12 inches (20 to 30 cm.) is the usual range; average weight likewise varies widely according to size, ranging from 7 to 17.6 ounces (200 to 500 gm.) with most of the averages between 7 and 10.5 ounces (200 to 300 gm.); 40 to 60 percent of total plant weight.

Skin around crown above ground soon becomes russeted or rough, and as this corky or barklike area develops, it changes in color from light tan to dark tan (12 B 5 to 14 K 8), and as it diminishes in density toward the ground line, the color becomes progressively clearer and darker purple (7 C 10 to 7 H 7 to 7 H 9). Below ground when moist, the skin color is brighter reddish purple (7 H 4 to 7 H 6), which, when dry, becomes very dark purple (48 L 3).

In cross section the root is flattened or slightly grooved on two sides; usually 8 to 12 easily distinguished zones of lighter and darker colors, the lighter zone usually indistinct and narrower than the darker and in the fall-grown crop barely distinguishable; in color essentially the same as Detroit Dark Red, although the spring crop contains more purple and, therefore, resembles the color of Morse Detroit.

The above- and below-ground moist-skin color has the same range as Flat Egyptian, but since it is usually older when harvested, the darker colors are more typical of marketed roots.

The freshly cut flesh color of spring-grown crops is alternately zoned with light purplish red (4 K 6) and various shades of purplish red (6 L 7 to 6 L 9). In the fall-grown crop or when more uniformly colored roots are produced, the lightest zone becomes 6 L 4 to 6 L 6 and the darkest 7 L 4 to 7 L 6.

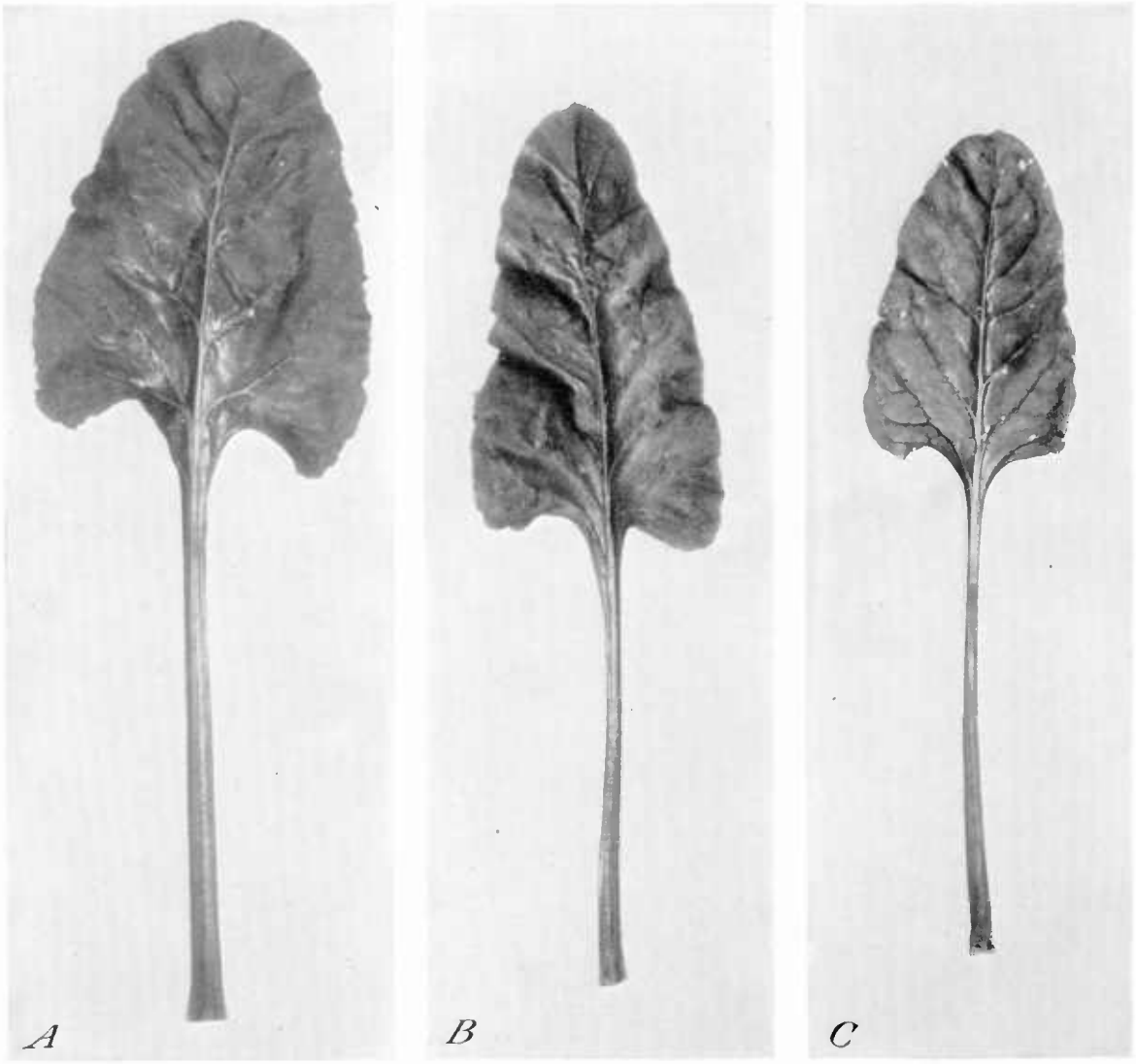
SYNONYMS

Early Long Blood, Extra Long Dark Blood, Extra Long Smooth Dark Blood Red, Improved Extra Long Dark Blood, Improved Long Blood, Improved Long Blood Red, Improved Long Dark Blood, Improved Long Dark Blood Red, Improved Long Dark Smooth Blood, Improved Long Dark Smooth Red, Improved Long Red, Improved Long Smooth, Improved Long Smooth Blood Red, Improved Long Smooth Dark Red, Improved Long Smooth Red, Improved Smooth Long Dark Red, Large Long Blood, Late Blood, Long Black Red, Long Blood, Long Blood Red, Long Dark Blood, Long Dark Blood Red, Long Dark Red, Long Dark Red Blood, Long Dark Smooth, Long Red, Long Red Blood, Long Smooth, Long Smooth Blood, Long Smooth Blood Red, Long Smooth Dark Blood, Long Smooth Dark Red, Long Smooth Deep Blood Red, Long Smooth Red, Mammoth Long Red, New Dark Egyptian, Smooth Long Blood, Smooth Long Dark Blood.

HISTORY

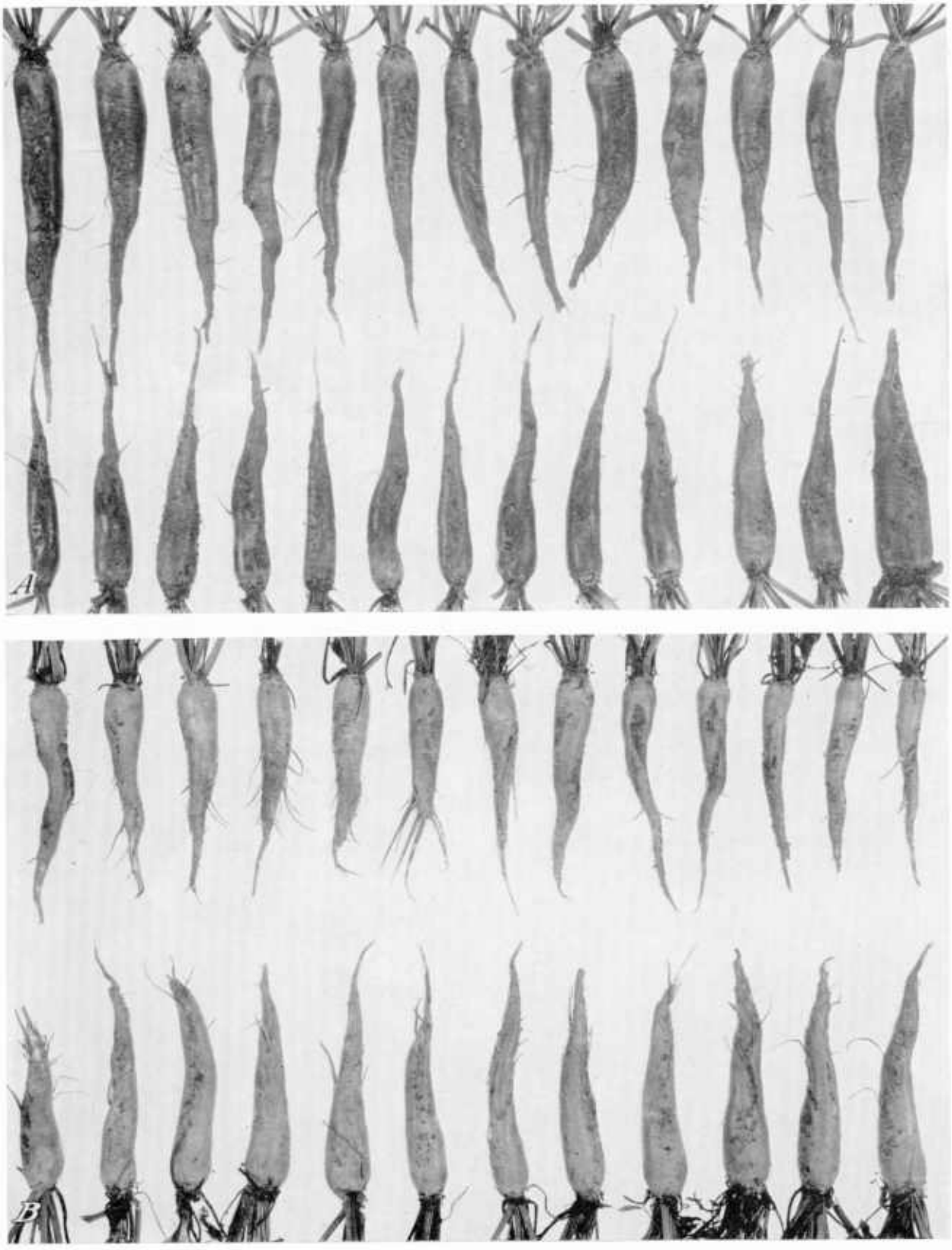
Although the present type has been improved by continued selection, the long, smooth dark-red-fleshed type of beet is one of the oldest types of which there are any printed records and probably was introduced into America early in the sixteenth century from France, where it was then the most favored type.

LONG DARK BLOOD BEET



Representative leaves of the same strain of Long Dark Blood beet grown at the Arlington Experiment Farm (A) *in 1932,* (B) *in 1933, and* (C) *in 1934, showing variation in size and shape due to climatic conditions.*

LONG DARK BLOOD BEET



Random samples of prime marketable roots of a uniform strain of Long Dark Blood beet as grown at (A) *the Arlington Experiment Farm in spring of 1934 and* (B) *at Beltsville, Md., in spring of 1935.* × 1/6.5.

FLESH COLORS OF RED GARDEN BEETS

Cross sections of beet roots of different color types showing difference in relative width of light and dark zones and in depth or intensity of color between crops grown in the spring and in the fall at Arlington Farm, Virginia, from the same lot of seed.

LITERATURE CITED

(1) BLAIR, A. W., and PRINCE, A. L.
1930. THE INFLUENCE OF LIME IN VEGETABLE GROWING. N. J. Agr. Expt. Sta. Bull. 498, 16 pp., illus.

(2) CAROLUS, R. L., and BROWN, B. E.
1935. MAGNESIUM DEFICIENCY. I. THE VALUE OF MAGNESIUM COMPOUNDS IN VEGETABLE PRODUCTION IN VIRGINIA. Va. Truck Expt. Sta. Bull. 89, pp. 1250–1288, illus.

(3) CHROBOCZEK, EMIL.
1934. A STUDY OF SOME ECOLOGICAL FACTORS INFLUENCING SEED-STALK DEVELOPMENT IN BEETS (BETA VULGARIS L.). N. Y. (Cornell Agr. Expt. Sta. Mem. 154, 84 pp., illus.

(4) CRANDALL, F. K.
1935. GROWING EARLY BEETS AND LETTUCE WITH GREEN MANURE. R. I. Agr. Expt. Sta. Ann. Rept. 47 (Contrib. 467): 87–91.

(5) ———
1935. TWENTY YEARS' RESULTS WITH MANURES AND FERTILIZERS IN VEGETABLE GROWING. Amer. Veg. Growers Assoc. Ann. Rept. 27: 172–180.

(6) ——— and ODLAND, T. E.
1930. THE AMOUNT OF MANURE NECESSARY FOR VEGETABLE GROWING. II. R. I. Agr. Expt. Sta. Bull. 225, 31 pp., illus.

(7) ——— and ODLAND, T. E.
1932. SUBSTITUTING FERTILIZERS, GREEN MANURE, AND PEAT FOR STABLE MANURE IN THE GROWING OF VEGETABLES. R. I. Agr. Expt. Sta. Bull. 234, 53 pp., illus.

(8) CRIST, JOHN W.
1926. EFFECT OF NUTRIENT CONDITIONS ON COLLOIDAL PROPERTIES OF CERTAIN VEGETABLE CROPS. Mich. Agr. Expt. Sta. Tech. Bull. 74, 27 pp., illus.

(9) ENZIE, W. D.
1935. PLANT LATE TO MAKE RED BEETS REDDER. Canner 81 (3): 14.

(10) ERWIN, A. T., and HABER, E. S.
1934. IRRIGATION FOR VEGETABLE CROPS IN IOWA. Iowa Agr. Expt. Sta. Bull. 308, pp. 113–143, illus.

(11) GILBERT, BASIL E.
1934. NORMAL CROPS AND THE SUPPLY OF AVAILABLE SOIL MANGANESE. R. I. Agr. Expt. Sta. Bull. 246, 15 pp.

(12) HARTWELL, BURT L., and DAMON, S. C.
1927. THE DEGREE OF RESPONSE OF DIFFERENT CROPS TO VARIOUS PHOSPHORUS CARRIERS. R. I. Agr. Expt. Sta. Bull. 209, 19 pp.

(13) HESTER, J. B., PARKER, M. M., and ZIMMERLEY, H. H.
1936. LIMING COASTAL PLAIN SOILS. Va. Truck Expt. Sta. Bull. 91, pp. 1303–1358, illus.

(14) KOTILA, J. E., and COONS, G. H.
1935. BORON DEFICIENCY DISEASE OF BEETS. Facts About Sugar 30: 373–376, illus.

(15) LLOYD, J. W., and LEWIS, E. P.
1935. SUBSTITUTION OF COMMERCIAL FERTILIZERS FOR MANURE IN VEGETABLE PRODUCTION. Ill. Agr. Expt. Sta. Bull. 421, pp. 579–610, illus.

(16) ——— and STRUBINGER, L. H.
1930. FERTILIZING TWENTY-FIVE KINDS OF VEGETABLES. Ill. Agr. Expt. Sta. Bull. 346, pp. 303–320, illus.

(17) MAERZ, A., and PAUL, M. REA.
1930. A DICTIONARY OF COLOR. 207 pp., illus. New York.

(18) PUCHER, G. W., CURTIS, L. C., and VICKERY, H. B.
1938. THE RED PIGMENT OF THE ROOT OF THE BEET (BETA VULGARIS L.). II. A METHOD TO DETERMINE BETANIN. Jour. Biol. Chem. 123: 71–75.

(19) RALEIGH, G. J., and RAYMOND, C. G.
1938. A PRELIMINARY NOTE ON THE CONTROL OF INTERNAL BREAK-DOWN IN TABLE BEETS BY THE USE OF BORON. Amer. Soc. Hort. Sci. Proc. (1937) 35: 526–529.

(20) RHODE ISLAND AGRICULTURAL EXPERIMENT STATION.
1935. MEASUREMENTS OF NITRATE NITROGEN AS INDICES OF CURRENT NITROGEN SUPPLIES. R. I. Agr. Expt. Sta. Ann. Rept. 47 (Contrib. 467): 69–71.

(21) ———
1936. THE EFFECT OF DAY LENGTH ON THE NITROGEN REQUIREMENTS OF BEETS. R. I. Agr. Expt. Sta. Ann. Rept. 48 (Contrib. 483): 22–23.

(22) ———
1937. EFFECT OF DAY LENGTH AND ACIDITY ON THE ASSIMILATION OF NITRATE AND AMMONIUM NITROGEN. R. I. Agr. Expt. Sta. Ann. Rept. 49 (Contrib. 503): 26–27.

(23) ———
1937. THE EFFECT OF CROPS ON SOIL ACIDITY. R. I. Agr. Expt. Sta. Ann. Rept. 49 (Contrib. 503): 27.

(24) RITCHIE, T. F.
1927. STANDARD DESCRIPTIONS OF VEGETABLES. BEETS AND CARROTS. Canada Dept. Agr. Bull. 82 (n. s.), 36 pp., illus.

(25) SKINNER, J. J., and RUPRECHT, R. W.
1930. FERTILIZER EXPERIMENTS WITH TRUCK CROPS. I. CELERY AND LETTUCE ON LEON FINE SAND. II. TOMATOES ON CALCAREOUS GLADE SOIL. III. TRUCK CROPS WITH MANGANESE ON CALCAREOUS GLADE SOIL. Fla. Agr. Expt. Sta. Bull. 218, 65 pp., illus.

(26) SMITH, JOHN B., and SCHLENKER, FRANK S.
1934. OPTIMUM SOIL-NITRATE LEVELS FOR TABLE BEETS: THEIR EFFECT ON CERTAIN NITROGEN-FRACTIONS IN JUICE EXPRESSED FROM THE LEAVES. R. I. Agr. Expt. Sta. Bull. 242, 28 pp., illus.

(27) THOMPSON, ROSS C.
1939. INFLUENCE OF VARIOUS FACTORS ON THE SHAPE OF BEET ROOTS. Jour. Agr. Research 58: 733–745, illus.

(28) TIEDJENS, V. A., and SCHERMERHORN, L. G.
1938. NOTES ON NUTRIENT DEFICIENCIES OF SOME VEGETABLE CROPS. Amer. Soc. Hort. Sci. Proc. (1937) 35: 704–708.

(29) TRACY, WILLIAM WOODBRIDGE, JR.
1903. LIST OF AMERICAN VARIETIES OF VEGETABLES FOR THE YEARS 1901 AND 1902. U. S. Bur. Plant Indus. Bull. 21, 402 pp.

(30) WESSELS, P. H.
1932. SOIL-ACIDITY STUDIES WITH POTATOES, CAULIFLOWER, AND OTHER VEGETABLES ON LONG ISLAND. N. Y. (Cornell) Agr. Expt. Sta. Bull. 536, 42 pp., illus.

INDEX TO VARIETAL NAMES

[The names of the principal or standard varieties are shown in capitals]

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