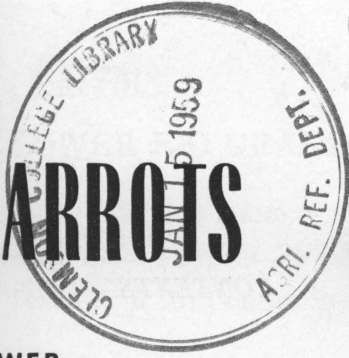


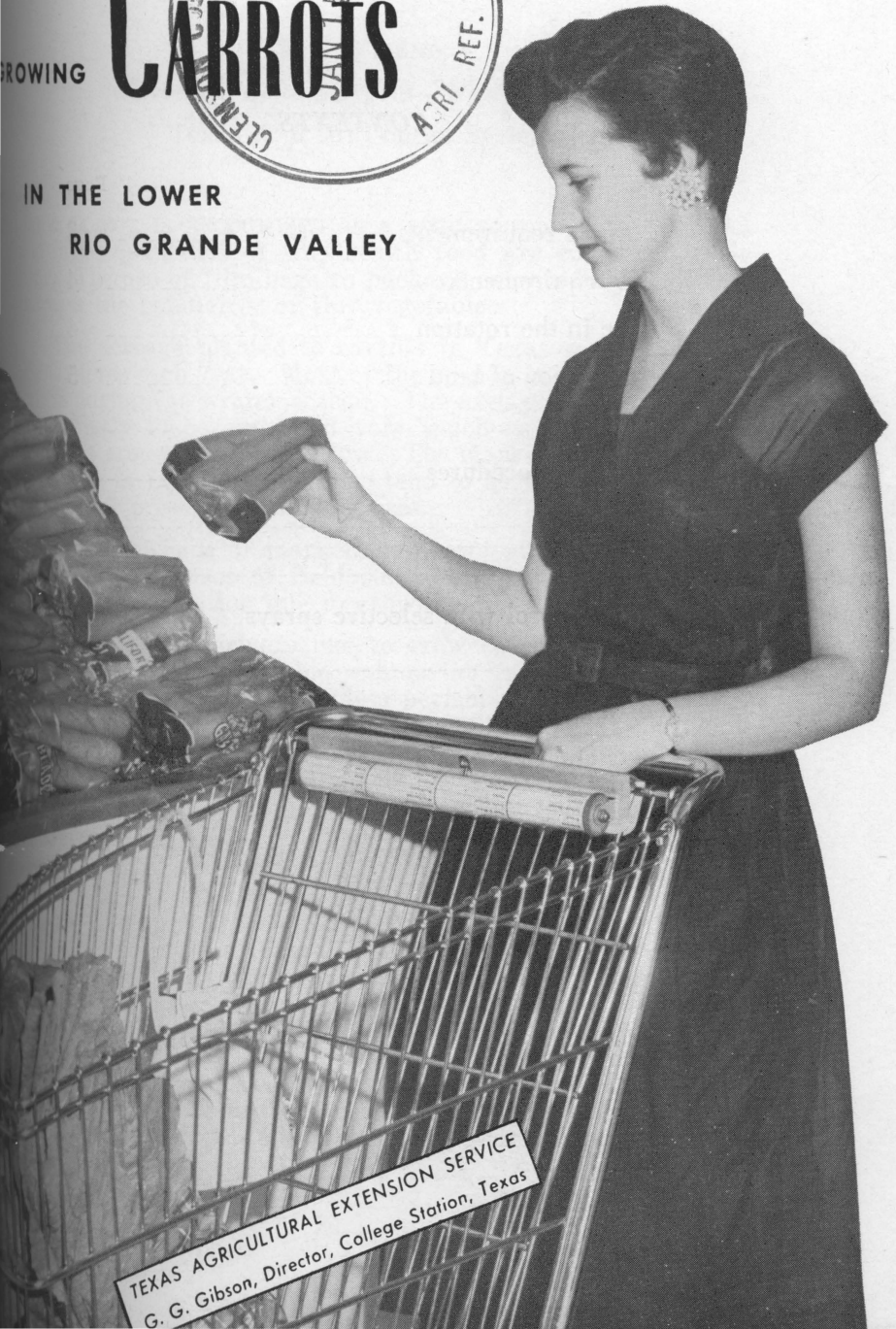
ow

CARROTS



GROWING

IN THE LOWER
RIO GRANDE VALLEY



TEXAS AGRICULTURAL EXTENSION SERVICE
 G. G. Gibson, Director, College Station, Texas

CONTENTS

	Page
Climatic requirements	3
Soil requirements	4
Place in the rotation	4
Preparation of land	5
Varieties	6
Planting procedures	7
Irrigation	7
Cultivation	8
Weed control with selective sprays	8
Thinning	9
Fertilizers	9
Pests and diseases	9
Harvesting and marketing	11

Growing Carrots . . .

IN THE LOWER RIO GRANDE VALLEY

W. H. FRIEND,

Associate County Agent—Horticulture

Texas A. & M. College System

THE CARROT IS RECOGNIZED as a good source of vitamin A, and large quantities of this health food are consumed each year. The use of film bags to package carrots has tended to increase the popularity of this vegetable.

The acreage planted to carrots in Texas ranges around 25,000 acres each year. Most of the crop is grown under irrigation during the winter season. The area planted to carrots is not likely to be expanded very much as the net returns from this crop are relatively low. The marketing of cold stored carrots in film bags will also tend to keep the winter crop at or below present acreage figures.

Average yields of marketable carrots in Texas are low. The principal causes of field culling of the roots are small size and malformation due to crowding.

South Texas farmers like to grow carrots because they can be sold in considerable volume at fairly remunerative prices, and because they are less perishable than most vegetables. Texas is advantageously located as a distribution point for fresh winter carrots, and the irrigated areas are well adapted for the production of this vegetable.

Climatic Requirements

Winter carrots are shipped out of Texas from about December 1 through the month of April. This means that the crop must be planted from about August 15 through November. Carrots thrive best when average temperatures range around 65 degrees. Root color is not improved by day length much longer than 9 hours. Carrot plants are damaged by temperatures in the low twenties; so the cold hazard must be considered when selecting a location for winter carrot production. Fifty-five-degree night temperatures and 75-degree daytime highs are the ideal range for growing good carrots.



Siphon irrigation on deep-bedded, prefertilized land, aids in soaking the soil to field capacity to depths ranging from 2 feet for clay loams to 4 feet for sandy loams.

Where winter rainfall is sparse, it may be necessary to apply about 12 inches of irrigation water (the equivalent of four 3-inch rains) during the carrot-growing season. Carrots are grown in the more humid sections of the State without irrigation.

Soil Requirements

Carrots are produced successfully on a wide range of soils. Well-drained sandy loams are preferred for carrot production because they are more easily managed, but large acreages are grown on clay loam and silty clay loam. These fine-textured (hard) soils are more difficult to work and tend to deform the roots but retain moisture better than light soils. In addition, they contain ample quantities of potassium. Heavy soils must be "loosened up" by adding large quantities of organic matter, and thorough applications of gypsum. It is difficult to maintain good tilth in clay soils which contain appreciable amounts of sodium.

Place in the Rotation

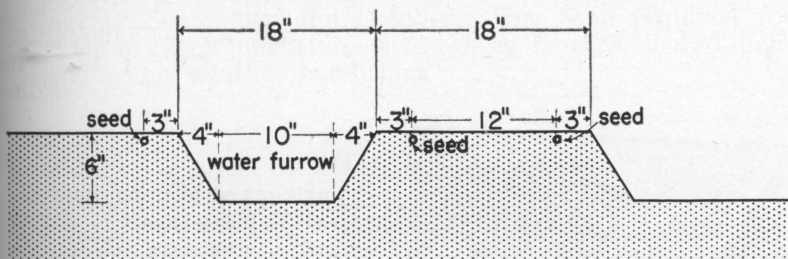
Carrots are highly susceptible to injury from the root knot nematode and from root rot disease. They should follow some nonsusceptible (grass) crop. The proper incorporation and composting of woody residues from green ma-

nure crops is a difficult problem in carrot production. Immature sweet sorghum and Sudangrass are excellent green manure crops to precede carrots, but this root crop also does well following corn, grain sorghum, cotton or flax. Most legumes tend to increase the nematode population in the soil and serve as host plants for cotton root rot.

Preparation of Land

Thorough preparation of the soil is an important step in carrot production. Failure to bring about complete decomposition of woody crop residues and poor seedbed preparation may result in poor stands, deformed roots and slow growth. A suggested set of operations for carrot growers includes: plowing, leveling, floating, flooding, plowing, disking, floating and bedding. Leveling and floating of the land facilitate even distribution of water over the soil surface. The wetting of the soil, and tillage to aerate it and hasten the decomposition of woody residues are also essential. Heavy cover crop disks instead of plows and chisels to loosen up the soil to the 12-inch level are used on most Texas farms. Plowing at successively greater depths during the summer season is sometimes practiced to reduce the nematode population in sandy soils. This drying out of the soil should be followed by flooding and tillage to decompose the crude organic material in the soil. Nitrogen concentrate (60 pounds of nitrogen per acre) should be broadcast over the crop residue before it is incorporated with the soil.

Listing the soil into rough beds 36 to 40 inches apart is essential in preparing the land. The phosphate fertilizer (60 pounds of P_2O_5 per acre) may be applied behind *wingless* middlebreakers that split the beds 8 to 10 inches deep. The ridges are then shaped with "sleds" that leave low beds, 18 to 20 inches wide and 18 to 20 inches apart shoulder to shoul-



Flat-type beds for pair-rowed planting. Drills of carrots are 12 inches apart and 3 inches back from shoulders. Beds usually are 6 inches high and 36 inches apart from center to center.

Pair-rowed planting is the most common method of growing irrigated carrots.



der. These raised beds are formed with sled-type planters at the time the seeds are planted.

Some growers prefer single-rowed planting and list the land into beds spaced 19 to 36 inches apart. A single (broad) band of carrot seed is planted on top of each narrow (12 to 14-inch) bed. Single-rowed carrots are cultivated with less difficulty than double-rowed carrots and irrigation is more efficient where water seeps in from both sides of the beds. However, this method tends to concentrate salts down the center lines of the beds.

Varieties

Imperator, derived from a cross between the high-quality Nantes carrot and the high-yielding Chantenay variety, is the standard commercial variety in Texas. A new variety, Gold Spike, is worthy of trial. Nantes is a high-quality carrot of the coreless type. It is of excellent quality and some strains yield good crops of medium-sized, cylindrical roots of deep orange color.



Single-rowed planting with rows spaced 30 inches apart is used by extensive producers of carrots. There were 900 acres of carrots on the farm where this picture was made.

Planting Procedures

Carrots usually are planted in paired rows 14 to 16 inches apart. The two bands of seed are planted on the top of flat beds made by "sledding off" 3-foot listed beds. Multiple unit vegetable seeders are used in planting carrots. They should be equipped with wide-shoe openers having splatter plates that scatter the seed thinly in bands 3 to 4 inches across. This banding of the seed gives the roots more growing room, reduces the number of malformed roots due to crowding and may reduce the amount of hand thinning.

The amount of seed used may vary from less than 1 pound for wide-spaced single-rowed carrots to as much as 5 pounds for summer-planted closely spaced carrots. Most growers of double-rowed carrots use 3 to 4 pounds of seed.

The depth of planting depends on the nature of the soil. It may vary from $\frac{1}{4}$ inch on hard clay ground to $\frac{3}{4}$ inch on light sandy soil. Moisture content also should be considered where carrots are grown on unirrigated land. In irrigated areas it is customary to "plant dry" and "water up the crop." This encourages weed growth, but selective (naphtha type) oil sprays take care of this problem. When extra early carrots are started in August, the planting operation should be preceded by furrow irrigation to cool off the soil and germinate weed seed. These weeds can be destroyed at the time the carrots are planted.

Viable seed band-planted in adequate amounts in well-prepared soil will help assure good stands.

Planting time extends from August 1 through November. Extra-early carrots for marketing in December usually bring the highest prices, but the expense involved in growing them is relatively high. Late carrots encounter more trouble from heat, and losses from root rot are higher than with main crop carrots. Most of the Texas carrot acreage is seeded during September and October. The time required for the crop to reach marketable size ranges from 90 to 120 days, depending on weather conditions.

Irrigation

Irrigation of the carrot crop actually begins with the preparation of the land. A second pre-planting irrigation is desirable after the land has been listed for planting. This furrow irrigation soaks the beds, cools the soil and causes weeds to emerge which can be destroyed easily when the soil is "sledded" during the planting operation. Water should be

applied soon after planting, especially if the pre-seeding irrigation was omitted. This post-seeding watering discourages ants and cutworms from feeding on the seed and young plants, and it encourages germination of the seed and emergence of the seedlings.

The amount of water used in growing a crop of carrots should be gauged by the amount of rainfall during the growing season and by the nature of the soil. As a general rule, about 3 acre-inches of water are needed during each 4-week period. A 3-inch irrigation wets medium-dry, sandy loam soil to the average foraging depth of carrot roots (4 feet). In clay soil, moisture must be sufficient to prevent excessive cracking or hardening of the soil which would result in many deformed roots. Water applied to cracked soil penetrates deeply and may result in a temporary high water table, causing the lower ends of the carrots to die and decay. The soil should be allowed to dry out almost to the wilting point during the last 30 days of the growing season. Root development proceeds more rapidly in soil that is well below field capacity. However, water should be applied during the first 10 weeks of growth whenever available moisture in the soil is one-third to one-half exhausted for sandy soil, and one-half to two-thirds exhausted for clay ground. From five to six 3-inch irrigations may be needed for producing maximum yields during an abnormally dry year, including pre-planting irrigations.

Cultivation

The carrot crop may be cultivated first prior to planting when the beds are harrowed or floated to destroy small weeds. The second cultivation is needed just as soon as the young carrot seedlings are large enough to be worked without causing excessive injury or coverage. Half-sweeps (beet hoes), disk attachments and duck-foot sweeps are useful in weeding small carrots. After the carrots are 6 inches high, larger sweeps can be used to free the middles of weeds and to fill cracks in the soil. Deep intercultural tillage is of doubtful value on well-prepared loamy soil.

Weed Control with Selective Sprays

The use of naphtha-type oil sprays to kill weeds in small carrots has revolutionized carrot production in Texas. This labor-saving method of weeding carrots probably has done more to encourage extensive carrot planting in Texas than any other factor. The straight naphtha is applied as a low pressure spray (30 to 40 pounds per square inch), medium

volume (25 to 50 gallons per acre depending on the size of the weeds) when most of the carrot seedlings have four or more true leaves. Results are best when the naphtha is applied to partially dry plants (after most of the dew has disappeared from the leaves). Carrots can endure an application of aromatic naphtha which kills most weeds and grasses. Spraying should be done while the weeds are small.

Thinning

Few Texas carrot growers hand-thin the plants because of the cost involved. Light seeding rates (2 pounds per acre) and planting in broad bands make it possible to grow fair yields of carrots without resorting to hand thinning. Some growers block the plants out (3 inches between clumps) with narrow (2-inch) hoes, but most of the acreage is unthinned. On loose loamy soils, it is safe to allow 12 to 14 carrots to remain in each linear foot of row, but on heavy clay ground the stand should be reduced to a 3-inch spacing.

Fertilizers

The fertility level of the soil must be considered when the fertilizer program is developed. Previous use of the land and the amount and nature of the residue that was added to the soil also affect the fertilizer scheme. Where 60 pounds per acre of nitrogen are applied to the residue before incorporation, and where 60 pounds per acre of P_2O_5 are applied deep in the beds before planting, supplemental fertilization of the soil likely will not be needed. If the growth rate seems slow, a water-furrow application of about 30 pounds per acre of nitrogen may be used.

Potash requirements of carrots are exceptionally high, but most South Texas soils contain an abundance of potassium. The calcium in the gypsum used to loosen up hard sodium soils releases potash from the clay particles. The calcium in superphosphate has this same effect.

Too much nitrogen during the last half of the growing season may cause excessive top development.

Pests and Diseases

Root knot nematodes cause heavy losses to carrot growers. These tiny soil-inhabiting worms are controlled most economically through adequate rotation with non susceptible crops and by plowing the land at successively greater depths

during the summer before planting. Fumigation of the beds with one of the commercial volatile soil fumigants is not highly effective in hot soil, and a considerable waiting period following treatment is necessary when the soil is cool and moist.

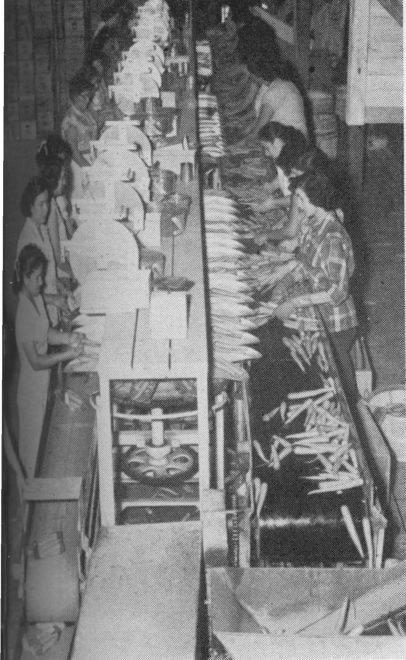
Cutworms, wireworms, cabbage loopers, wingless May beetles, larvae of carrot beetles, vegetable weevils, crickets and six-spotted leafhoppers are the insects most likely to be found in Texas carrot fields. Cutworms, loopers, wingless May beetles, and crickets do their damage when the seedlings are quite small. The wireworms, carrot beetle grubs and vegetable weevils feed on the developing "storage" roots of carrot plants. The six-spotted leafhopper is the carrier for the virus that causes aster yellows in carrots.

Control measures for all of these pests are outlined in L-255 "Guide for Controlling Insects and Diseases of Vegetables in Texas," which may be obtained from county agricultural agents in the South Texas area.

The principal disease which affects Texas carrots is leaf blight. The fungus causing the disease forms irregular cankerous spots on the leaves and leaf stalks. A severe infection causes the leaves to turn yellow and finally die. A crop of



Carrots from outside washers are graded and sized, and the larger roots are packed in mesh sacks or baskets. The smaller roots travel the conveyor belt to the "cello" bag packers.



Top-grade carrots ranging in size from $\frac{3}{4}$ inch to 1 inch in diameter are packed in the popular "cello" film bags which hold 1 pound.

carrots may lose several sets of leaves to blight during a season that is especially favorable for the spread and development of this disease. High-pressure spraying with freshly made (neutral) Bordeaux mixture is the most effective control for carrot blight, but some of the new organic fungicides of the zineb and maneb type leave less objectionable residue on the tops. However, residue is no problem where the roots are sold as topped carrots.

Harvesting and Marketing

Carrots for the fresh market are harvested when most of the roots reach a diameter of $\frac{3}{4}$ to $1\frac{1}{2}$ inches at the crown. Soup-stock carrots are allowed to attain considerably larger size.

Especially designed carrot "lifters" loosen the soil in which the carrots are growing so that the long roots can be pulled from the soil with minimum breakage. These "lifters" are like heavy-built half-sweeps with the wings turned down at an angle. They are attached 20 inches apart to the tool bars of powerful tractors which pull them at a depth of 12 inches in tight soil.

After being loosened, the carrots are lifted from the soil, graded for size, conformation and blemishes, topped and placed in field bags. The bags of field-graded, topped carrots are hauled to the packing shed where they are washed and

further graded into "cello" bag carrots and soup stock (bulk carrots). The top grade, medium-sized roots ($\frac{3}{4}$ to $1\frac{1}{4}$ inch) are packaged in plastic film bags which are later packed in wire-bound master crates. The larger carrots ($1\frac{1}{2}$ to $1\frac{3}{4}$ -inch roots) are packed in bushel baskets or mesh bags and shipped for resale to hotels, restaurants and canners.

Relatively few carrots are tied in bunches and shipped as top carrots in paper-lined lettuce crates, because of the greater expense involved in this type of preparation.

Large acreages of Texas carrots are grown under contract at a specified price per acre or per ton. These bulk carrots are used largely by soup manufacturers. Consumer interest in carrots has grown because it is a source of carotene. Deep-colored carrots are an important source of carotene, from which vitamin A is produced within the body.