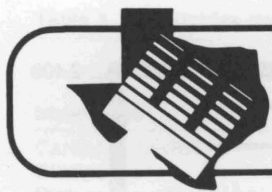


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Texas Agricultural Extension Service

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KEYS TO PROFITABLE FRESH CARROT PRODUCTION

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Texas ranks second, behind California, in the production of fresh market carrots. Nearly 17,000 acres were planted in 1983, valued at approximately \$27 million. Yields averaged 164 hundredweight per acre statewide for the period 1979-1983.

Per capita consumption has risen in recent years following a decline in the early 1970s. In 1982, U.S. consumption averaged 7.4 pounds per person.

Production Areas.

Two major areas of carrot production are the winter production area, consisting of the Rio Grande Valley, Laredo and the San Antonio-Winter Garden area, and the early fall production area, consisting of the High Plains and Trans-Pecos areas. Usually 60 to 70 percent of the state's acreage is in the Rio Grande Valley. In the winter production areas, seeding begins in late July and continues into February with most active seeding in September through November. Harvest usually begins in November with heavy shipments from January through April. Late crops furnish production into June.

In the High Plains and Trans-Pecos areas, planting begins about mid-April and continues into August. Harvest starts in late July and continues into January, with peak movement from mid-September through November.

Seasonal Movements

Movement of Texas carrots to market is shown in figure 1. Peak production occurs from January through April. Major market competition for the Rio Grande Valley and Winter Garden areas comes from California, whereas both California and Michigan compete with the High Plains in the early fall market.

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Climatic Requirements

Carrots can tolerate a wide range of environmental conditions but maximum yield and quality are achieved when temperatures are moderate (50° to 80° F.). High temperatures cause poor color and bitter taste. Although carrots can tolerate light freezes, they are damaged by temperatures in the low 20s; this effectively limits winter production to South Texas.

Soil Types

Carrots can be grown on most Texas soils; however, the most desirable for commercial production is a loose, friable, sandy loam. Such a soil enables the plant to develop a long, smooth, straight root. Generally carrots mature slowly on heavy soils. Consider soil types individually, especially from an irrigation and fertility standpoint, since each type responds differently to water and fertilizer applications.

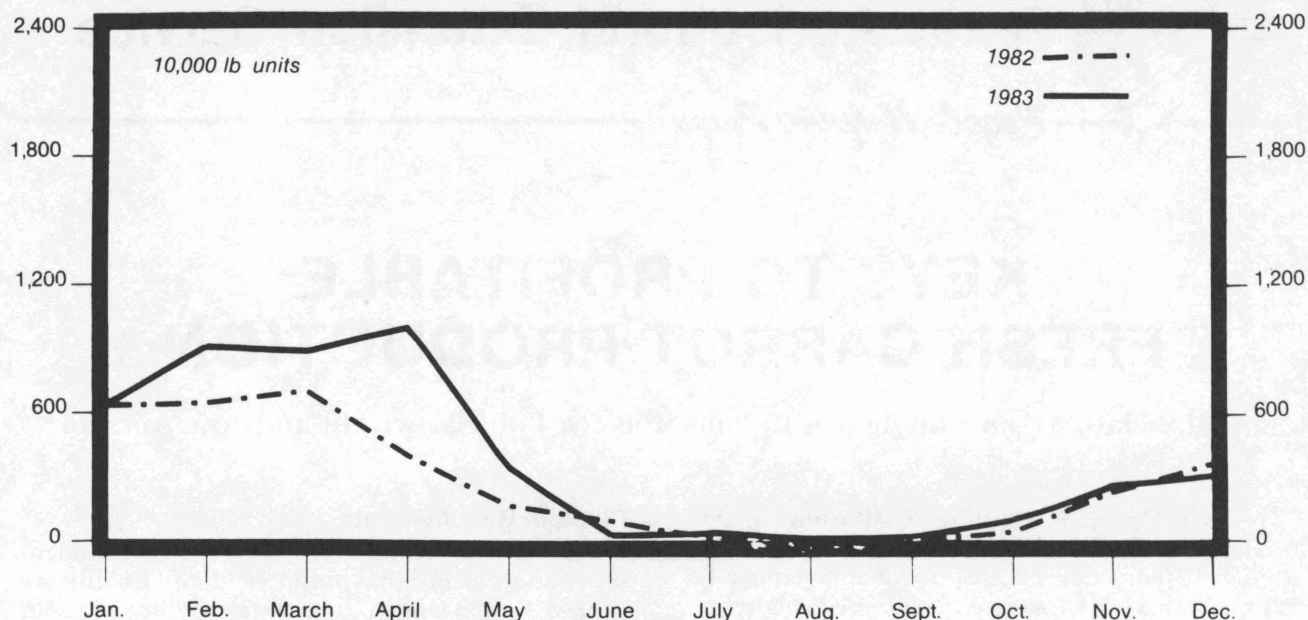
Fertilization

The soil fertility level influences any fertilizer program. Usually 60 to 80 pounds of phosphate per acre are banded or broadcast and incorporated before planting. One hundred to 140 pounds of nitrogen are usually split into a preplant and one or two side-dress applications. Most soils in the carrot-producing areas of Texas contain sufficient potassium. Micronutrient deficiencies are rare. When banding fertilizer, place the band several inches below and to the side of the seed row; carrot roots forced to grow through a band of fertilizer frequently fork, making them unmarketable.

Varieties

Imperator is the standard fresh market variety in most areas of Texas. Long Imperator and Imperator 58 account for more than 80 percent of Texas' carrot

TEXAS CARROTS FOR FRESH MARKET: SEASONAL MOVEMENT*



*Rail plus truck unloads in 41 cities by months. Source: Market News, USDA.

Figure 1. Seasonal movement of Texas carrots for fresh market.

acreage. Many hybrid varieties are now available which have higher yield potential with better quality and uniformity than open pollinated lines, but high seed cost and difficulty in obtaining desired plant stands have restricted the use of hybrids. About 2000 acres of canning carrots are grown, mostly Chantenay and Danvers types. A smaller but increasing amount of carrots are frozen as diced products for the retail and institutional trade.

Seeding Rates

Carrots are planted on raised beds, 36 to 40 inches from center to center. Growers usually plant raw seed two to four rows per bed using 1 to 4 pounds of seed per acre, depending on soil conditions and time of year. Precision seeding with pelleted seed is also done most commonly with four to six rows per bed using the equivalent of 1.5 to 2.5 pounds of raw seed. It is difficult to germinate carrots in hot weather, on heavy soil or in soil with a cloddy surface, so high seeding rates are used under these conditions. Desired in-row plant spacing varies from 1 to 3 inches depending on soil type and number of rows per bed. Hand thinning of stands is seldom done.

Irrigation

Most carrots are planted dry and furrow irrigated. A preplanting irrigation may be desirable to supply ample subsurface soil moisture and to germinate

weed seeds which can be destroyed during the planting operation. If the preplanting irrigation is omitted, apply the water shortly after planting. Carrots are extremely sensitive to salinity and soil crusting during germination. Sprinkler irrigation reduces these problems and is therefore more efficient in germinating carrots than furrow watering and should be used when possible.

Irrigation requirements depend on rainfall, soil type and environmental conditions. Generally, three to six well-timed furrow irrigations are required in South Texas. Growers in the High Plains may apply 1 to 1.5 inches of water a week through overhead sprinklers. On heavier soils, moisture should be sufficient to prevent the soil from cracking or hardening, which can cause many deformed roots. During the last 2 to 3 weeks of the growing season, limit moisture because root development proceeds more rapidly in soil that is well below field capacity.

Cultivation

Cultivate the soil before planting by harrowing or floating to destroy small weeds. A second cultivation may be needed as soon as the young seedlings are large enough to be worked without causing excessive injury or coverage.

Cultivate only as needed and never when fields are wet. Deep intercultural tillage is of doubtful value on well-prepared loamy soil.

Table 1. Insecticides suggested for certain carrot insects.

Insecticide	Pest						
	Aphids	Beet armyworms	Cutworms	Flea beetles	Leaf-hoppers	Carrot weevils	Wireworms
Carbaryl (Sevin®)			Xb	X	X		
Diazinon	X						Xg, pp
Endosulfan (Thiodan®)	X						
Malathion	X						
Methoxychlor				X	X		
Methyl parathion	X			X	X		
Mevinphos	X		X		X		
Parathion	X				X	X	Xpp
Trichlorfon		X	X				

*Bait formulations are indicated by the letter "b," granular formulation by a "g" and preplant application by "pp."

Weed Control

Incorporate a preplant application of 1/2 to 1 pound of Treflan or 4 to 6 pounds of Prefar per acre for preemergent weed control. Lorox at the rate of .5 to 1.5 pounds active ingredient per acre applied after planting but before crop emergence is another option. Lorox at the same rate applied after the crop is at least 3 inches tall helps control winter annual weeds that escape preplant or preemergent treatments. Never apply more than 4 pounds active ingredient Lorox per crop in any combination of pre- and post-emergent treatments.

Insect Management

Insects may cause severe damage to the root, crown and tops of carrots. The root-feeding wireworm is cylindrical, brownish to yellowish, hard-bodied larval form of the click beetle. They feed on the root of developing seedlings and may bore into the maturing carrot, rendering it unmarketable. Wireworms are more severe in carrots that follow any type of grass crop. A preplant insecticide application is suggested in fields with a history of wireworm problems.

Carrot weevil larvae tunnel leaf petioles before burrowing into the crowns, resulting in a scarred root that is unsalable. The tiny, white legless larvae are difficult to detect so target control efforts primarily toward adult weevils. Several species of cutworms may also damage carrots by their nocturnal stem cutting at the soil surface. Apply insecticide when a significant amount of damage has been detected.

Yellow, stunted, deformed and wilted leaves are feeding symptoms of sucking insects, such as aphids, leafhoppers or spider mites. Appearance of these symptoms warrants careful scouting for these pests.

A limited amount of defoliation from chewing insects is tolerable without yield loss, but initiate control procedures before damage becomes too severe. Adult flea beetles are tiny brownish-grey insects that chew small holes in leaves and may severely defoliate carrots when large populations are present. They commonly "hop" abruptly like a flea when

disturbed. Beet armyworm caterpillars are light green with a black spot on their side behind the head. Beet armyworms may cause severe defoliation and may be difficult to control with insecticides.

Carefully scout at least weekly to determine if insect pests are present in damaging levels. Begin control procedures only when pests have been detected at levels sufficient to cause loss. Table 1 lists the currently suggested insecticides available for use on carrots. See the label for rate, application information and precautions.

Disease Control

Several diseases are known to affect carrot production in Texas. Seedling disease or damping off may be a problem during prolonged wet weather. Some control may be obtained by using high quality seed and treating the seed with a protectant fungicide (Thiram, 8 ounces per 100 pounds of seed). Root knot nematodes and cotton root rot can cause considerable damage to carrots. Both can be reduced by practicing crop rotation. If nematode-infested land is to be used, it may be necessary to use a soil fumigant, such as Telone II, before planting. Leaf blight, caused by the fungi *Alternaria* or *Cercospora*, reduces yield and quality if not controlled. Copper-containing fungicides, maneb and chlorothalonil have been effective in controlling leaf blight. Several applications are usually necessary to obtain good control. Use maneb or chlorothalonil formulations at the rate of 1 1/2 to 2 pounds or 2 to 3 pints per acre, respectively, in enough water to assure proper coverage. Powdery mildew is a disease that has recently appeared in Texas. However, it does not cause sufficient damage to justify treatment. Aster yellows, caused by mycoplasma and transmitted by leafhoppers, can be serious. Destroying weeds in fields and areas close by, together with an effective insect control program, should reduce the evidence of this disease.

Harvesting

Nearly all carrots for fresh market and processing are machine harvested. The drag-type, power-take-

off-driven Food Machinery Corporation harvester, which digs, conveys, tops and elevates the roots into an adjacent truck, is common. It harvests 3 to 5 acres per day and takes the place of approximately 60 laborers. A few markets prefer carrots with tops intact, but labor costs for this type of operation are not competitive with those for machine-harvested carrots.

Packing, Storing and Processing

Central packing sheds for processing topped, fresh carrots for market are designed to wash, size, sort, package and cool the product with maximum efficiency and a minimum amount of hand labor. Generally harvested carrots are first unloaded into a water vat as they arrive from the field in bulk or in pallet boxes. From the water vat they travel by conveyor through one or two washing operations, then into a sizing machine and past sorters and

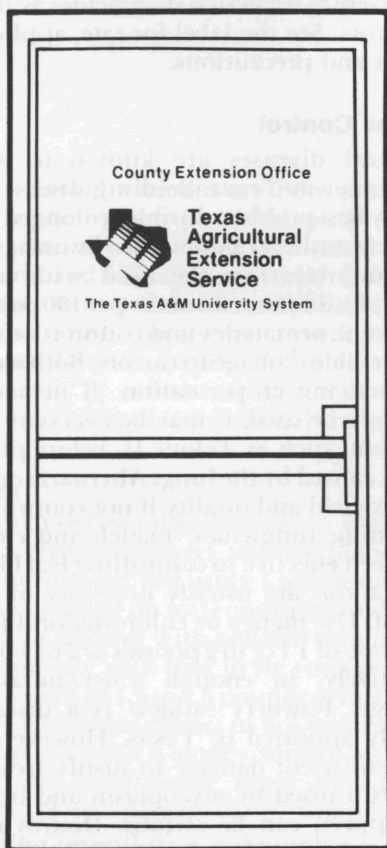
graders. They are placed by hand on scales to fill 1-pound polyethylene film bags. The bags are then tied or sealed and packed in 48 1-pound master containers, mesh sacks or wire-bound crates.

The 1-pound consumer packages usually contain carrots of two sizes—the small to medium 1/2 to 3/4 inch in diameter and the medium to large 3/4 to 1 1/4 inch in diameter. The 1-pound polyethylene packages are sold in retail outlets.

Another standard package is the 50-pound mesh or polyethylene master bag containing carrots 1 1/4 to 2 inches in diameter. These are sold to restaurants, the military services, schools and other institutions.

To market a good quality fresh product, effective hydrocooling before packaging and transit temperatures at or near 40° F. are necessary. If carrots are stored after harvest, the recommended temperature for long-term storage is 32° F. with a relative humidity of 90 to 95 percent.

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