THE PICKLE INDUSTRY OF NORTH CAROLINA

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CHAPTER I

INTRODUCTION

North Carolina holds an important place in the United States in the growing of pickle cucumbers and in the production of pickles. In 1963 North Carolina ranked second to Michigan in the number of acres planted in pickle cucumbers and ranked second in 1962 and third in 1963 in the volume of cucumbers produced.

A systematic compilation of facts on a crop in which North Carolina ranks second in the United States and has an important processing industry has potential value as a guideline for other researchers studying crops that are involved with food processing. In addition, an evaluation of North Carolina as a location for production of pickles and pickle cucumbers can provide information that could aid other pickle companies in making decisions for locating within North Carolina. An analysis of the location factors of the present pickle cucumber production could be of value in locating areas where new or expanded acreage of this crop can be made, because the available acreage of cucumbers in North Carolina was less than the demand of the pickle companies in 1963.[1] Efforts to obtain new acreage could be directed towards areas with environmental and economic characteristics similar to the present growing areas.

Practically all the pickles produced in North Carolina are cucumber pickles, and the term "pickles" is used in this thesis to refer to cucumber pickles. The word "cucumbers" refers to pickle cucumbers

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[1] "Pickles Offer Way Out of a Pickle" Agricultural Review (May 11, 1964), p. 1.

unless specifically shown to refer to another type of cucumber.

A. OBJECTIVES

The objectives in making a study of the North Carolina pickle industry are as follows: first, to provide a geographic description of the pickle industry and the production of pickle cucumbers in North Carolina; second, to determine the factors influencing the location of the North Carolina pickle industry and pickle cucumber production; third, to evaluate North Carolina as a location for the pickle industry and for pickle cucumber production; and fourth, to determine problems of the pickle industry and pickle cucumber production in North Carolina and to suggest solutions for these problems.

B. RESEARCH METHODS

Library research, field investigation, and mail questionnaires were used to compile information for this study.

The Use of the Library in this Study

The library was used mainly to compile published statistical information, to acquire technical information on pickling, to obtain information on agricultural practices, to gather climatic data, and to acquire information on cucumber diseases and insect pests.

The Use of the Questionnaire to Obtain Information

Questionnaires were mailed to the agricultural agents of each county in North Carolina to determine areas and trends of pickle cucumber acreage. Each county agent was asked to estimate the number of acres of pickle cucumbers in his county in 1963, to specify the trends in the

pickle cucumber acreage for the last five or ten year period, and to explain the causes for the trends. The necessity for asking each county agent in North Carolina for information on the acreage of pickle cucumbers is due to the fact that no federal or state agency had these data. Cucumber acreage is a good indicator of cucumber production.

Field Techniques Used in this Study

The principal field technique used in this study consisted of personal interviews with responsible personnel at each of the pickle processing plants in North Carolina. The information gathered from these interviews was the source of their materials, the size of their operations, the distribution of their products, the evaluation of North Carolina as a location for the pickle industry, the specific factors for the locations of the pickle plants in the state, and the present problems of the North Carolina pickle industry.

C. THE CUCUMBER

Cucumbers belong to the cucurbit family of plants, which also includes the squashes, watermelons, and musk-melons. Within the Cucurbitaceae, cucumbers are identified as Cucumis sativus. They are most closely related to the West India gherkins and musk-melons. Cucumbers originated in northern India, where they have been cultivated for over 3,000 years. The cultivation of the cucumber spread from India to Europe and later to China. Cucumbers were grown and "much appreciated" by the Greeks and Romans.[2]

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[2] Thomas W. Whitaker and Glen N. Davis, Curcurbits (1962), pp. 2-3.

Pickle cucumbers are different in several ways from "slicer" cucumbers, which are normally sold fresh in retail stores and used in salads. The pickle varieties are shorter than the slicer cucumbers. The thinner skins on pickle cucumbers permit pickling solutions to penetrate them more easily than the thicker skinned, but less perishable, slicer cucumbers.[3] The skins of pickle cucumbers have "warts", while the skin of the slicer variety is smooth. The strength of the carpals (membranes separating the three elongated seed cavieties) of cucumbers is important in pickle varieties because gases form in the seed cavieties during the fermentation process of brining. If the carpals are weak and separate under the pressure of this gas, the cucumber expands and becomes a "bloater" of greatly reduced economic value.

D. TYPES OF PICKLES AND THE METHODS OF MANUFACTURING THEM

Three general types of pickles are distinguished by the manufacturing methods of processed pickles, fresh-pack pickles, and genunine dill pickles. Each of the three basic types includes two or more subtypes.[4]

Methods of Manufacturing Processed Pickles

Processed pickles are made from cucumbers that have been cured in brine. The three general types of processed pickles are sour pickles,

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[3] The North Carolina Agricultural Extension Service, Cucumber Production in North Carolina (1954), p. 5.

[4] The primary sources for this section are: W. V. Cruess, Commercial Food and Vegetable Products (1958), Chapter 22; The National Pickle Packers Association, The Pickle (n. d.), pp. 10-13.

sweet pickles, and dill pickles.

Brining Pickle Cucumbers.-- Cucumbers that are brined undergo fermentation and are saturated with the salt water solution. Cucumbers are brined in wooden vats or tanks, which are generally eight to fourteen feet in diameter and six to eight feet in depth. Wooden heads, fitted into the tanks and held down by crosspieces four inches square, hold the cucumbers down in the brine.

Bacteria and fungi carried naturally by the cucumbers cause the fermentation of the cucumber sugars. The brine slows the fermentation, and, thus, prevents spoilage of the cucumbers. The lactic acid bacteria are the principal and most desired organisms active in the fermentation of cucumbers. They are more active than the spoilage bacteria in saline solutions. The lactic acid produced by the lactic acid bacteria is important in controlling the activity of spoilage organisms. Brining tanks in North Carolina are outdoors, and the sunlight prevents the development of a lactic acid-destroying, yeast-like film that grow on indoor tanks.

The brining of cucumbers begins with the brine between 35 and 40 degrees salometer.[5] The strength of the brine is raised about four degrees salometer per week. If the cucumbers are fermenting too rapidly, the brine is strengthened more rapidly. The rate of increase of the strength of the brine is faster in warmer climates or warmer weather than in cooler ones because fermentation is more vigorous in warmer temperatures.

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[5] The salometer is a hydrometer used to test the strength of brine. Four degrees salometer equal approximately one percent salt in a water solution.

The brine is strengthened until 60 degrees salometer is attained. Fermentation has usually ceased before the brine has reached that strength. The cucumbers are thoroughly cured about 90 days after they are put in the brine. The cured cucumbers can be kept almost indefinitely at 60 degrees salometer, but pickle processors generally consider five years to be the maximum length of time that cucumbers should be kept in brine. Most cucumbers are kept in brine for less than one year. Cucumbers in brine are referred to as "brine stock" or "salt stock".

When the brine stock is to be manufactured into finished pickles, brined cucumbers are removed from the tanks and sorted into finer size divisions. Most of the salt is removed from the brine stock by repeated soakings in hot and cold water. Soda alum and tumeric are usually added to the last rinse water to make the cucumbers more firm and to give them a uniform color. After this processing the treatment of the cucumbers varies according to the type of pickles to be made.

Sour Pickles.-- The cucumbers that are made into sour pickles are soaked in vinegar of about 40 or 50 grains (four or five percent acetic acid) for a few days. They are usually then packed in 30 to 50 grain vinegar. The final vinegar should be at least 25 grains in strength to insure against spoilage. Spices are often added to the final vinegar.

Marketed sour pickles can be whole sour pickles or one of several variations. Mixed sour pickles are sour pickles cut into small pieces and mixed with pieces of other sour pickled vegetables, such as caullflower, onions, and peppers. Chow-chow is cut sour pickles or mixed sour pickles with mustard and other spices added. Sour relishes are made with finely chopped pickles with or without other finely chopped

pickled vegetables combined with it.

Sweet Pickles.-- The manufacture of sweet pickles begins with the same treatment used to make sour pickles. The pickles are then soaked in spiced vinegar to which sugar is added gradually. The sugar must be added gradually to the vinegar to prevent shriveling of the cucumbers due to osmotic action caused by the sweet vinegar.

Sweet pickles are sold as whole pickles, crosscuts, and strips (cucumber quartered lengthwise). Sweet dill pickles are sweetened dill pickles. Sweet mixed pickles are usually cut into pieces and mixed with other sweet pickled vegetables, such as cauliflower and onions. Sweet relishes are finely chopped sweet pickles, which are usually mixed with other finely chopped pickled vegetables.

Processed Dill Pickles.-- Processed dill pickles are made by soaking processed pickles in a brine and vinegar solution to which dill plant and dill spices have been added. They are sold as whole pickles, crosscuts, and strips. Processed dill pickles are finely ground to make dill relish.

Methods of Manufacture of Fresh-Pack Pickles

Fresh-pack pickles are made from fresh cucumbers rather than from brine stock. After being sorted by size the cucumbers are washed with jets of water in an inclined revolving drum. Sometimes they are washed and bleached at the same time by jets of stream in an inclined revolving drum through which they pass. The cucumbers are then packed in jars or cans with appropriate spices and syrup. After being closed the containers usually pass through a continuous pasteurizer on a

conveyer belt. In the pasteurizer the cucumbers are heated by jets of water, which become progressively warmer and then progressively cooler before the containers of pickles go out. In an older method the containers are placed in a tank that is filled with water. The water is heated to pasteurize the cucumbers, cooled, and drained off.

The two basic types of fresh-pack pickles are sweets and dills. The sweet fresh-pack pickles that are made with cucumbers sliced crosswise are the "bread and butter" style pickles. The same pickle is also made with the cucumbers quartered lengthwise. The cucumbers are cooked in the pasteurization process in a syrup of spiced and slightly sweetened vinegar. Fresh-pack dill pickles are usually made with whole cucumbers. Dill flavored syrup and dill and other spices are put in the containers with the green cucumbers. Kosher and "Polish" pickles are types of fresh-pack dill pickles. Sweet vegetable relish is a third type of fresh-pack pickle. It is made with fresh cucumbers and other fresh vegetables, such as cabbage, red peppers, and green tomatoes.

Method of Manufacture of Genuine Dill Pickles

Genuine dill pickles are made by the fermentation process. The fresh cucumbers are put in barrels with dill weed, dill spices, and brine of about ten percent salt. Some vinegar is often added to help prevent spoilage. The cucumbers ferment and are ready to be eaten in about six weeks. Some genuine dills have been made in large tanks in recent years.

Few genuine dill pickles are made commercially in North Carolina because the temperatures of the eastern part of the state promote ..

spoilage. Genuine dills are susceptible to spoilage at temperatures above 80 degrees Farenheit.

Overnight dills are prepared like genuine dills, but the fermentation is stopped after one or two days by putting the cucumbers under refrigeration. Overnight dills must be kept in cold storage during the warmer months to prevent spoilage.

E. DEVELOPMENT OF THE NORTH CAROLINA PICKLE INDUSTRY

Commercial pickle production in North Carolina developed rapidly during the 1920s and again in the 1950s. Several pickle factories began production in the state in the 1920s. The rapid expansion during the 1950s was largely a result of the relocation of two northern pickle factories in North Carolina.

Factors Influencing the Growth of the Industry

The growth of the pickle industry can be attributed to factors influencing the growth of the industry in the United States as a whole and to special factors favorable to the growth of the North Carolina segment of the industry.

An expanding market is the basic reason for growth of the United States pickle industry. The expanding market is based on the rapid growth of the population and the rising pickle consumption per capita in the United States, which had risen between 1921 and 1961 from one and two-tenths pounds to four and one-tenth pounds per year.[6]

The factors influencing the increased importance of North Carolina

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[6] United States Department of Agriculture, Agricultural Statistics (1963), p. 305.

as a part of the United States pickle industry are the location factors of the North Carolina pickle industry and pickle cucumber production, which are discussed in Chapter II and III. The basic factors that are favorable to the increased importance of North Carolina as a pickle industry state are the advantageous natural and economic conditions of eastern North Carolina for growing pickle cucumbers and the proximity of the state to the large population of the northeastern United States.

Pickle Processing in North Carolina

There is indication of only small commercial pickle processing in North Carolina prior to 1920. The H. J. Heinz food company is said to have had a brinery in Robeson County prior to the turn of the century or in the decade between 1900 and 1910. Charles F. Cates produced pickles commercially on an Alamance County farm from 1898 until the operation was relocated to Faison, North Carolina in 1929.

The modern development of the North Carolina pickle industry began about 1925. Two of the state's five packing companies were founded in the 1920s. The Mount Olive Pickle Company began operations at Mount Olive in 1926, while the Charles F. Cates and Sons company was founded at Faison in 1929. The J. Weller Company of Wilmington and the Magnolia Products Company of Kinston also began producing pickles in the 1920s. These two companies were bought by the Johnson-Earl-Myers Company, a Pittsburgh, Pennsylvania wholesale grocery company, which began pickle production in New Bern about 1928. The Johnson-Earl-Myers Company became the Orringer Pickle Company in the 1930s and continued operations until 1962.

The Rose Hill Pickle Company began production at Rose Hill in the late 1930s and continued until the early 1950s. The Almar Pickle Company of Ahoskie started in 1945 and is operating there at present along with two subsidiary firms. The Wallace Pickle Company of Wallace was founded about 1946 and stopped production about 1959. Its operations were resumed in 1962 but are limited to brining and sales of fresh cucumbers. The Wanoco Canning Company of Wadesboro produced pickles from 1954 to 1956.

The most outstanding factor in the rapid expansion of the North Carolina pickle industry during the 1950s was the relocation in the state of two northern pickle factories. The Lutz and Schramm pickle company of Pittsburgh, Pennsylvania moved its production operations to Ayden between 1952 and 1958. Only fresh-pack pickles were produced at Ayden in 1952, but after 1958 Lutz and Schramm manufectured pickles only at Ayden. The Perfect Packed Products Company relocated its factory in Henderson from Long Island City, New York in 1959.

The Addis Cates Company of Faison was founded in 1964 and operates a brinery at Parkton. The operations of this company are limited to brining and sales of fresh cucumbers.

Five North Carolina factories are producing finished pickles in 1964. These are the factories of the Almar Pickle Company and two subsidiary firms at Ahoskie, Lutz and Schramm at Ayden, Charles F. Cates and Sons at Faison, the Perfect Packed Products Company at Henderson, and the Mount Olive Pickle Company at Mount Olive. The Wallace Pickle Company of Wallace and the Addis Cates Company of Faison specialize in

sales of fresh cucumbers and operate brineries at Wallace and Parkton.

The estimated production of the North Carolina pickle factories based on their consumption of cucumbers, has increased between 1930 and 1963 from the equivalent of 176,000 to 3,200,000 cases of 24 number 303 cans. The state's estimated pickle production accounted for 1 percent of the United States total in 1930 and 8 percent in 1963.

Pickle Cucumber Production in North Carolina

Pickle cucumbers are the primary raw material of the pickle industry. Pickle cucumber production was stimulated in North Carolina by the founding of the several pickle factories in the state during the 1920s. Eastern North Carolina proved capable of growing large acreages of pickle cucumbers, and for this principal reason two northern pickle factories relocated in North Carolina in the 1950s and one in 1945. Many northern pickle manufacturers are buying cucumbers in North Carolina. This increased market for North Carolina pickle cucumbers has stimulated the increase in the production of this crop.

The acreage of pickle cucumbers in North Carolina has increased from 500 acres in 1929 to 20,400 acres in 1963 (Figure 1). The annual production in the same period increased from 75,000 bushels to 2,041,667 bushels. The North Carolina acreage of pickle cucumbers accounted for 18 percent of the United States total in 1963, and the state's production totaled 10 percent of the United States production.

The acreage and production of pickle cucumbers in North Carolina are increasing rapidly (Figure 4). The 1963 acreage in the state was 40 percent above the 1960 acreage, while the United States increase in the

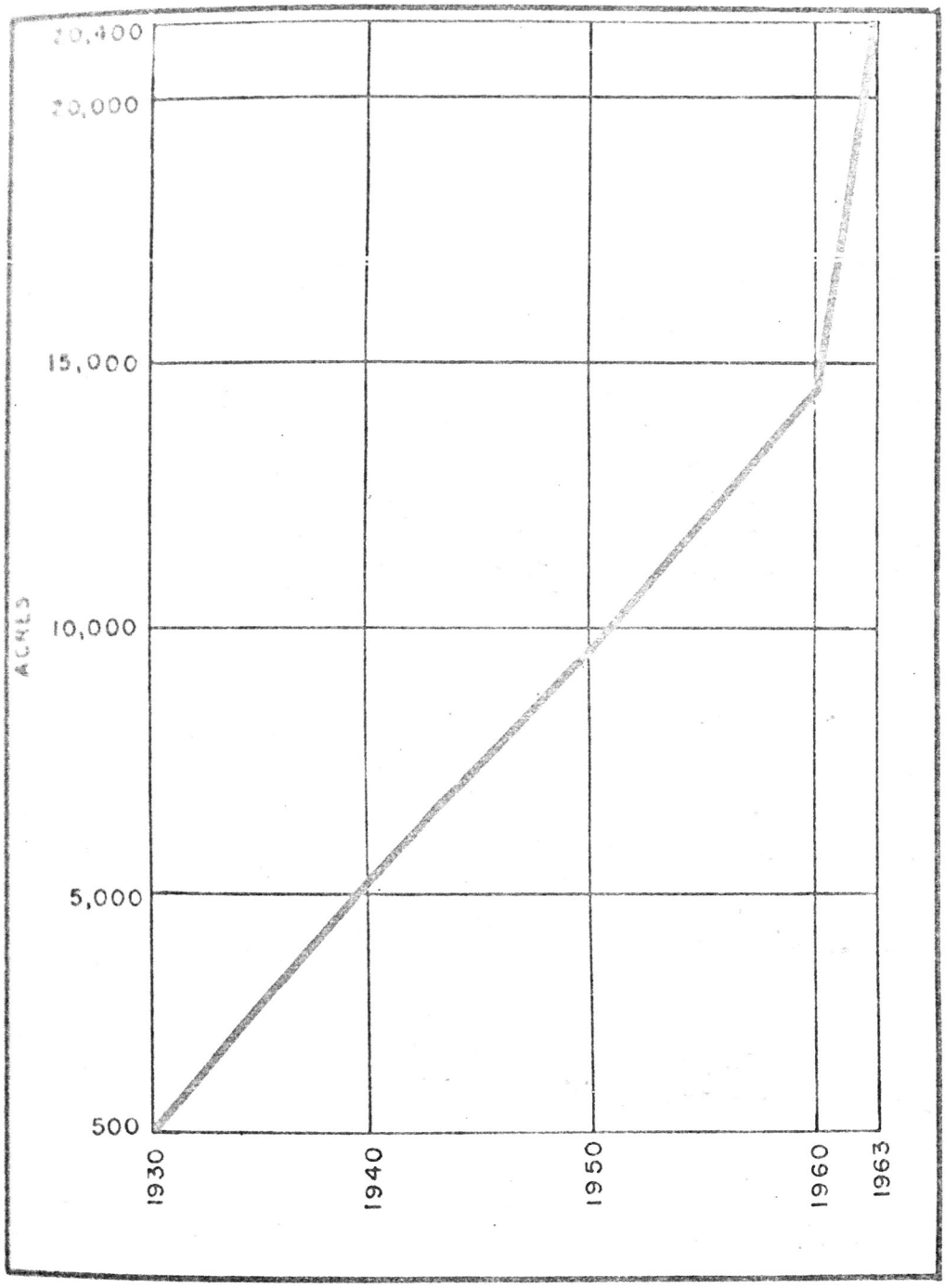

Figure 1. North Carolina Pickle Cucumber Acreage, 1930-1963 (Source: Appendix A).

same period was 17 per cent. Michigan's increase was 13 per cent, and the Wisconsin increase was 3 per cent. (Michigan and Wisconsin had the first and second largest productions of cucumbers in 1963). The relative as well as absolute increase of North Carolina pickle cucumber acreage over a longer period is shown by the following figures expressing the 1963 acreages as percentages of the 1950-1959 average acreages: North Carolina, 147 per cent; Michigan, 66 per cent; Wisconsin, 75 per cent; and the United States, 86 per cent. The North Carolina production of pickle cucumbers has increased greatly but not as much as the acreage in comparison to other states. The following figures express the 1963 cucumber productions as percentages of the average productions of 1950-1959: North Carolina, 180 per cent; Michigan, 163 per cent; Wisconsin, 122 per cent; and the United States, 152 per cent.[7]

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[7] The statistics in this section are from the following sources: United States Department of Agriculture, Agricultural Statistics (1941), p. 242; United States Department of Agriculture, Vegetables-Processing (1963), pp. 20-1; United States Department of Agriculture, Agricultural Statistics (1962), p. 271.

CHAPTER II

PICKLE CUCUMBER PRODUCTION IN NORTH CAROLINA AND ITS LOCATION FACTORS

The North Carolina pickle cucumber producing region has physical and economic characteristics favorable for the production of this crop. These characteristics are supplemented by a greater market demand for North Carolina pickle cucumbers than the state currently produces.

A. DISTRIBUTION OF PICKLE CUCUMBER ACREAGE

The pickle cucumber growing region of North Carolina includes most of the coastal plain and parts of the eastern portion of the piedmont, especially in the north (Figure 2). Several of the easternmost coastal plain counties are excluded from the region because of poor, droughty, or wet soils. The pickle cucumber growing region of North Carolina can be divided into four general areas with four nuclei of concentrated production.

The Northern Area of Pickle Cucumber Production

The pickle cucumber production of the northern area centers on Warren County on the northeastern piedmont and extends southeastward to United States Highway 301. Approximately 6,335 acres of pickle cucumbers were grown in the northern area in 1963.[1] The estimated acreages of the

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[1] Acreage figures are based on estimates by county agricultural agents.

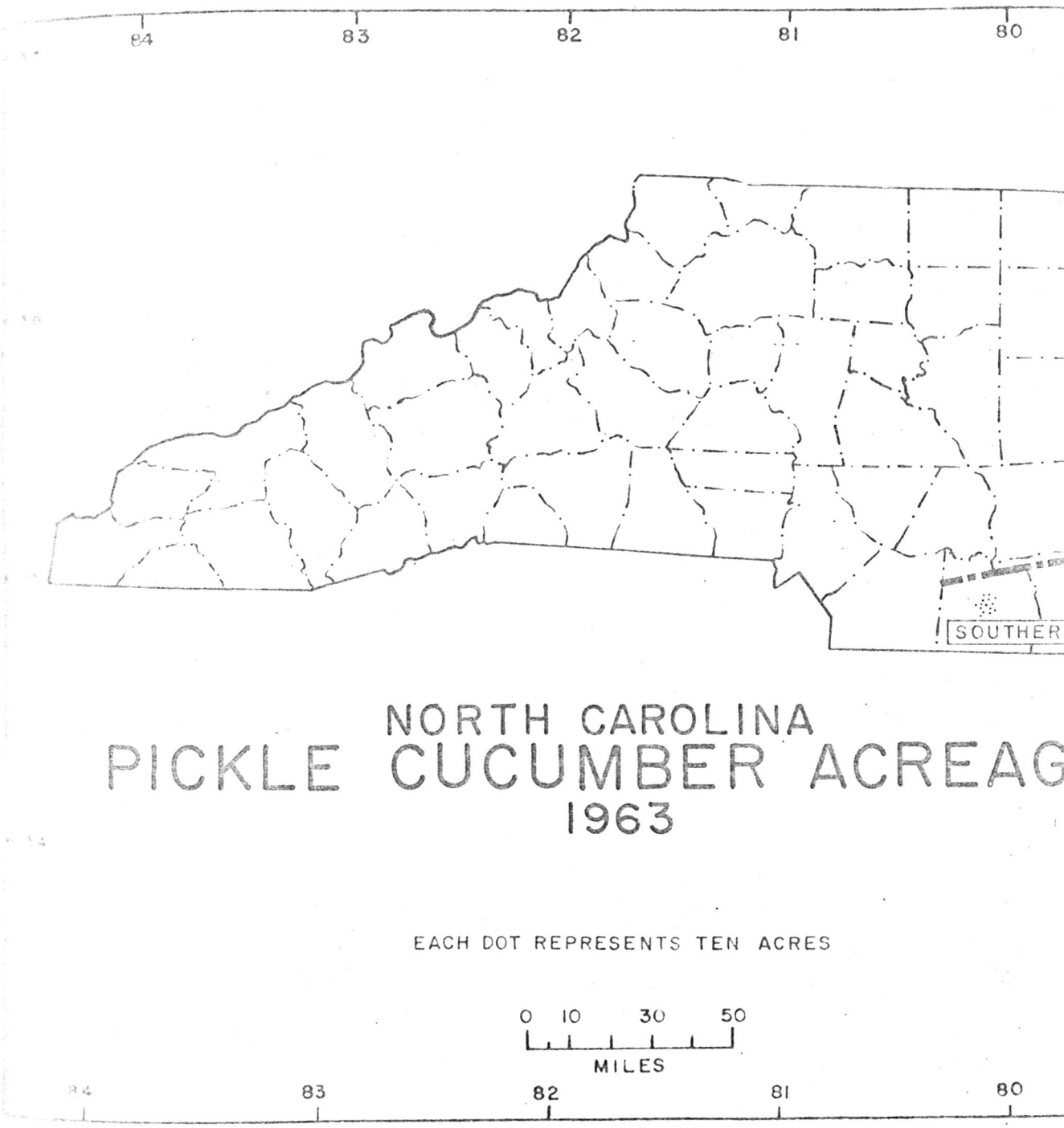
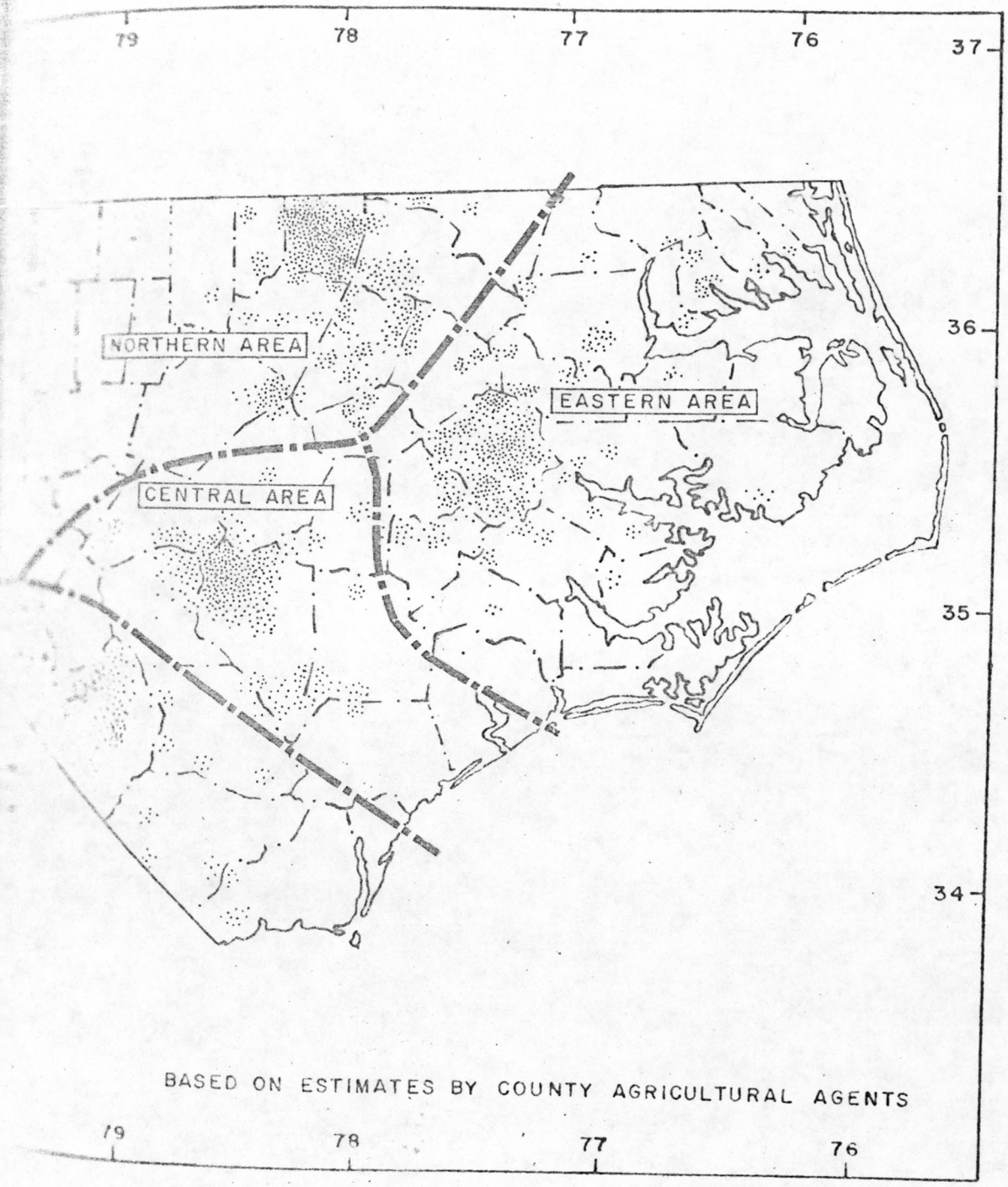


Figure 2. North Caroli



...e cucumber acreage. 1963.

counties in the northern area in 1963 are as follows: Warren County, [illegible] acres; Nash County, 950 acres; Halifax County, 600 acres; Franklin County, 400 acres; Wake County, 400 acres; Vance County, [illegible] acres; Granville County, 60 acres; and northern Edgecombe County, [illegible] acres. The northern area also extends northward into southern Virginia, and some of the cucumbers produced in the area in North Carolina are carried to an assembly point at Emporia, Virginia (Appendix C).

One of North Carolina's two largest pickle factories is located in the northern area. The factory and brinery of the Perfect Packed Products Company are at Henderson in Vance County. A brinery is maintained by the Mount Olive Pickle Company at Littleton in Halifax County. These two companies with factories at Henderson and Mount Olive (both in the northern area) control most of the cucumber production in the northern area. The company that manufactures pickles at Faison has some acreage in the extension of the area into Virginia. Practically all of the cucumbers produced in the northern area are manufactured into pickles in North Carolina factories.

The Eastern Area of Pickle Cucumber Production

Pitt County is the center of concentration of the pickle cucumber production of the eastern area. The area extends from the Pitt County area eastward to include several coastal counties with small acreages. Some of the adjacent coastal counties do not grow pickle cucumbers. The estimated acreage of the eastern area in 1963 was 5,235 acres. Over 50 percent of the area's acreage is concentrated in Pitt County and the counties adjacent to it. The estimated 1963 acreages of the more important

producing counties of the eastern area are as follows: Pitt County, 2,300 acres; Martin County, 600 acres; Greene County, 300 acres; Bertie County, 350 acres; Beaufort County, 300 acres; Perquimans County, 300 acres; Craven County, 250 acres; southern Edgecombe County, 225 acres; and Lenoir County, 200 acres. The acreages of the counties of the eastern area with smaller acreages are estimated to be as follows: Washington County, 75 acres; Chowan County 60 acres; Hyde County, 57 acres; Pamlico County, 50 acres; Pasquotank County, 50 acres; Jones County, 50 acres; Gates County, 45 acres; Hertford County, 10 acres; and Onslow County, 8 acres.

Two brineries and factories operate within the eastern pickle cucumber growing area at Ahoskie in Hertford County and Ayden in Pitt County. The Lutz and Schramm factory at Ayden is mainly responsible for the concentrated production in the Pitt County area, and the Ahoskie factory has smaller, scattered acreage in the northern part of the eastern area. However, all the North Carolina pickle companies and several out-of-state companies have cucumber acreage contracted in the eastern area. Approximately 80 percent of the cucumbers grown in the eastern area are processed in North Carolina factories.

The Central Area of Pickle Cucumber Production

The pickle cucumber production of the central area is concentrated in northeastern Sampson County. Approximately 4,855 acres of cucumbers were grown in the area in 1963. The estimated acreages of the counties in the area are as follows: Sampson County, 3,000 acres; Harnett County, 600 acres; Cumberland County, 400 acres; Duplin County, 325 acres;

Wayne County, 245 acres; Johnston County, 160 acres; Pender County, 75 acres; and Moore County, 50 acres.

Three brineries and two pickle factories operate within the central area of cucumber production. Consolidated brinery-pickle factory units exist at Mount Olive (one of the state's two largest factories) in southern Wayne County and at Faison in northeastern Duplin County. A brinery is operated at Wallace in southern Duplin County by a company specializing in sales of fresh cucumbers. The majority of the acreage in the central area furnishes cucumbers to the factory at Faison, while a large part of the production is processed at the Mount Olive factory. The Wallace Pickle Company has small acreage in the area. A firm manufacturing pickles in Maryland also has a small acreage in the central area. Only a small proportion of the cucumbers produced in the central area are processed outside of North Carolina.

The Southern Area of Pickle Cucumber Production

The southern cucumber area is centered in western Robeson County. The pickle cucumber acreage of the southern area in 1963 was an estimated 3,380 acres. The acreages of the counties in the area are estimated to be as follows: Robeson County, 3,000 acres; Balden County, 312 acres; Brusnwick County, 175 acres; Anson County, 155 acres; Columbus County, 135 acres; Scotland County, 100 acres; and Hoke County, 100 acres. The southern area extends to a slight degree into the adjacent parts of South Carolina.

A brinery at Parkton in Robeson County is the only processing facility in the southern cucumber area. The company that operates the brinery specializes in sales of fresh cucumbers and has its principal

assembly and shipping station at Saint Pauls in Robeson County.

The majority of the cucumber acreage in the southern cucumber area is controlled by the Addis Cates Company. The Tree Pickle Company, which manufactures pickles in western New York, also has important acreage in the area. Its assembly and shipping station is at Lumberton in Robeson County. Other companies with pickle cucumbers contracted in the southern area are the Perfect Packed Products Company, which manufactures at Henderson, and the Wallace Pickle Company of Wallace. Approximately 95 percent of the cucumber production of the southern area is processed in factories outside of North Carolina. New York is the principal state processing the cucumbers of the southern area because of the important acreage of the Tree Pickle Company.

B. PHYSICAL ASPECTS OF PICKLE CUCUMBER PRODUCTION AND PHYSICAL LOCATION FACTORS

Climatic Requirements[2]

Temperature Requirements of Cucumbers.-- The cucumber plant requires warm temperatures because it can be killed by even a light frost. The ideal temperature for germination is 70 degrees Farenheit, and germination seldom occurs below 50 degrees Farenheit. The best temperature for growth of the cucumber plant is between 75 and 80 degrees Farenheit. The rate of growth of leaves is slowed by temperatures above the optimum but not by temperatures below the optimum requirements. However, soil temperatures

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[2] The primary sources for the physical or natural factors are: North Carolina Agricultural Extension Service, Cucumber Production in North Carolina (1954); Thomas W. Whitaker and Glen N. Davis Cucurbits (1962), Chapters 5-7.

of 70 degrees Farenheit or higher are needed for optimum cucumber growth. The growing season requirement is from 55 to 65 days from the planting date to the first harvest and from 85 to 100 days from the planting to the last harvest.

All areas of North Carolina have an average growing season of over 100 days. The shortest average growing season in North Carolina is reported for Mount Mitchell in Yancey County with 128 days. The longest frost-free season is 269 days at Beaufort in Carteret County. The length of the shortest average growing season is long enough for one crop of cucumbers, while two and perhaps three crops could be produced in the period of the longest average growing season. The central and eastern piedmont and all of the coastal plain have an average frost-free period of over 200 days.[3]

The average dates of the last killing frost in North Carolina are important for the pickle cucumber production because of their relation to the dates of the harvest season (Figure 3). Approximately one-third of the entire production of the 20,400 acres in the state in 1963 was shipped to factories in the states to the north of North Carolina. The growing areas of North Carolina, which have an earlier season for the pickle cucumber crop, provide cucumbers for processors in the northern states. Even in North Carolina the southernmost pickle cucumber growing areas provide cucumbers to the processors in the northern part of the state 10 to 14 days in advance of the northern growing areas.

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[3] The climatic data is from: United States Department of Agriculture, Climate and Man (1941), pp. 1035,1042.

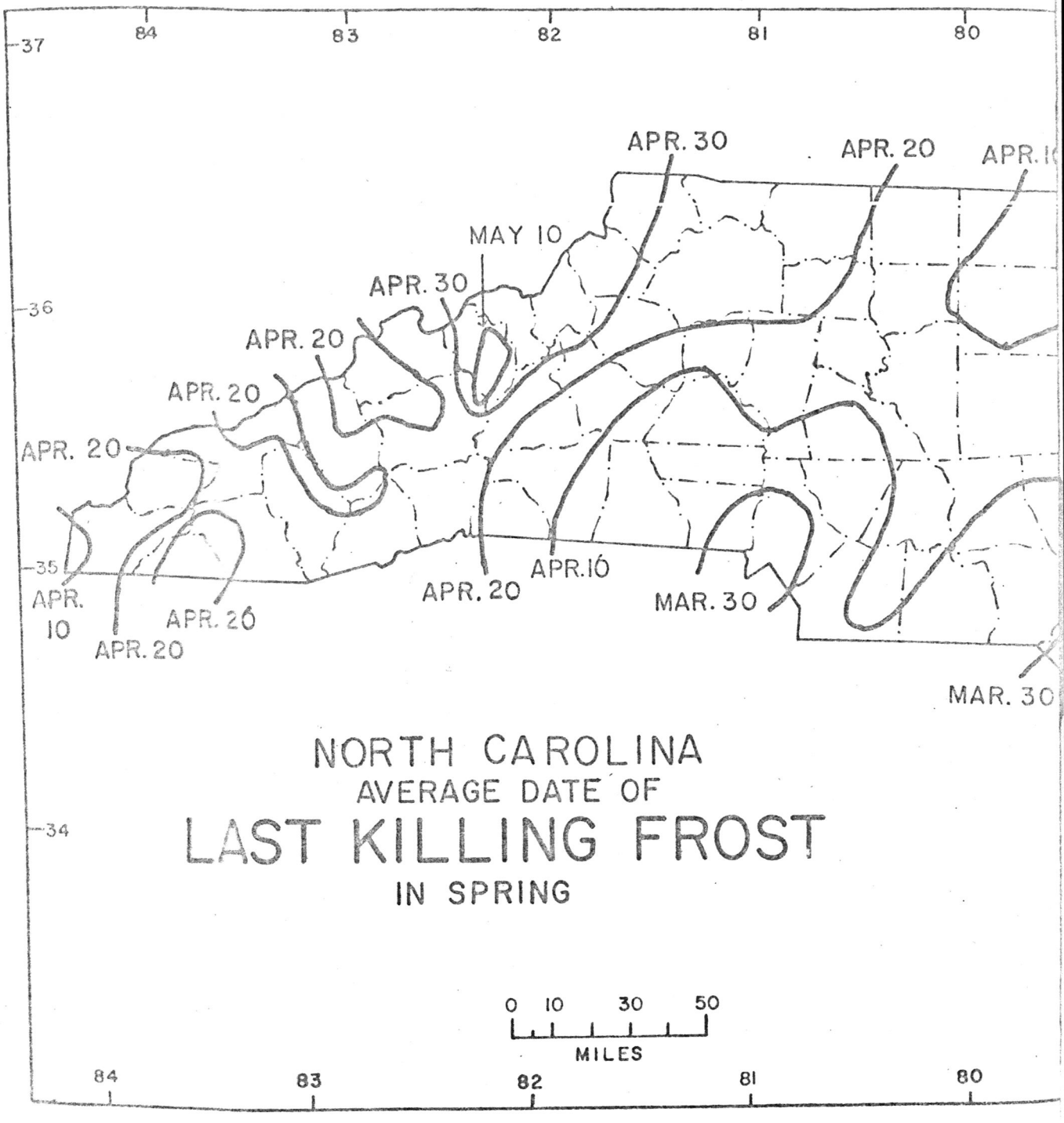
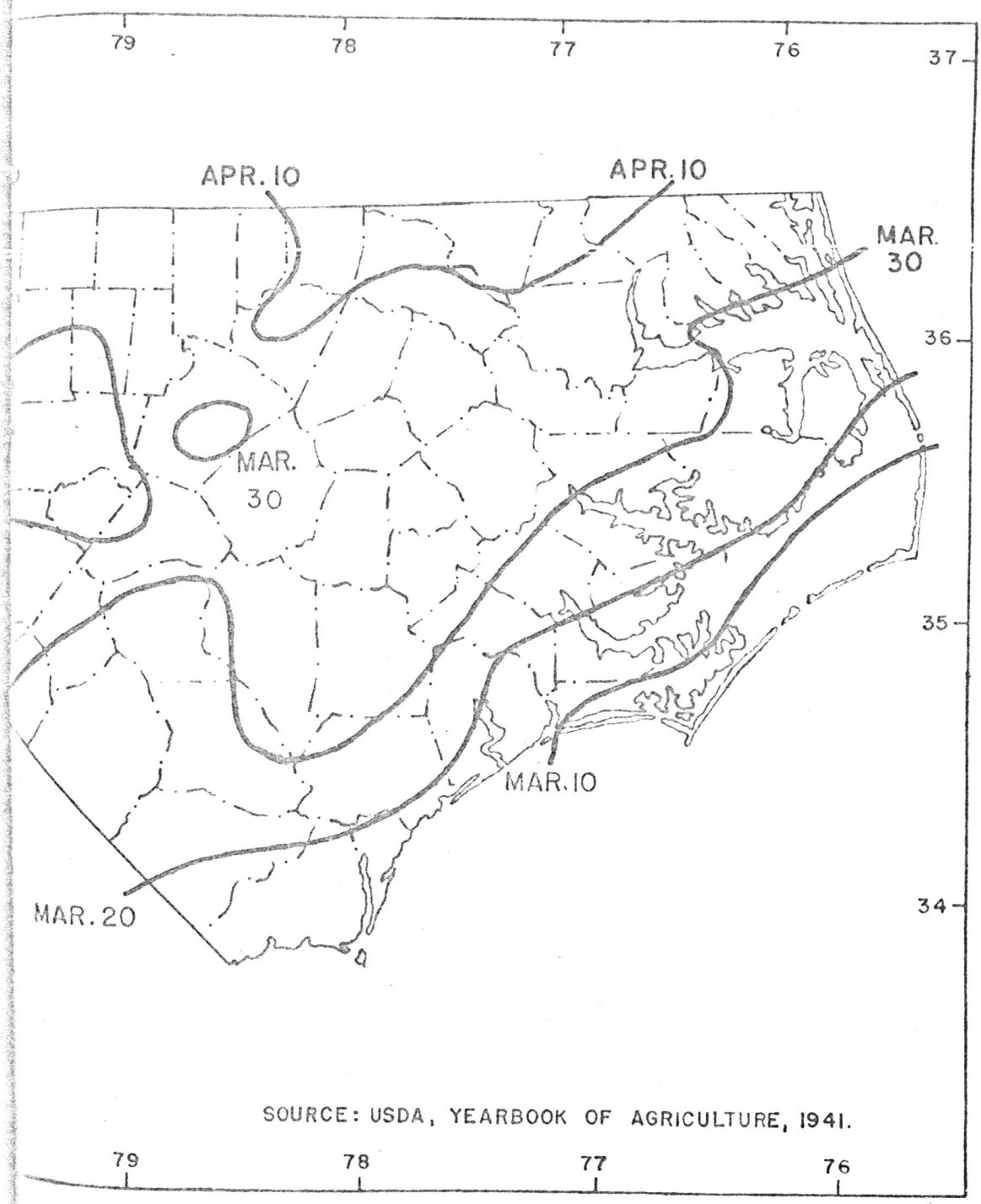


Figure 3. North Carolina
frost in spring.



rage date of last killing

The lower average temperatures during the growing season in the mountain region of North Carolina provide conditions favorable for the development of the cucumber disease scab, which has limited production in that region.

Rainfall Requirements of Cucumbers.-- Moderate amounts of rainfall well-distributed throughout the growing season provide the best moisture conditions for maximum cucumber yield. Optimum water intake by cucumber plants requires a soil temperature of 70 degrees Farenheit or higher.

The average rainfall for North Carolina, 1942-1961, for the months of the cucumber growing season are: April - 3.56 inches; May - 3.89 inches; June - 4.35 inches; July - 5.88 inches.[4] A large part of the rainfall in the warm months is convectional in origin.[5] The rainfall in North Carolina throughout the year and growing season is fairly well distributed. However, 40 days of drought can be expected in five out of ten years in the northern pickle cucumber producing region. In one out of ten years over 60 days of drought can be expected in all of the cucumber growing areas except for a small area in the southeastern part of the state.[6]

Soil Requirements of Cucumbers

Sandy loam soils are considered the best soils for production of

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[4] United States Department of Agriculture-North Carolina Department of Agriculture, North Carolina Agricultural Statistics (1962), p. 73.

[5] United States Department of Agriculture, Climate and Man (1941), p. 1004.

[6] North Carolina Agricultural Experiment Station, Agricultural Drought in North Carolina (1956), pp. 46-7.

pickle cucumbers in North Carolina (Figure 4). However, cucumbers are grown on a wide range of soils, and good yields have been obtained on loams, clays, peat, and muck soils. The lighter soils are especially recommended when an early harvest is desired because they warm up quicker than the heavier soils in the spring. Cucumbers are sensitive to acidity and should not be grown on soils with a pH less than 5.5. The ideal pH range[7] is pH 6.0 to 6.5.

In the northern area of the North Carolina pickle cucumber region, clay loam soils give the best yields. The northern area experiences more drought than the other areas of the North Carolina pickle cucumber producing region,[8] and the preference for heavier soils might be due to their greater water-holding capacity. Poorly drained soils should not be used for cucumbers. Coarse sandy soils that would be extremely droughty in case of rainfall deficiency should not be used for cucumbers unless irrigation is available.

The eastern part of North Carolina has extensive areas in which the predominant soil associations are characterized by sandy loam topsoils (Figure 3). This area includes the eastern piedmont and the coastal plain except for most of the coastal areas, which have mainly sandy, muck, or silt loam soils.[9] The sandhills area in the southwestern coastal

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[7] The pH factor is a measure of acidity-alkalinity. pH 7 is neutral, pH 14 is maximum alkalinity, and pH 0 is maximum acidity.

[8] North Carolina Agricultural Experimental Station, Agricultural Drought in North Carolina (1956), pp. 46-7.

[9] North Carolina Department of Agriculture, Fertility Status: North Carolina's Coastal Plain Soils (1961), p. 4.

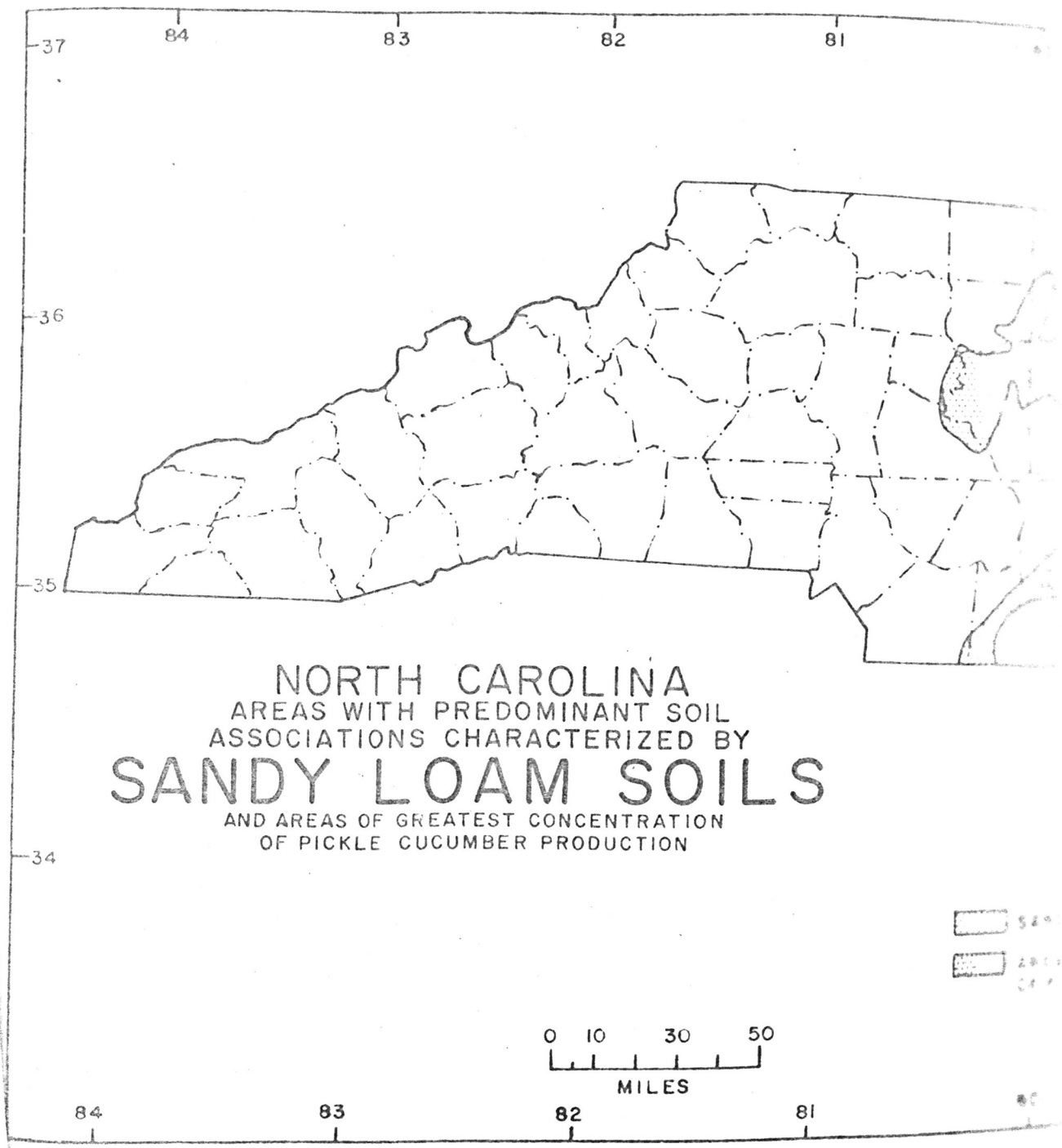
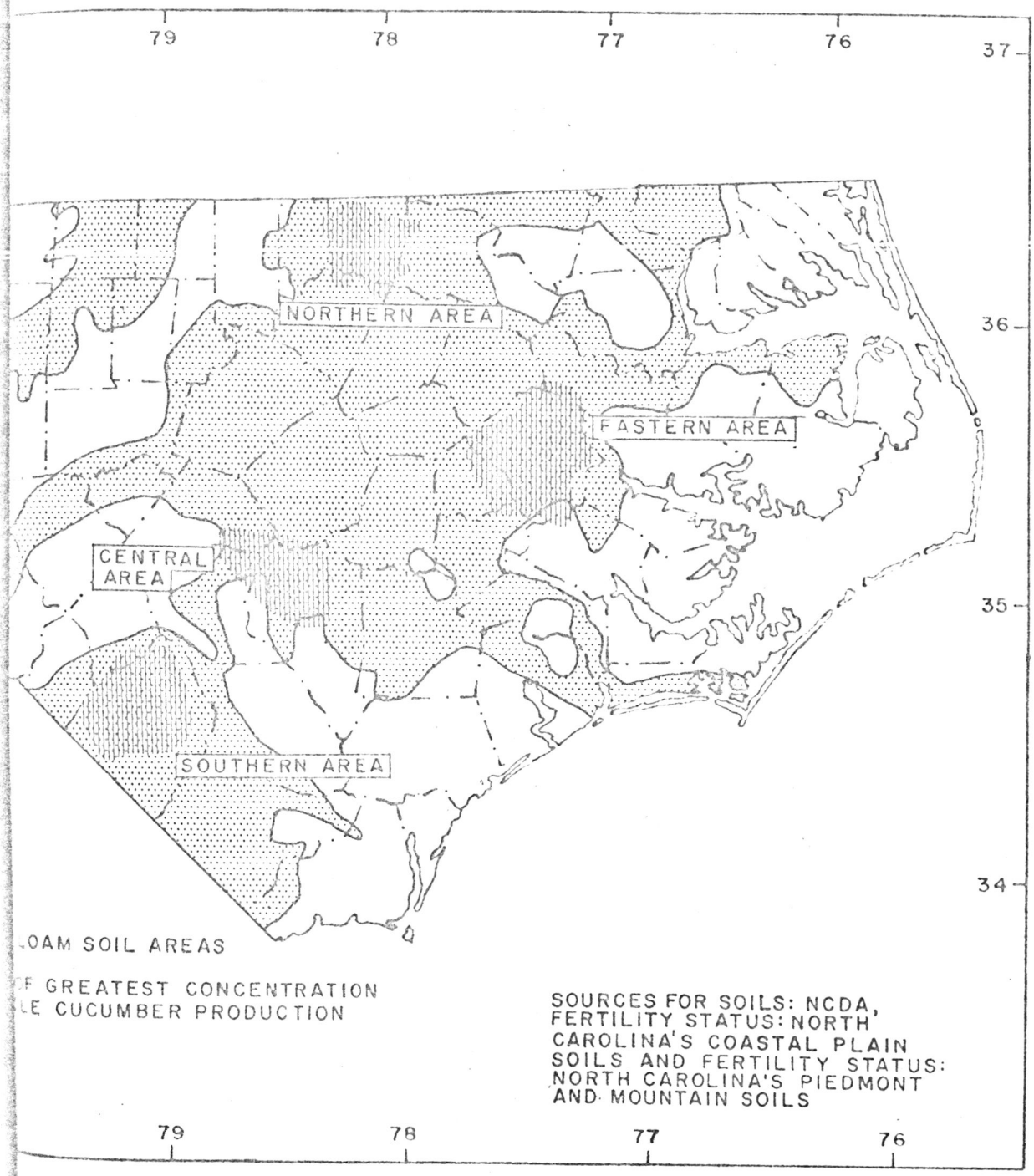


Figure 4. North
associations
and areas of
cucumber



OAM SOIL AREAS

F GREATEST CONCENTRATION
E CUCUMBER PRODUCTION

a areas with predominate soil
terized by sandy loam soils
st concentration of pickle

plain also lacks extensive areas of sandy loam soils.

Pollination

Cucumber plants produce both male and female flowers except for a rare type that produces only female flowers. The pollen must be transferred from the male to the female flower for the fruit to develop. If a female flower is not pollinated, it dies and falls off the vine. Inadequate pollination causes the fruit to be poorly shaped and the yield to be reduced.

The cucumber pollen is sticky and can be transferred only by insects. Bees are the principal agent of pollination of cucumbers, and the number of bees in a field affects the yield. Placing bee hives close to cucumber fields is a recommended practice. Poor pollination occurs if bee activity is slowed down by extended periods of cool and cloudy or rainy weather. Insecticides should be applied to cucumbers only in the late afternoon in order to minimize the harm to bees.

Diseases and Insect Pests

Diseases of Cucumbers.[10] -- The major cucumber diseases in North Carolina are damping-off, angular leaf spot, anthracnose, downy mildew, root-knot, scab, and bacterial wilt. The principal methods of controlling damage by diseases are the use of disease-free and treated seed, the practice of crop rotation, the use of sanitary field practices, the application of fungicidal dusts and sprays, soil fumigation, and the

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[10] The primary sources for this section are: North Carolina Agricultural Extension Service, Cucurbit Diseases in North Carolina (1963); North Carolina Agricultural Extension Service, Cucumber Production in North Carolina (1954), pp. 16-9. A good secondary source is: Thomas W. Whitaker and Glen N. Davis, Cucurbits (1962), Chapters 7 and 8.

use of the seeds of disease-resistant varieties of pickle cucumbers. Crop rotation is recommended to avoid diseases caused by organisms that winter in the soil on parts of old cucurbit plants. Cucumbers should not be grown on land where cucumbers or other cucurbits were grown the previous year, or, preferably, the previous two years. Sanitary field practices include avoiding the use of fields near other fields where cucurbits were grown the previous year, avoiding cultiviation or harvesting when the plants are wet in order to reduce spreading of disease organisms in fields, and plowing cucurbit plants under deeply after the harvest to speed up decay of the plants in order to reduce survival of disease organisms in them.

Downy mildew and anthracnose are the two most important cucumber diseases in North Carolina. Both of them are most severe during the later parts of the season and during wet weather. These diseases can end the cucumber harvest prematurely. However, their importance in North Carolina is limited by the fact that the cucumbers would be abandoned because of the tobacco harvest even if they continued to yield.

Anthracnose is a seed-borne disease, which also survives in the soil on parts of dead plants. It can cause damage to the cucumbers in transit as well as in the fields. Pickle cucumber varieties that are resistant to anthracnose have been developed, but none of them are in general use in North Carolina.

Downy mildew, like anthracnose, is caused by a fungus. Air currents transport it to North Carolina each spring from areas farther south. Fall crops of cucumbers are usually severely damaged by downy mildew. The Pixie variety of pickle cucumbers is resistant to downy mildew, but

...ilt as to the vine. The pickleworms arrive in southeastern North ...lina from areas farther south each spring about the first of ... The melonworm is similar to the pickleworm, but it feeds on the ...t less than the pickleworm does.

The striped cucumber beetle and the melon aphid are also important ...s of cucumbers. The melon aphid is the more serious in the southern ...ast. It can weaken and even kill cucumber plants. The striped ...umber beetle causes damage principally by spreading the organisms ...t cause bacterial wilt. The spotted cucumber beetle is similar to ... striped cucumber beetle but less serious. The squash bug and the ...sh vine borer do relatively small damage to cucumbers in North Carolina.

C. ORGANIZATION OF PICKLE CUCUMBER PRODUCTION IN NORTH CAROLINA

Pickle cucumbers are grown by farmers in North Carolina only ...e contract. The contracts used by the buying companies must be ...ved by the North Carolina Department of Agriculture each year before ...racting with the farmers begins. Any buyer not paying cash for ...e products bought in North Carolina must obtain a permit from the ...rtment of Agriculture by establishing financial responsibility and ...station.[12]

The farmers contract to grow a certain number of acres of pickle

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[12] North Carolina Department of Agriculture, Rules, Regulations, ...tions, and Standards, Chapter III, Article 2.

cucumbers with seed provided by the buying company. The buying company agrees to buy the cucumbers of a specified size and quality that are delivered to the receiving station at a certain place during a specified period (Plate A). The buying company may buy cucumbers before or after the period specified in the contract.

The contract also specifies the prices to be paid to the farmers. The cucumbers are graded into three sizes at the receiving stations, and a different price is paid for each size. The number one pickle cucumbers (the smallest) have a maximum diameter of one and one-sixteenth inches. Their price is six dollars per hundred pounds (about two bushels) or six cents per pound. The number of two pickle cucumbers have a diameter of from one and one-sixteenth inches to a maximum of one and one-half inches. The price paid for them is two dollars and twenty-five cents per hundred pounds or two and one-fourth cents per pound. The number three pickle cucumbers have a diameter of from one and one-half inch to a maximum of two inches. Their price is one dollar per hundred pounds or one cent per pound. The buying companies are not obligated to buy cucumbers with a diameter over two inches or those that are deformed, ball shaped, or diseased. The pickle companies sometimes offer to buy oversized or poorly shapped cucumbers for 25 cents per bushel. The farmers are paid by check at the time of delivery or are paid weekly for the deliveries during the week.

North Carolina farmers received an average of 1.28 dollars per bushel for pickle cucumbers in 1963. The average prices per bushel were 1.33 dollars in Michigan, 1.46 dollars in Wisconsin, and 1.36 dollars

the entire United States.[13]

Each receiving station buys the production of an average of about [illegible] acres of cucumbers. The buying companies transport the cucumbers by truck to their brineries or pickle factories or to assembly points to load trucks for longer distance shipping.

D. PICKLE CUCUMBER VARIETIES AND SEED USED IN NORTH CAROLINA

Varieties of Pickle Cucumbers Used in North Carolina

Several characteristics are desired of any variety of pickle cucumbers. The varieties chosen to be grown in particular areas usually have the most favorable combinations of characteristics for that area. The ideal variety of pickle cucumbers would, first, produce large yields. Second, in form, it would have blunt ends and would have a length to width ratio of 2.9:1 or 3:1. Third, the color of the fruit would be uniform and light to dark green. Fourth, interiorly, the carpel attachment would be strong and the seeds late-developing because large seeds are undesirable in cucumber pickles. Fifth, the skin of the fruit would be tender so that pickling solutions could enter the fruit easily and the pickle would be tender to eat. Sixth, the cucumber plant would be resistant to all cucumber diseases.

The principal variety of pickle cucumbers grown in North Carolina is called Model. This variety, introduced in 1946 by the Asgrow Seed

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[13] United States Department of Agriculture, Vegetables-Processing (1963), p. 21. The published figures are given as dollars per ton. The U.S.D.A. uses 48 pounds as the weight of a bushel of pickle cucumbers although 50 pounds per bushel is used in commerce.

Company, is adapted to growing conditions in the southern states.[14] Model gives good yields. Its fruit is "medium green, blunt ended, and sticky" and holds up well in shipment.[15] The latter characteristic is important because of the large percentage of North Carolina pickle cucumbers that is shipped out of the state fresh. Model cucumbers also brine well. The major deficiency of the Model variety is its lack of resistence to cucumber diseases. The Model harvest season is often ended by diseases earlier than the natural cessation of the yielding by the plant. However, this is not serious in most of the North Carolina producing regions because the cucumbers would be generally abandoned because of the tobacco harvest even if they continued to yield.

Pixie, another variety of pickle cucumbers, is used in some places in the northern and eastern cucumber growing areas. This variety is resistant to downy mildew, powdery mildew, and anthracnose. Therefore, it is especially useful for growing in areas where cucumber diseases are sever. The resistance of Pixie to the major diseases of the North Carolina cucumber region also allows a longer harvest season in areas where the cucumbers are not abandoned for the tobacco harvest. Pixie cucumbers are not good for brining because their carpels separate easily. This defect prevents Pixie from being widely grown in North Carolina. The Pixie variety was developed by Dr. W. C. Barnes of the Clemson College Truck Experiment Station at Charleston.

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[14] Thomas W. Whitaker and Glen N. Davis, Cuburbits (1962), p. 57.

[15] North Carolina Agricultural Extension Service, Cucumber Production in North Carolina (1954), p. 7.

Seed Used in North Carolina

The companies contracting pickle cucumbers provide seed to the growers in order to insure that the desired varieties of cucumbers will be grown. One pound of seed is necessary to plant one-half acre. The price of the seed, one and one-half dollars per pound, is deducted from the payment to the farmers for cucumbers delivered. California is the principal source of the pickle cucumber seed used in North Carolina; Colorado is a secondary source. Seed grown in dry climates, such as in California and Colorado, are less likely to carry disease organisms.

E. AGRONOMICAL PRACTICES IN GROWING PICKLE CUCUMBERS

The preparation of fields, fertilization, planting, thinning, and cultivation are important matters in the production of pickle cucumbers.[16] Approximately 20 man-hours of labor per acre were used in the pre-harvest period to produce pickle cucumbers in North Carolina in 1959.[17]

Preparation of Fields

Fall plowing of fields is advisable to reduce infection by cucumber diseases that winter in the soil. If the land has not been plowed in the fall, it should be plowed three or four weeks before the planting date. The land should be harrowed immediately after plowing and several times thereafter before the planting date. The field is bedded with five or six feet between rows, and the seed is planted on top of the beds.

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[16] The primary source for this section is: North Carolina Agricultural Extension Service, Cucumber Production in North Carolina (1954), pp. 4-12.

[17] United States Department of Agriculture, Labor Used to Produce Vegetables (1964), p. 35.

Fertilization

The amount of fertilizer generally required for pickle cucumbers in North Carolina is 800 pounds of 8-8-8 fertilizer[18] per acre. However, the fertilizer requirement varies with soil differences, and the exact determination of fertilizer requirements by soil testing is highly recommended. Fifteen pounds of nitrogen per acre should be applied as side dressing when the plants are thinned.

Planting

The cucumber seed can be planted either in hills or drilled. The best method is considered to be drilling the seed and then thinning to leave the desired plant density. The seed should be planted at a depth of one-fourth to one-half inch.

The planting date of pickle cucumbers in North Carolina varies from about the tenth of April in the southern area to the first of May in the northern area (Figure 4). Since the cucumber seed needs warm temperatures for germination and the plant can be killed by a light frost, the planting must be later than the average date of the last killing frost in the spring.

Thinning

When the cucumber seeds are planted with a drill, two thinnings are necessary. The plants should be thinned to twice the desired number when the vines have three or four leaves. The first thinning reduces the consumption of moisture and fertilizer by the unnecessary plants. However,

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[18] The 8-8-8 fertilizer contains eight percent, each, of nitrogen, phosphoric acid, and potassium carbonate (potash).

enough plants are left to insure a good stand in case of drought or damage by insects or diseases. When the vines are about six inches long the plants are thinned to a 12 to 14 inch interval in the rows. The second and last thinning takes place late enough to insure a good stand and early enough to prevent the excessive number of plants from disturbing the early growth of the vines. The plants thinned out should be cut rather than pulled in order to avoid disturbing the root systems of the plants left in the field.

Cultivation

Cultivation serves to conserve soil moisture and plant nutrients by reducing the number of weeds and to permit rainfall to sink into the ground by loosening the soil surface. Cultivation should begin as soon as the emerging plants can be seen a considerable distance down the rows. Subsequent cultivations are made as needed to control weeds. Three to five cultivations, and often one or two hoeings, are usually necessary to control weeds. Cultivation should not be continued after the vines are 15 to 18 inches long or, at the latest, when the fruits begin to form. Cultivation must be shallow because the cucumber roots are shallow and often extend beyond the vines. The vines should be trained up and down the rows in order to shade out weeds.

F. HARVESTING PICKLE CUCUMBERS AND THE EFFECTS OF THE HARVEST LABOR REQUIREMENT

Pickle cucumbers have a higher harvest labor requirement than any other vegetable crop harvested for processing in the United States. An

estimated 80 man-hours of labor were used in 1959 to harvest pickle cucumbers in North Carolina, while 129 man-hours per acre were used in the United States as a whole.[19] The ability to provide the necessary harvest labor is an essential factor for the pickle cucumber production in North Carolina.

Harvesting Cucumbers in North Carolina

The harvest season of pickle cucumbers in North Carolina begins about May 25 in the southern area, June 1 in the eastern area, and June 10 in the northern area. The first pickings give small yields, and reasonably large yields begin at least one week after the harvest begins. The first, early pickings are necessary even though the yields are small. The production of fruit by the vine is reduced if the cucumbers are allowed to ripen on the plant. An average pickle cucumber plant will produce an estimated five to ten cucumbers if none are picked, but it will produce 35 to 40 if the immature fruit are picked regularly.

The frequency of picking pickle cucumbers varies with the growing conditions. However, cucumbers grow rapidly. Pickings are generally necessary every other day and sometimes every day in the period of fastest growth. The frequency of pickings is important for pickle cucumbers because the fruit over two inches in diameter is unmarketable and higher prices are paid for the smaller sizes.

Pickle cucumbers are picked by hand as pickers pass along the rows on foot. The pickers sometimes use a "T" shaped stick to spread the

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19 United States Department of Agriculture, Labor Used to Produce Vegetables (1964), pp. 16,35.

vines in order to find the fruit. The cucumbers are put into pails, baskets, or sacks by the pickers and hauled to the receiving stations by truck, car, and wagon. The cucumbers are graded according to size at the receiving stations. Different sizes are separated by being passed over a bed of diverging slats (Plates B and C). The smallest sizes fall through the spaces between the slats first, and the larger cucumbers fall through last.

The use of a tractor-drawn harvesting aid has begun in the eastern area of production, especially in Pitt County (Plate D). Several pickers ride on the harvesting aid and pick the cucumbers as they are drawn along the rows. The use of this harvesting aid is said to reduce harvest labor requirements by two-thirds. Further, the yields are said to be increased by the use of the harvesting aid because of more complete picking and less damage inflicted on the vines by the pickers. Better soils and cultivation practices are also used because the crop becomes economically more important with the higher yields and increased acreage per farmer made possible by the reduced labor requirement.[20]

The Location Influence of the Harvest Labor Requirement

The labor required for growing and harvesting pickle cucumbers in North Carolina is usually provided by the members of the growers' families (Plate D). This limits the acreage that individual farmers can grow because of the large harvest labor requirement. The acreage of pickle cucumbers per grower in North Carolina averages between one and one-half acres. When local hired labor is used, the pickers

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20 "Pickling Cukes Are Making Money for Farmers", Agricultural Review (July 15, 1964), p. 3; Hank Goodman, "Farm Notebook", Kinston Daily Free Press (June 20, 1964), p. 13.

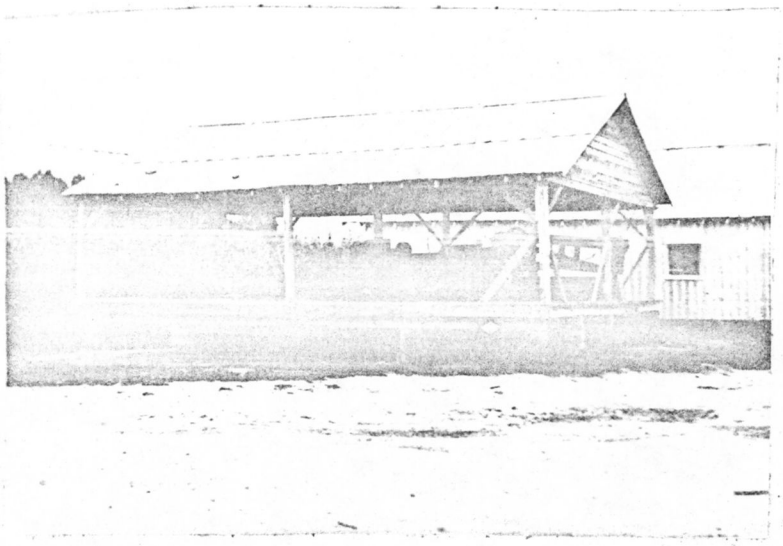

Plate A. Pickle cucumber receiving station in the central cucumber area.

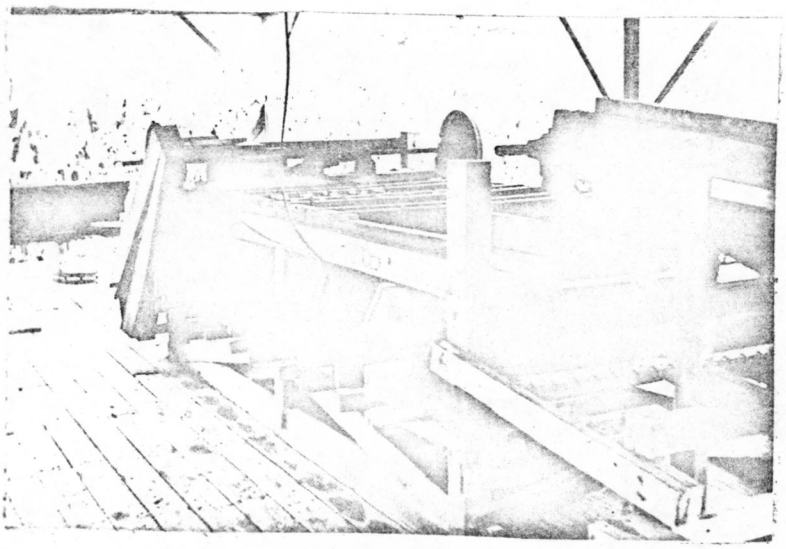

Plate B. Grading machine used to sort the cucumbers by size at the receiving station.

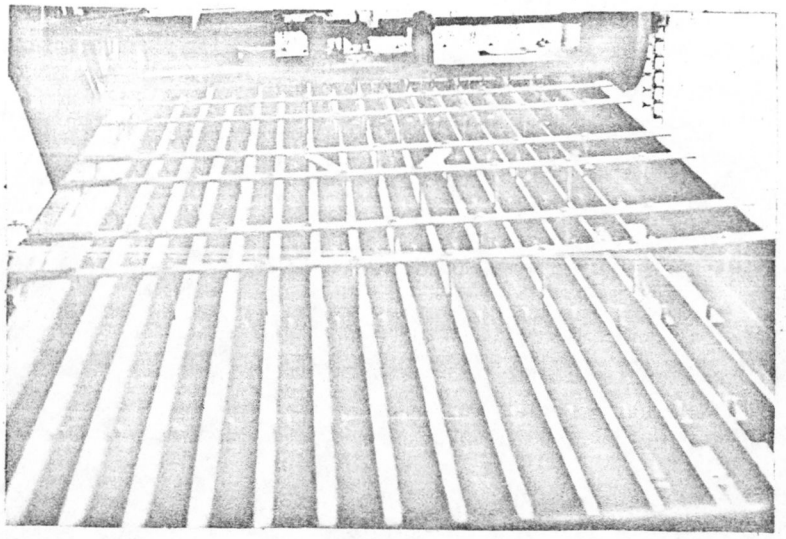

Plate C. Diverging slats of the cucumber grading machine.

Plate D. Picking cucumbers with harvesting aid and child labor in the eastern cucumber area (photographed by Dr. H. Daniel Stillwell).

are generally paid one-half dollar per bushel. The use of Negro migrant labor from Florida to harvest pickle cucumbers has begun in Perquimans County. However, the labor for the pickle cucumber harvest in North Carolina is still provided predominately by the growers and their families.

The North Carolina pickle cucumber producing region has a high percentage of rural-farm population. Only six of the 40 counties reporting pickle cucumber acreage have lower percentages of rural-farm populations than the entire state, which has 17.7 per cent. Eight North Carolina counties have over 500 acres of pickle cucumbers. Four of these counties have over 40 per cent rural-farm population, while three of them have over 30 per cent. The last of these eight counties, Pitt County, has only 28.4 per cent rural-farm population.[21] The lower per cent for Pitt County's rural-farm population is attributable to the location of the city of Greenville within the county.

The large rural-farm populations in the counties of the pickle cucumber growing region provide the large labor requirement of the pickle cucumber harvest. Pickle cucumbers are not responsible for the existence of this large rural-farm population because they are a supplementary income crop and not a major income providing crop. The large rural-farm population in the pickle cucumber growing region depends on flue-cured tobacco, which is the major income yielding crop of the region. Tobacco is, like pickle cucumbers, a crop having a heavy harvest labor requirement, and the production of it in eastern North Carolina has stabilized the large rural-farm population that provides the required labor for the pickle cucumber harvest. The more important income-providing crops

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[21] United States Bureau of the Census, County and City Data Book, (1962), pp. 262, 272.

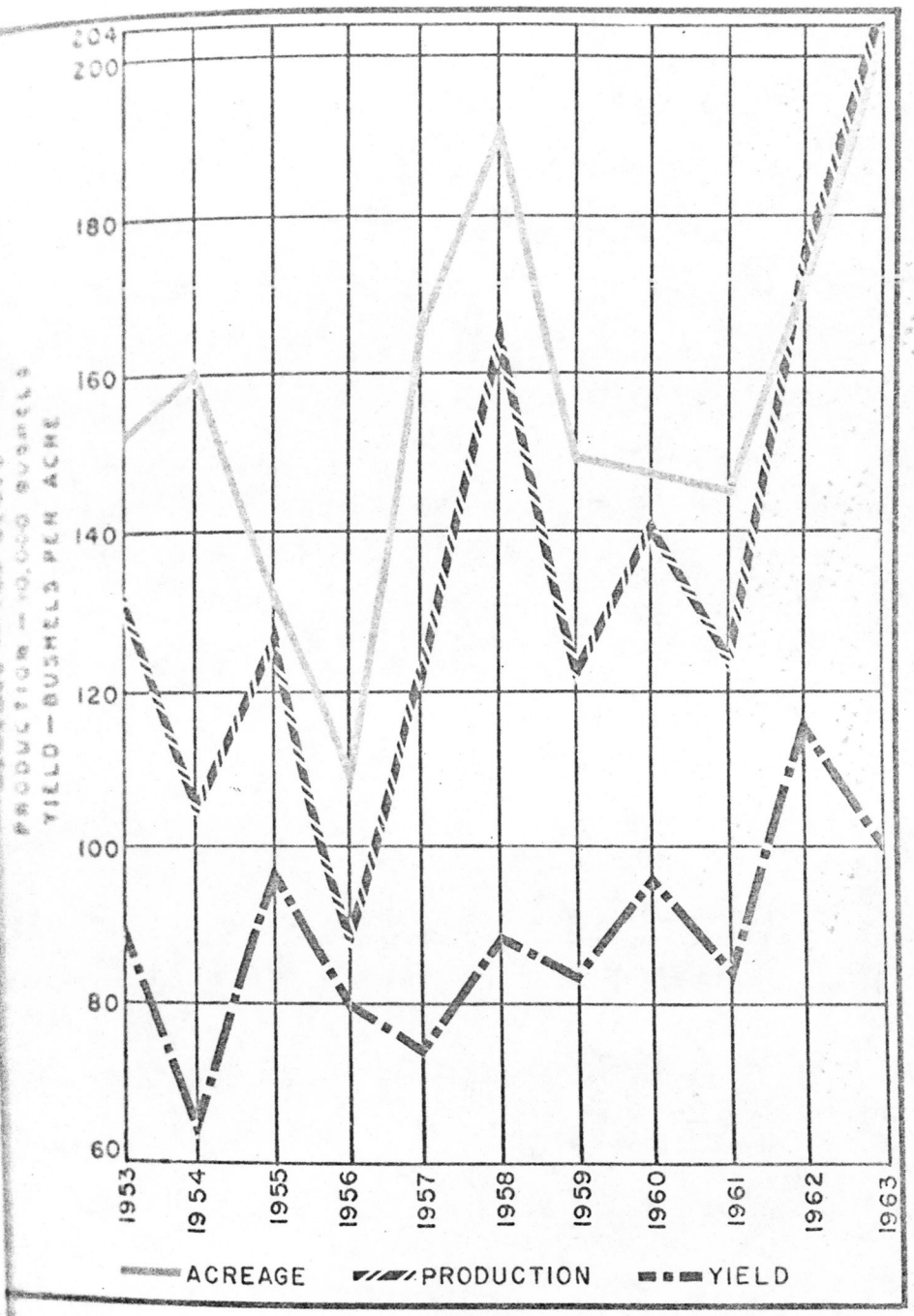

Figure 5. North Carolina Acerage, Production, and Yield of Pickling Cucumbers, 1953-1963 (Source: Appendix A).

the supplementary income crop status of pickle cucumbers in the crop pattern of the growing region. This status results in pickle cucumbers being grown with less care than the more important crops. Increased yields have been reported where the use of harvesting aids have permitted individual farmers to grow acreages large enough to be economically significant.[24]

The North Carolina production of pickle cucumbers in 1963 was 1,641,667 bushels, which was 10 per cent of the United States production. Only two states, Michigan and Wisconsin, had higher productions in 1963. Michigan produced 5,676,250 bushels, and Wisconsin produced 2,062,500 bushels. In 1962 only Michigan produced more pickle cucumbers than North Carolina. The growers received 2,622,000 dollars for the 1963 crop in North Carolina, while the crop was worth 7,329,000 dollars in Michigan and 3,020,000 dollars in Wisconsin. In the United States 26,899,000 dollars were paid for the 1963 pickle cucumber crop.[25]

H. MARKETS FOR NORTH CAROLINA PICKLE CUCUMBERS

North Carolina brineries and pickle factories are the principal markets for the pickle cucumbers grown in the state. The production of an estimated two-thirds of the pickle cucumber acreage in North Carolina is processed in factories within the state. All of the North Carolina

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[24] "Pickling Cukes Are Making Money for Farmers", Agricultural Review (July 15, 1964), p. 3.

[25] United States Department of Agriculture, Vegetables-Processing (1963), p. 21.

pickle cucumber processing factories are located within the pickle cucumber growing region (Figure 6).

Fresh pickle cucumbers that are shipped out of the state are processed predominately in states to the north of North Carolina. Maryland is the principal out-of-state recipient of North Carolina pickle cucumbers. The states of New York, Michigan, and Virginia are of second order importance, while Pennsylvania is at the third level of importance as an out-of-state processor of North Carolina pickle cucumbers. Other states north of North Carolina as far as New York and west as far as Michigan process smaller quantities of North Carolina cucumbers.

Some of the state's cucumbers are exported to Canada for processing. The out of state companies obtain North Carolina cucumbers either by contracting acreage in the state or by buying from companies that have acreage in the state.

The principal reason that northern pickle factories buy North Carolina pickle cucumbers is to begin production and distribution of fresh-pack pickles before the harvest begins in the northern states. The increasing consumption of fresh-pack pickles in the United States,[26] in combination with North Carolina's relatively southern location, has created a northern market demand for the state's pickle cucumbers. North Carolina's location in the middle south, rather than in the deep south, is important in at least two ways for the existence of the northern market for the state's pickle cucumbers. First, transportation rates to the northern market are less than they would be from states to the south of North Carolina. Second, the time interval between the end of the North

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[26] Willis W. Stephenson, "The Pickle Industry and Its Financing" (n.d.), pp. 41-2.

Carolina harvest season and the beginning of the northern harvests is shorter than the interval between the end of the harvest season of states farther to the south and the beginning of the northern seasons. This permits more continuity in the fresh-pack operations of the northern factories once they have begun fresh-pack production using North Carolina cucumbers. The harvest season of pickle cucumbers begins in Maryland and Virginia about one or two weeks before the end of the harvest season in North Carolina. The western New York and Michigan harvest seasons begin 10 to 15 days after the end of the North Carolina harvest.

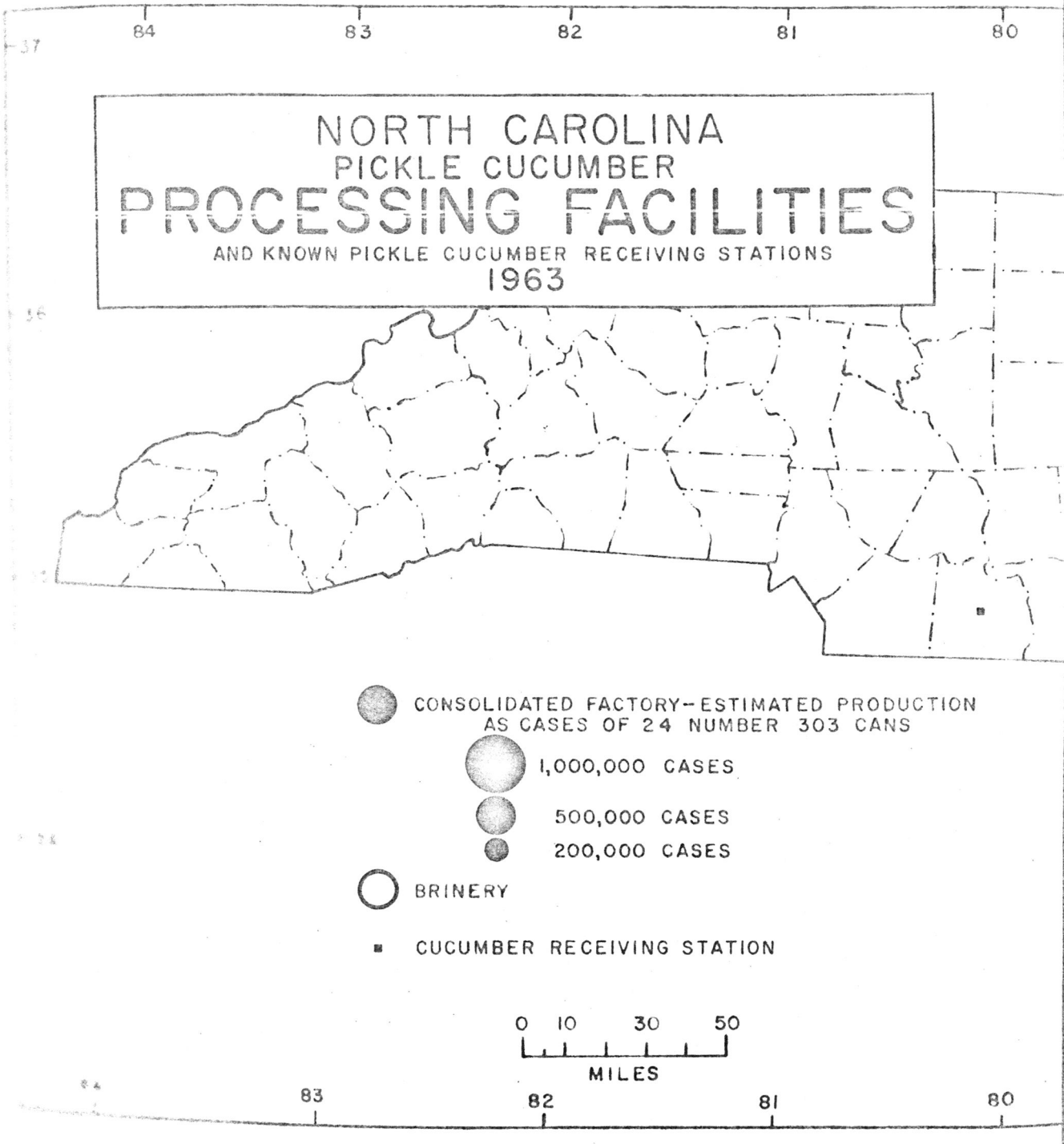
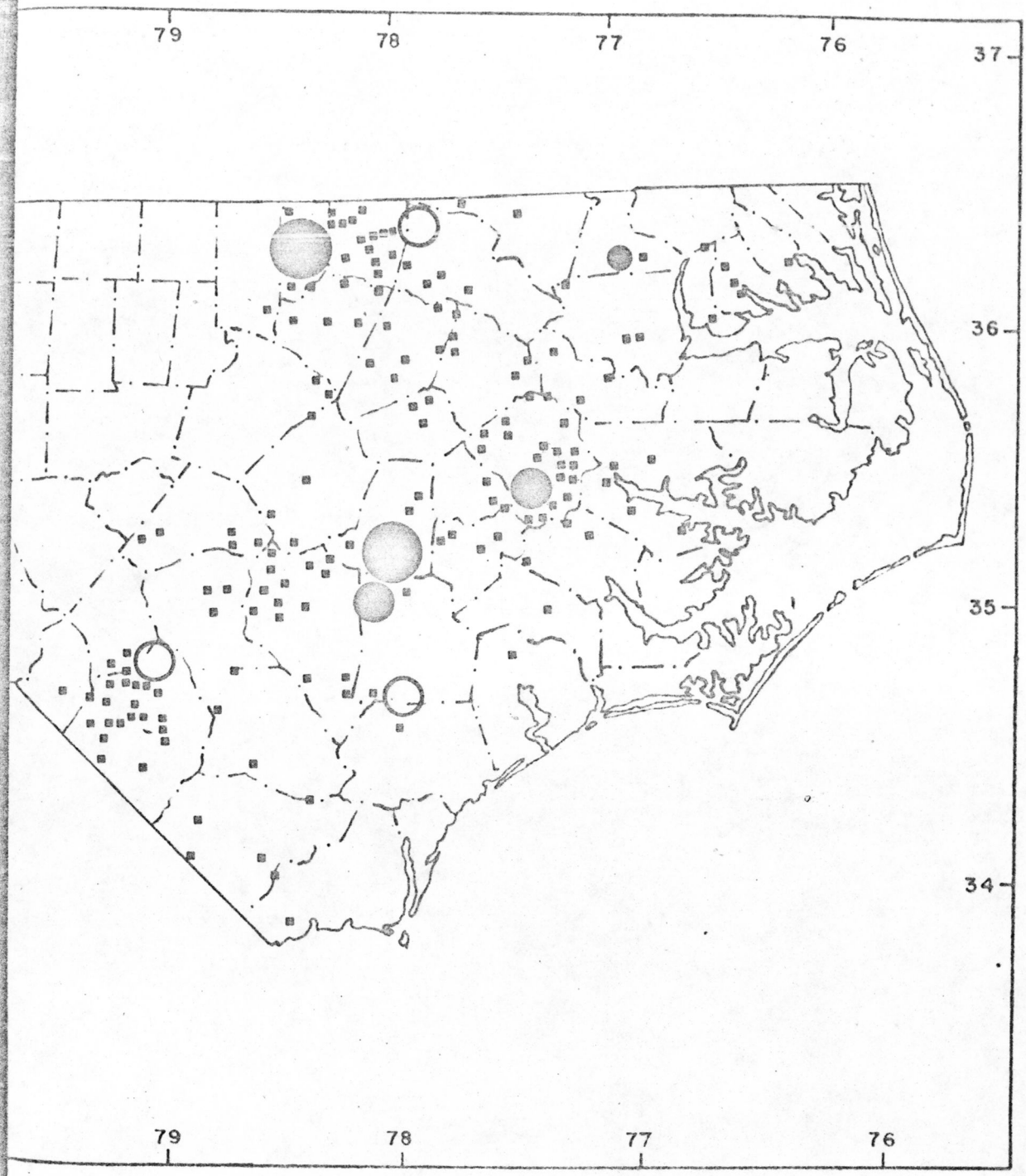


Figure 6. North Caroli
facilities and kn
stations.



a pickle cucumber processing

m pickle cucumber receiving

Testing the strength of the brine in the tanks is facilitated by "V" shaped troughs. The open sides of the troughs are placed against the side walls of the tanks, and brine can be drawn from any depth for testing. The cucumbers are held in the brine by round, wooden "heads" (Plate J). The heads are fitted inside the tanks and held in place by wooden crosspieces four inches square. A hole four inches square is cut in each tank head so that samples of the cucumbers can be removed for examination. This hole is covered with a wooden square held in place by one nail so that it can be revolved to uncover the hole. A wooden platform, elevated to within two or three feet below the tops of the tanks, gives access to all the tanks.

A salt storage building, called the "salt house", is an essential part of a brinery. The salt house is usually located close to a railroad siding to facilitate unloading the salt from boxcars and storing it in the salt house (Plate G). The salt is taken from the salt house to put on tanks in order to strengthen the brine (Plate H) or to make brine. Facilities for making brine of the desired strength are located adjacent to the salt house. The brine is pumped in a system of pipes to spigots distributed throughout the tank yard. Brine is placed in individual tanks with rubber hose attached to the spigots. A system of pipes furnishing fresh water to all parts of the tank yard is also a necessity. Ditches under the platform drain brine and water from the tank yard.

Cucumbers are brought to the brinery from the receiving stations on trucks (Plate I). The cucumbers that are put into the tanks to be brined are carried from the trucks to the tanks by various means. The

least mechanized method is used when the cucumbers are transported to the brinery in baskets and each basket is emptied individually into a tank. The baskets are moved from the edge of the platform to the tanks on flat push-trucks, on rollers, or on conveyer belts driven by electric motors. When the cucumbers are brought to the brinery in open-top, twenty-bushel wooden boxes, they can be carried and put in the tanks by fork-lift trucks that are adapted to hold the boxes while turning them upside down (Plate J). A more modern type of method of moving cucumbers is a conveyer system into which the cucumbers are dumped at the edge of the platform. The type of container in which the cucumbers arrive at the brinery does not affect these systems except for the size of the receptacle into which the cucumbers are dumped where the system originates. One variation of this type of system consists of a series of fast-moving conveyer belts. The cucumbers fall off the end of the belts into the tanks. Another variation of this type of system moves the cucumbers by the combined effects of gravity and flowing brine. The cucumbers are raised on a conveyer belt to a height of about 30 feet above the edge of the platform, and then they enter a trough into which brine is pumped (Plate K). The trough descends from its height where the cucumbers enter it to the level of the tanks where the cucumbers and brine flow out of it (Plate L). The brine and cucumbers move due to the force of gravity. However, the slope of the trough is not great enough to cause the cucumbers to move in it without the effect of the flowing brine. The brine is continuously pumped out of the tank and recirculated in the system until the tank is full of cucumbers.

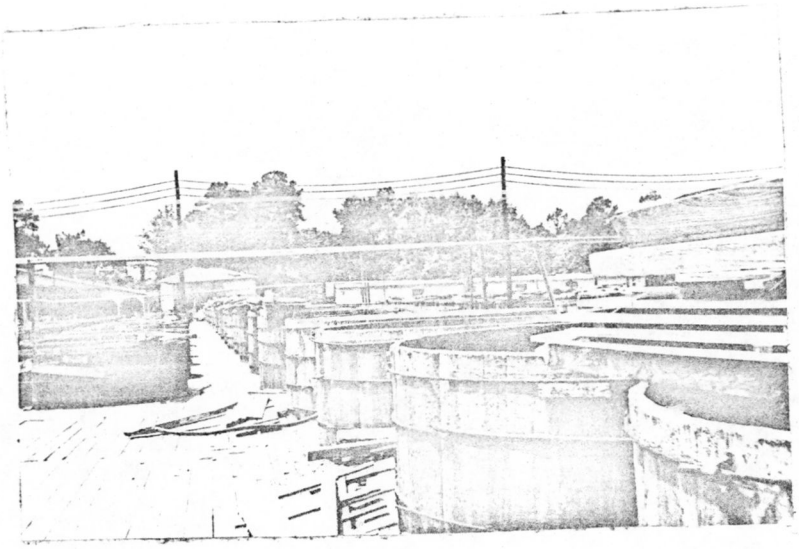


Plate E. Tanks and platform in the brinery at Mount Olive.

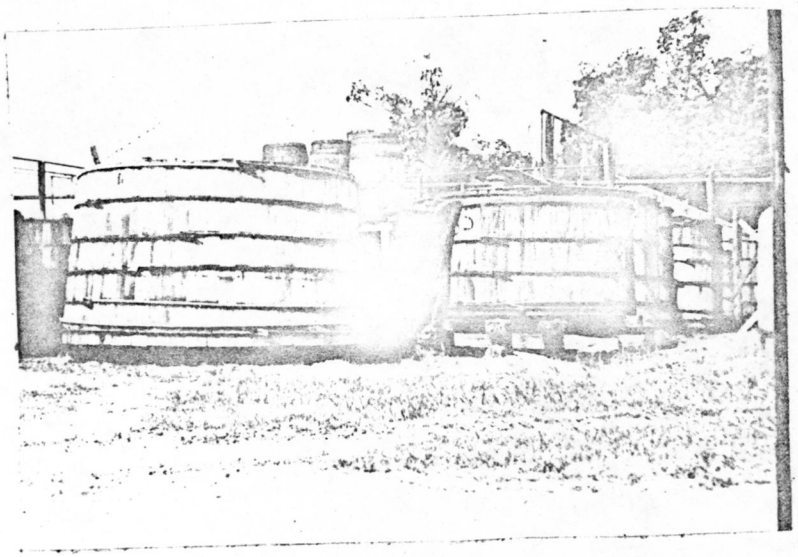


Plate F. Tanks in the brinery at Faison.

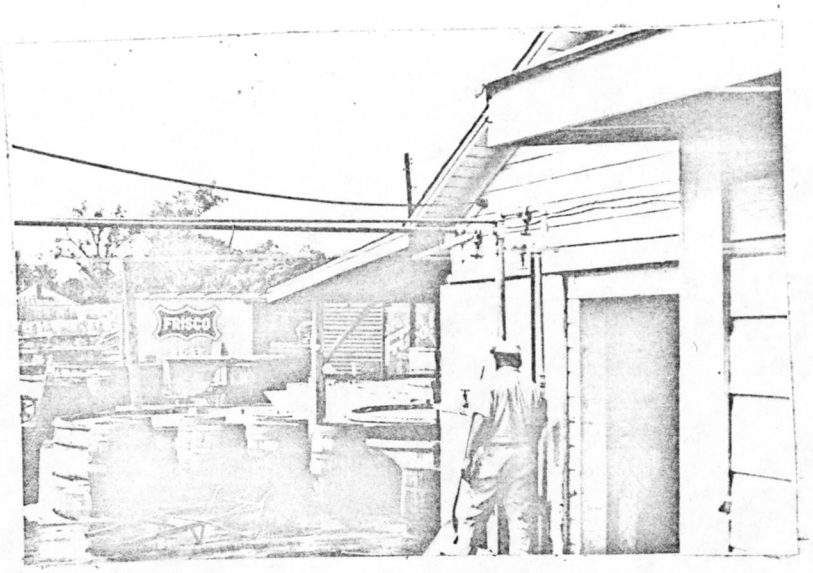


Plate G. Salt house, boxcar containing salt and tank for making brine (right foreground) at the Faison brinery.

Plate H. Adding salt to a tank to strengthen the brine (the covered tank is exceptional).

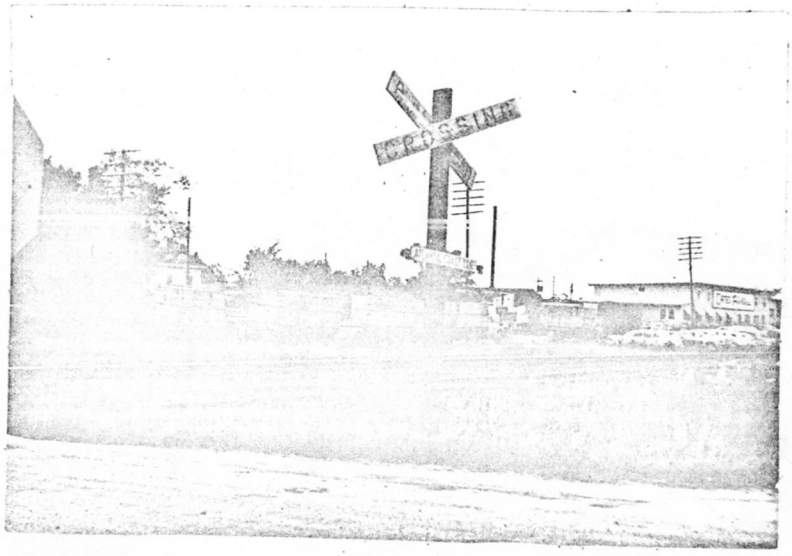


Plate I. Trucks delivering cucumbers in twenty-bushel boxes to the brinery-factory at Faison.

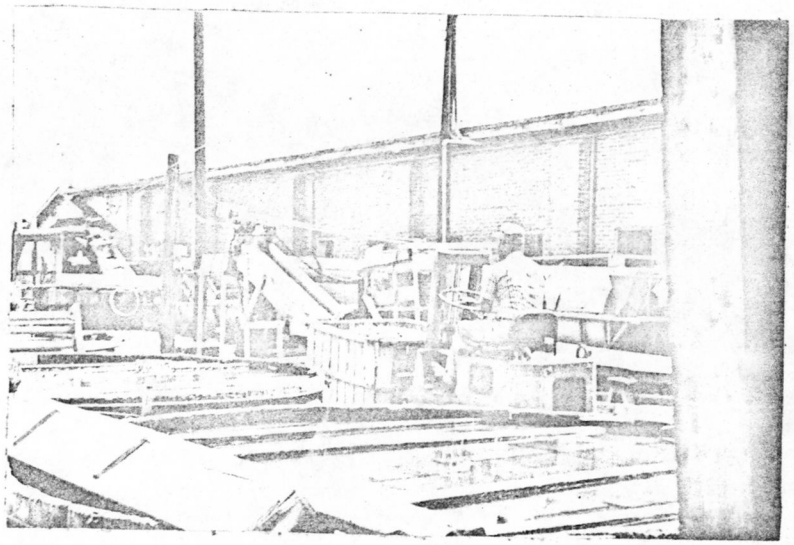


Plate J. Fork-lift truck carrying twenty-bushel box of cucumbers at the Mount Olive brinery-factory.

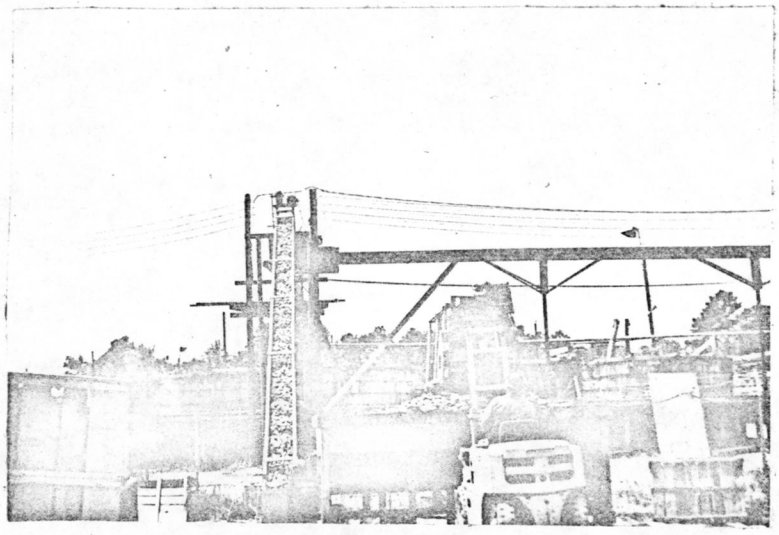


Plate K. Cucumbers being dumped into a hopper by a fork-lift truck and lifted by converyer belt to enter a trough in which they are carried by flowing brine and gravity at brinery at Mount Olive (See Plate L).

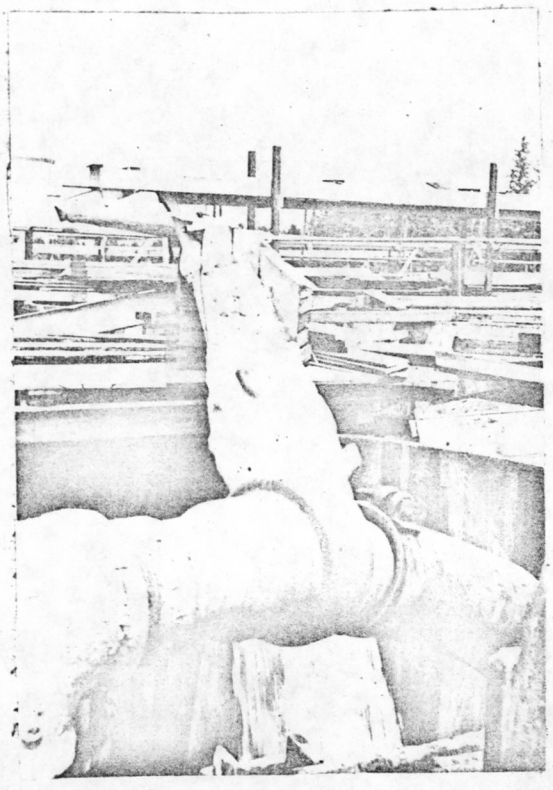


Plate L. Cucumbers and brine flowing out of a trough into a tank in the gravity-flowing brine method of transporting cucumbers in brinery at Mount Olive (See Plate K).

The cucumbers are removed from the tanks for processing any time after they have been cured. The old standard method of removing the cucumbers is by use of a string net fastened to an iron hoop on the end of a wooden pole. The net is used to dip the cucumbers out of the tanks. A more modern method of removing the cucumbers from the tanks is by use of an inclined conveyer belt. One end of the belt is lowred into the cucumbers and brine. Rubber or wooden slats attahced to the belt hold the cucumbers on the belt, which lifts the cucumbers out of the tanks. A bung in a hole in the side of the tanks near the base allows them to be drained. After the cucumbers have been removed and the brine has been drained, the tanks are filled with fresh water to prevent drying and warping of the tank slats.

Description and Activities of Pickle Packing Factories

Pickle packing factories produce the finished, consumer's pickle products. The activities of a pickle packing factory center on the packing room. Processed pickles pass from the processing room to the sweetening room where they are converted into sweet pickles before going to the packing room. Sour pickles and processed dill pickles are treated in other rooms before being carried to the packing room. Fresh cucumbers for fresh-pack pickles go to the packing room from the washing and bleaching room. The pickles are packed in the containers in the packing rooms by machines and by hand (Plate M). The containers are then filled with syrup, sealed, and labeled by machines as they are carried on a conveyer belt. Fresh-pack pickles are pasteurized in the packing room (Plate N). The containers are put in cardboard boxes before being sent to the warehouse.

The storage of the materials for pickle manufacture requires much space in the factory. The containers require the greatest amount of storage space. Caps or lids, labels, spices, vinegar, and sugar require smaller amounts of storage space. Vinegar is often stored in large metal tanks at the larger factories.

Storage of the finished pickles also requires large amounts of space. The trend of increasing consumption of fresh-pack pickles has increased storage space needed for finished pickles. Processed pickles are made from brine stock as needed. Therefore, they require less storage space then fresh-pack pickles that must all be packed during the cucumber harvest season. The cases of finished pickles are usually placed on pallets and moved in the warehouse with fork-lift trucks.

Most of the pickles manufactured in North Carolina are packed in glass containers. The standard sizes of jars are eight ounce, sixteen ounce (pint), thirty-two ounce (quart), and gallon. Pickles are packed in cans mainly for the United States Government. Very few pickles are packed in barrels in North Carolina because the temperatures of the region make spoilage of genuine dills probable.

B. SOURCES OF MATERIALS USED IN NORTH CAROLINA PICKLE FACTORIES AND BRINERIES

The principal materials used in consolidated pickle factories are cucumbers, vinegar, salt, containers and caps, sugar, spices, labels, and other fruits and vegetables. Water is used in large amounts by brineries and pickle factories. The Mount Olive consolidated pickle

Plate M. Women packing pickles in jars by hand in the packing room of the Faison factory.

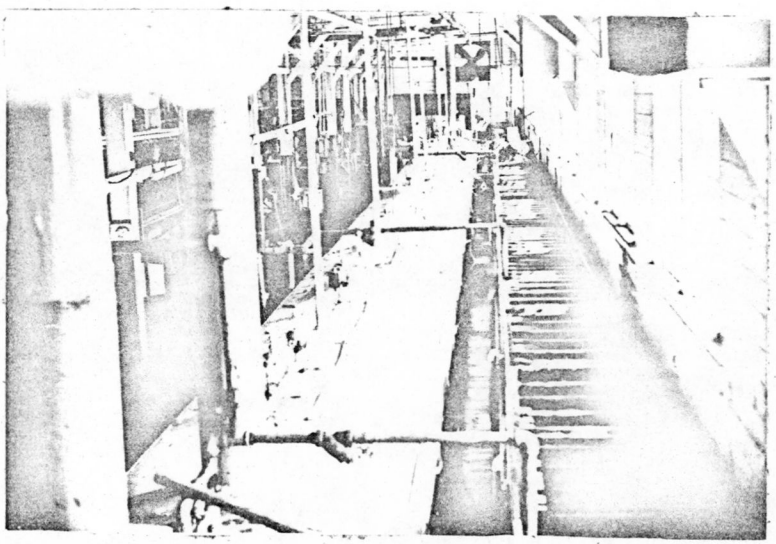


Plate N. The continuous pasteurizer in the packing room of the factory at Faison.

The glass containers are transported by trucks. Most of the hauling is done by the pickle companies' trucks when they return to the factories after making deliveries of pickles. The glass manufacturers pay the costs of transportation of the glass jars to the purchasers. The pickle company trucks earn money by hauling the glass as return loads to the pickle factories. The choice of where to buy glass containers is determined principally by the areas where pickles are sold and seldom by the criteria of proximity of the sources to the pickle factories. The glass manufacturers maintain warehouses in some cities through which their customers' trucks frequently pass, even though there is no glass factory there.

Caps for glass containers are obtained from Chicago. Baltimore is the source of cans for the pickle factories. Both caps and cans are transported by truck.

Sources of Sugar for the Pickle Factories

Refineries in Savannah and Baltimore are the principal sources of the sugar used in the North Carolina pickle factories. The ports of Norfolk and Charleston are also important suppliers of sugar, but they have been less important as sources of sugar since imports from Cuba ceased. The state of Louisiana was an important supplier of sugar during the first half of 1964 because of low prices due to a surplus of sugar there. However, the refinery at Savannah normally controls sugar prices in North Carolina, and the Baltimore refinery adjusts its net price (price plus freight) to equal the Savannah net price.

Sources of Spices for the Pickle Factories

The North Carolina pickle factories obtain most of their spices from merchants in Baltimore, New York City, and Chicago. Some of the spices commonly used are celery seeds, mustard seeds, mixed pickle seed, oil of dill, oil of cloves, garlic chips, alum, and tumeric.

Sources of Chemicals for the Pickle Factories

New York City firms are the principal sources of chemicals, which are used in pickle manufacture principally as preservatives. Polysorbate 80 and sodium benzoate are two commonly used chemicals.

Sources of Labels for the Pickle Factories

The preprinted labels that are glued on pickle jars come from many sources. The states of North Carolina, Virginia, and Rhode Island furnish labels to North Carolina pickle factories.

Sources of Peppers, Onions, Cauliflowers, and other Fruits and Vegetables for the Pickle Factories

Fruits and vegetables other than cucumbers are used in North Carolina pickle factories in much smaller quantities than cucumbers. Peppers are normally obtained from farmers in the vicinities of the pickle factories. Small onions are imported from the Netherlands through the port of Baltimore. Cauliflower is brought to North Carolina from Long Island, New York and New Jersey. Other items, such as large onions, carrots, and cabbages are normally obtained from wholesale grocers in the vicinities of the pickle factories.

Special Capital Goods (Food Machinery and Tanks) Used by the Brineries and Pickle Factories

Baltimore, New York, and Chicago are important sources of food

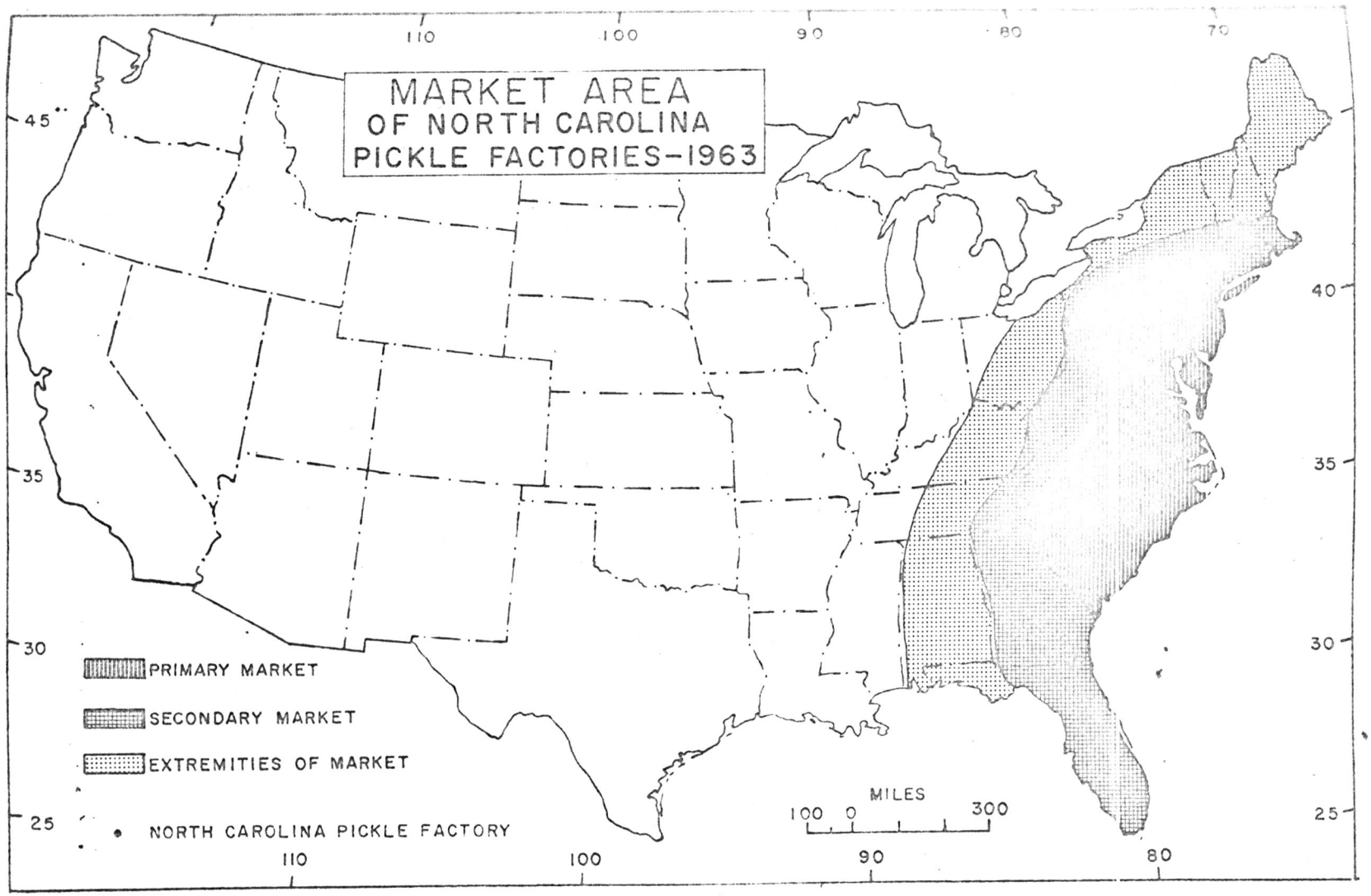


Figure 7: Market Area of North Carolina Pickle Factories, 1963.
(Source: Personal Interviews).

five per cent of the North Carolina pickle production. Most of the pickles sold to the United States are used by the armed forces. The government purchases pickles by receiving bids on publicized contracts or by placing orders directly. The pickles purchased by the government are shipped to warehouses in all sections of the United States.

A principle of economic geography is that most of any product produced in a place will be consumed relatively close to that place. This principle holds true of the pickle production of North Carolina. However, the area of most concentrated sales extends farther to the north than to the south of North Carolina. This north-south assymetry is caused by two factors. First, there is a much greater population to the north than to the south of North Carolina, especially in the densely populated northeastern portion of the United States. This population constitutes a greater potential or realized market for North Carolina pickles than exists to the south of the state. The second reason for the more northerly extension of the market area is a historical one. Two of the North Carolina pickle factories were relocated in North Carolina from Pennsylvania and New York within the past 12 years, and three of them were relocated in the state from New York and Pennsylvania within the past 20 years. In accordance with the previously mentioned principle of economic geography, the major market areas of these factories before their relocations were in the northern areas where the factories were located. These companies have retained the major markets in the north that they served before the relocation of their factories in North Carolina. The bulk of the sales of North Carolina pickles are between the

E. CONSUMPTION OF PICKLES

Approximately four and one-tenth pounds of pickles per capita were consumed in the United States in 1961.[3] A consumer survey conducted in 1962 showed that pickles were served daily in 30.7 per cent of the homes in the sample in the South, 17 per cent in the Northeast, and 21.6 per cent in the entire United States. Pickles were served at least once a week in 83 per cent of the homes in the South, 82.1 per cent in the Northeast, and 77.4 per cent in the United States as a whole.[4]

A survey of grocery chain stores showed that the percentage of pickle sales to the total store sales in the South (.41 per cent) is greater than in the mid-Atlantic states (.25 per cent) or in New England (.29 per cent). Only in the Mid-west (.43 per cent) were pickle sales a larger percentage of the total sales than in the south.[5]

The two studies cited above suggest that more pickles are consumed per capita in the South than in the United States as a whole. The Northeast consumption per capita seems to be approximately equal to, or slightly less than, the national average.

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[3] United States Department of Agriculture, Agricultural Statistics (1963), p. 306.

[4] Owens-Illinois Glass Company, A Consumer Survey on Pickles (n.d.), p. 15.

[5] "Pickles and Olives: Sales Performance", Chain Store Age (Mid-July, 1962).

F. LOCATION FACTORS OF THE NORTH CAROLINA PICKLE PROCESSING INDUSTRY

The importance of the North Carolina pickle industry is due to the favorable location of eastern North Carolina in regard to raw materials and markets. The labor factor adds to the favorableness of North Carolina as a pickle industry location.

Pickle Cucumbers as a Location Factor of the Pickle Industry

The large production of pickle cucumbers in North Carolina is the primary reason for the location of the present pickle industry in the state. Cucumbers are the biggest single cost item in the production of cucumber pickles. The perishable nature is an influence towards location of pickle processing facilities in the growing regions. The large labor requirement of the pickle cucumber harvest has restricted large scale cucumber production to relatively few areas. (Figure 8).

Markets as a Location Factor of the Pickle Industry

The second major reason for the location of North Carolina's pickle industry is the location of the state's pickle cucumber producing region in relative proximity to the heavily populated northeastern United States and, yet, within the southeastern United States. Thus, two market areas are accessible from the North Carolina location. The primary market area of the state's pickle factories extends from the southeastern states to the northeastern states.

Labor as a Location Factor of the Pickle Industry

Labor conditions and labor costs are unimportant location factors of the North Carolina pickle industry in comparison to the cucumber and market factors. Nevertheless, North Carolina has a labor advantage for

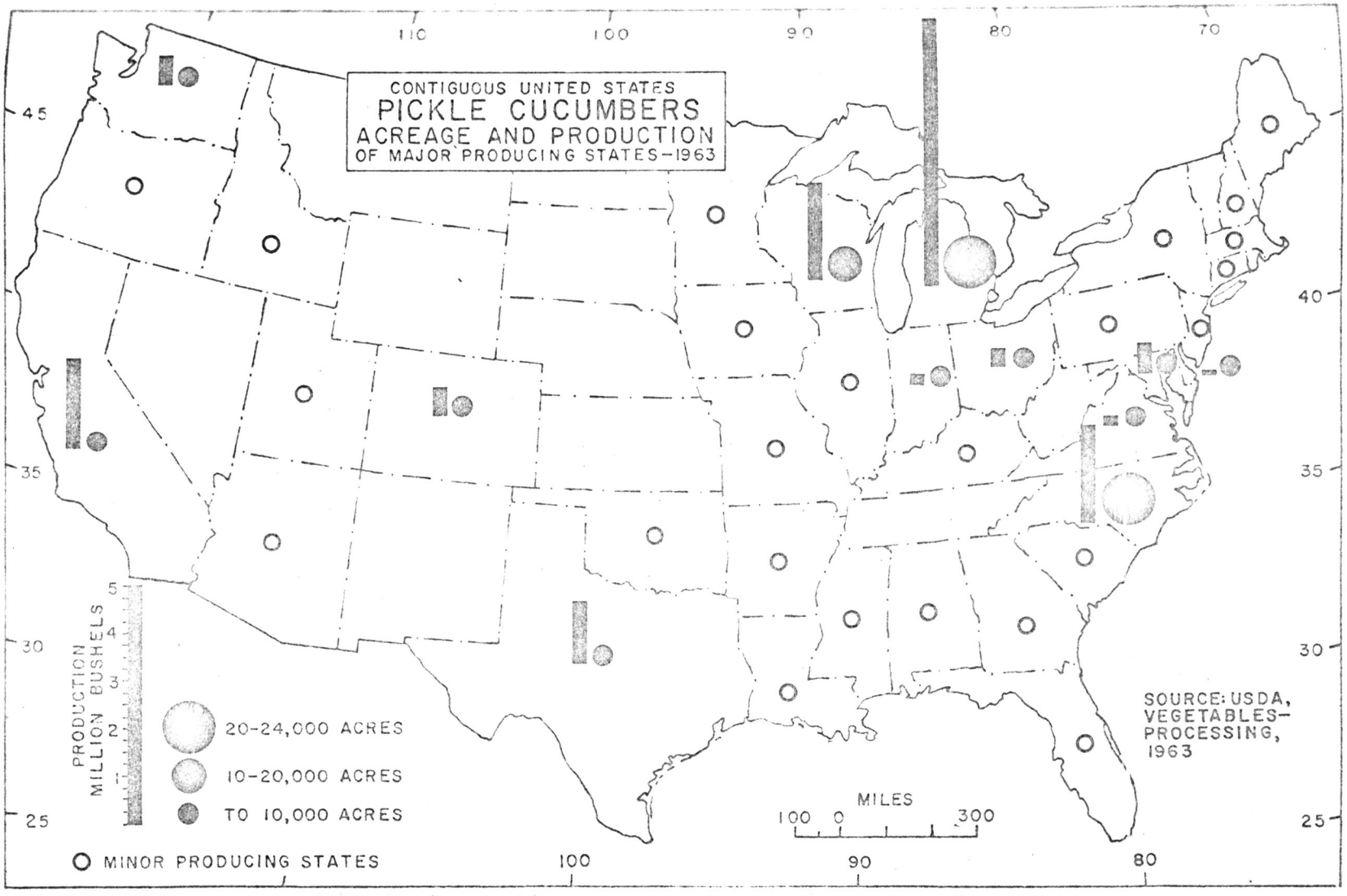

Figure 8. Contiguous United States Pickle Cucumbers, Acreage and Production of Major Producing States, 1963.

pickle factories in comparsion to areas outside the South. First, most of the labor used in pickle factories is unskilled labor, which is abundant in North Carolina. Second, lower wage rates are paid in pickle factories and brineries in the South than in other sections of the country. The sectional averages of the average wage rates of 19 job categories in brineries and pickle factories are as follows: South, 1.53 dollars per hour; Northeast, 1.69 dollars per hour; North Central, 1.72 dollars per hour; and West, 2.05 dollars per hour.[6]

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[6] Pickle Packers International, "Summary of Wage Reports ....Spring, 1964" (1964).

CHAPTER IV

CONCLUSIONS

A. EVALUATION OF NORTH CAROLINA AS A LOCATION FOR THE PRODUCTION OF PICKLE CUCUMBERS

Eastern North Carolina is a good location for the production of pickle cucumbers because of a favorable climate, favorable soils, established markets, and an agricultural economy in which pickle cucumbers find a definite, if minor, role.

Climate of North Carolina as a Location Factor for Pickle Cucumbers

Cucumbers are well adapted to the climatic conditions of the North Carolina frost-free season. In the North Carolina pickle cucumber producing region drought occurs most often in the northern area of production, but the production of the entire region can be lowered by drought. Extremely high temperatures sometimes result in cucumbers having an undesirable whitish color, while abnormally cool weather can reduce yields during the early part of the harvest season. Temperature conditions alone do not, however, cause lowered productions for entire seasons. The cooler temperatures of the mountain region have been a major limitation on cucumber production in that region by providing conditons favorable for the cucumber disease scab.

Soils as a Location Factor for Pickle Cucumbers

Sandy loam soils, on which cucumbers generally grow best in North Carolina, are extensive in the eastern part of the state. However, none of the soil associations of the western piedmont or mountain regions

predominately sandy loam soils. The areas of soils most unfavorable for cucumbers in eastern North Carolina are those of sandy soils and areas of muck soils. These soils occur principally in the coastal areas and in the sandhills section. Crop failure of cucumbers planted on sandy soils is expected in case of drought. Muck soils are suceptible to frosts at a later date than the lighter (coarser textured) soils, which warm up more quickly in the spring and permit earlier planting dates.

Market Conditions as a Location Factor for North Carolina Pickle Cucumber Production

The strong market for North Carolina pickle cucumbers is an essential element in the favorableness of the state for the production of this crop. The five North Carolina factories manufacturing finished pickles provide the solid foundation of the market for the state's production of pickle cucumbers. Further, pickle factories in states to the north of North Carolina constitute a well-established market for a significant portion of the state's pickle cucumber production. The out-of-state market for North Carolina's pickle cucumbers is based on the state's relatively early harvest season and the desire of the northern manufacturers to begin production of fresh-pack pickles before their local cucumber harvests begin. The transportation rates for cucumbers from North Carolina to the northern factories are not excessive because of the relative proximity of the state to the northern factories. The pickle factories in the northern states have little or no interruption in their fresh-pack operations between the end of the North Carolina cucumber season and the beginning of the northern harvest seasons.

The Agricultural Economy of North Carolina as a Location Factor for Pickle Cucumber Production

The harvest labor is the most critical factor in the production of pickle cucumbers. The labor available in eastern North Carolina is an element of fundamental importance in making that region a favorable location for the production of pickle cucumbers. The predominance of flue-cured tobacco in the agricultural economy of eastern North Carolina is the basic factor in the existence of the farm labor available in the region. The high income yielding tobacco crop, which also has a large harvest labor requirement, supports the large rural population that supplies the necessary labor for the pickle cucumber harvest. The rural labor force of eastern North Carolina can harvest the cucumber crop because there is relatively little work to do on the more important crops during the period of the pickle cucumber harvest. The pickle cucumber crop attracts many eastern North Carolina farmers because it is a source of supplementary income in the early summer before the major income-providing crops of the region are marketed.

The characteristics of the agricultural economy of eastern North Carolina that make the region a favorable location for the production of pickle cucumbers also have unfavorable influences on their production. The unimportant status of pickle cucumbers in the agricultural economy of North Carolina results in lower yields than would be possible if they were grown with the care given the more important crops. Cucumber fields that are still producing are sometimes abandoned if the tobacco harvest begins before the end of the cucumber yielding season. The low yields in North Carolina are illustrated by the fact that the state had

about one-third more acres of pickle cucumbers than Wisconsin in 1963, but the Wisconsin production was slightly greater than the North Carolina production.

B. EVALUATION OF NORTH CAROLINA AS A LOCATION FOR THE PICKLE INDUSTRY

North Carolina is an exceptionally good location for the pickle industry in regard to sources of materials because of the state's large pickle cucumber production. A populous market area, mainly in the Atlantic coastal states, and relatively low labor costs combine with the state's pickle cucumber production to make North Carolina one of the most favorable locations for the pickle industry among the Atlantic coastal states.

Evaluation of North Carolina as a Location for the Pickle Industry in Regard to Sources of Materials

The procurement of pickle cucumbers is the most critical material acquisition task of the pickle industry. Cucumbers are the only material that is important to the pickle industry as a location factor because of the large quantities of them that are needed, their perishable nature, and the limitation of their production by their large harvest labor requirement. The large pickle cucumber production of North Carolina is, therefore, a factor giving the state an advantage in regard to sources of materials as a location for the pickle industry. The relatively low production per grower of pickle cucumbers in North Carolina makes their acquisition more costly than in areas of more concentrated production. However, the low yield in North Carolina reduces little the location

advantage for the pickle industry that the large pickle cucumber production gives the state.

Evaluation of North Carolina as a Location for the Pickle Industry in Regard to Labor Conditions

Adequate labor is available in North Carolina for the pickle industry. Brineries and pickle factories require mostly unskilled labor, which is abundant in North Carolina. The average wage rates in pickle factories and brineries in the southern states are lower than in other parts of the United States. North Carolina probably has, therefore, a relative advantage over areas outside of the southern states in regard to labor costs for the pickle industry.

Evaluation of North Carolina as a Location for the Pickle Industry in Regard to Markets

North Carolina does not have any metropolitain area so large that it could serve as the sole market for the pickle production of the state. North Carolina pickle factories are at a definite disadvantage to pickle factories in the populous northeastern United States in regard to that market area, because of the greater transportation costs that must be paid by the North Carolina factories to send pickles into that market. However, eastern North Carolina is within 500 to 650 miles of most or all of the northeastern area of dense population. Raleigh, for example, is approximately 490 miles from New York City. Good highways connect North Carolina with northeastern states. The location of North Carolina allows marketing of pickles from the state in the northeastern United States. This is definitely shown by the extension of the primary market area of the North Carolina pickle factories to New York.

The North Carolina location of pickle factories permits marketing of pickles in a large part of the southeastern United States as well as in the Northeast. Raleigh is about 500 miles from Jacksonville, Florida, 425 miles from Atlanta, and 450 miles from Chattanooga. North Carolina can be considered, therefore, as having a compromise location for the pickle industry in regard to markets. The state is not ideally located to serve the northeastern market, but it is well located to sell its pickles in both the southeastern and the northeastern United States. The advantages of North Carolina as a location for the pickle industry in regard to markets will increase, therefore, as highway facilities are improved.

C. PROBLEM OF THE LARGE LABOR REQUIREMENT OF THE PICKLE CUCUMBER HARVEST

The harvest labor requirement of pickle cucumbers is the most important problem of the pickle industry today.[1] The big labor requirement of the pickle cucumber harvest limits the acreage of cucumbers grown and makes the assembly of the cucumbers expensive for the pickle industry of North Carolina. The problem of the big labor requirement of the cucumber harvest has different significances for the agricultural economy and for the pickle industry. Pickle cucumbers provided only .2 per cent of the North Carolina farm marketing income in 1962,[2] while they are the

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1 W. R. Moore, Secretary-Treasurer, Pickle Packers International, Personal Communication (July 7, 1964).

2 Computed from: United States Department of Agriculture-North Carolina Department of Agriculture, North Carolina Agricultural Statistics (1963), cover; and United States Department of Agriculture, Vegetables-Processing (1963), p. 21.

primary material used in the pickle industry.

The harvest labor requirement of cucumbers has prevented individual farmers from growing acreages large enough to be economically significant because the labor necessary for harvesting larger acreages has not been available. Yields from pickle cucumbers are not as high as possible because their relative lack of importance for the growers results in them giving the cucumbers less care than the more important crops. The production of pickle cucumbers per grower is low because of the small acreage per grower and the low yield per acre.

The low volume of production of pickle cucumbers per grower results in high costs for the assembly of the cucumbers by the pickle industry.

> The cost of assembling the raw products necessary to support the operation of a processing plant is influenced by the density and volume of production. Low raw product assembly costs are usually associated with high density and large volume per production unit. Low density can be partially offset by large volume producers and, in some cases, small volume producers can be partially offset by high density.[3]

The big harvest labor requirement of pickle cucumbers is, therefore, an important problem of the North Carolina pickle industry because of the resulting high costs of assembling the cucumbers. The small volume of production per grower of pickle cucumbers in North Carolina is partially offset by the relatively high density of growers in the areas of the greatest concentrations of production, especially in Pitt, Robeson, Sampson, and Warren Counties.

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[3] T. Everette Nichols, Jr., "Plant Requirements", Tarheel Farm Economist (July, 1964), p. 3.

The small acreages and low productions per grower of pickle cucumbers cause high assembling costs for the pickle industry by necessitating a great number of receiving stations distributed over a wide area. The collecting stations are less efficient (have higher costs) than they would be if each one handled a greater volume of cucumbers. The wide distribution of the receiving stations causes greater costs for transporting the cucumbers from them to the brineries and factories.

The harvest labor problem of pickle cucumbers in North Carolina could be ameliorated by some method of providing the necessary labor for concentrated production or by some way of reducing the labor requirement by mechinization of the harvest in order to permit concentrated production with less labor. The necessary labor for a high density of growers with a high volume production of pickle cucumbers could be provided by the migrant farm laborers who migrate yearly from Florida to the northern states. This practice has begun in Perquimans County.

A mechanical harvester that permits reasonable yields would be the definitive solution to the problem of obtaining maximum concentration of production of pickle cucumbers. Intensive work is being done on the development of a mechnaical harvester for pickle cucumbers (Plate 0). The North Carolina Pickle Producers Association is promoting research in North Carolina on mechanization of the cucumber harvest. Continuation and intensification of developmental work on a mechanical harvester is recommended as the best approach to a solution for the pickle cucumber harvest labor problem.

Harvesting aids for pickle cucumbers provide a semi-mechanized

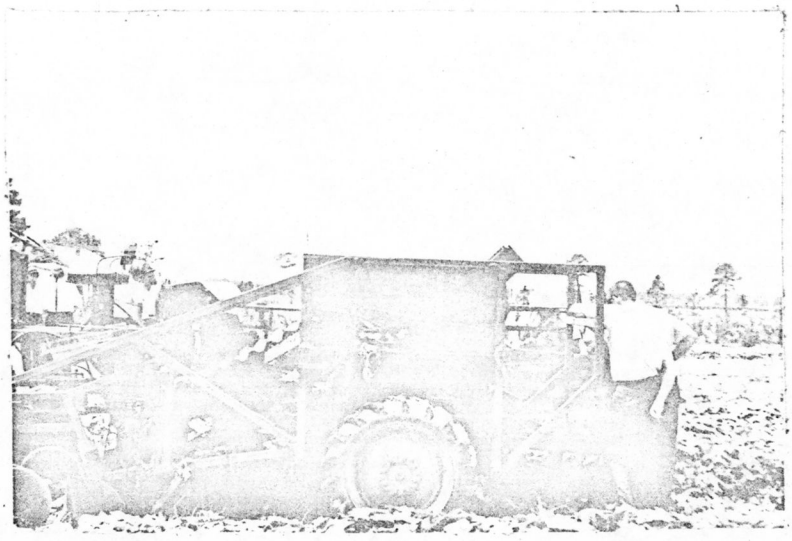

Plate O. Experimental mechanical harvester (of the Food Machinery Corporation) for pickle cucumbers during trial at Faison in June, 1964.

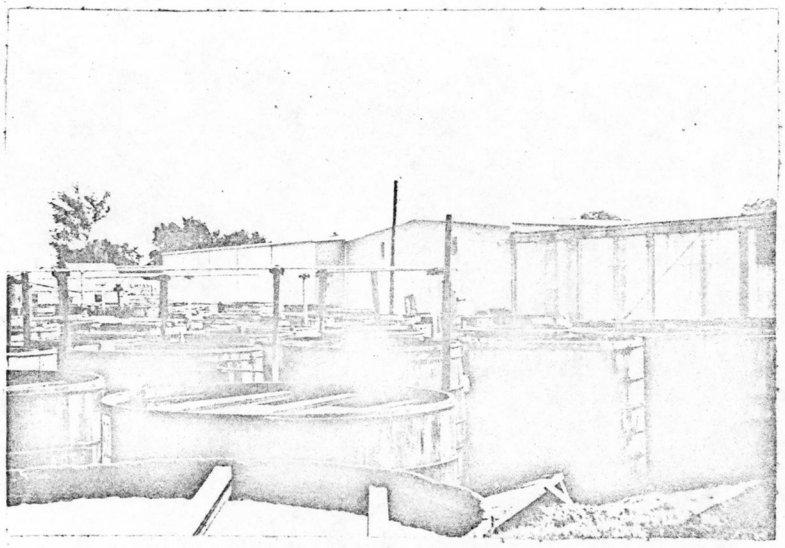

Plate P. Growth of the North Carolina pickle industry symbolized by expanding warehouse facilities at the Faison factory.

method of reducing the needed harvest labor of pickle cucumbers by increasing the efficiency of the labor. An increase in volume of production per grower and a greater density of growers can be realized by the use of harvesting aids. The use of harvesting aids in pickle cucumbers is recommended in areas where the necessary hired labor is available. Harvesting cucumbers with the use of harvesting aids have begun principally in the eastern area of production in North Carolina, especially in Pitt County. Pickle cucumber harvesting aids are manufactured in Bethel in Pitt County.

D. TRENDS AND PROSPECTS

Growth is the most noticable trend in the North Carolina pickle and pickle cucumber production (Plate P). The state's recent growth in pickle manufacture has been due to both factory relocations to within North Carolina and increasing volumes of business done by the North Carolina pickle companies. The increase in the volume of business is due to the favorable location of North Carolina for the pickle industry as well as the increasing consumption of pickles in the United States. The growth of the pickle cucumber production of North Carolina is based on increased markets for the cucumbers, increased acreages, and increased yields per acre. All evidence indicates a continued increase in production of pickle cucumbers and in the volume of pickles manufactured in North Carolina.

The production of pickle cucumbers in North Carolina will become more and more concentrated in the areas of the state that are most favorable for them. The acreage of cucumbers in many counties is

in North Carolina that can be confidently predicted is an increased demand for North Carolina pickle cucumbers. The threat to the Michigan harvest labor supply has stimulated more intensive work on the development of a mechanical harvester for pickle cucumbers. The development of such a machine could be the most important ultimate effect of the Michigan harvest labor problem on the North Carolina production of pickle cucumbers.

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APPENDICES

APPENDIX A

ACRES, PRODUCTION, VALUE, AND YIELD OF NORTH CAROLINA PICKLE CUCUMBERS, 1929 - 1963

Year	ACRES HARV.	PROD. 1000 BU.	VALUE $1000	YIELD BU. PER ACRE
1929	500	75	56	150
1930	500	88	60	175
1931	1200	180	90	150
1932	1300	120	62	92
1933	1600	184	70	115
1934	2500	195	127	78
1935	3200	272	204	85
1936	3200	272	190	85
1937	5670	425	251	75
1938	4700	338	220	72
1939	4100	295	206	72
1940	5130	487	258	95
1941	7140	643	347	90
1942	6900	483	362	70
1943	5200	411	329	79
1944	7800	647	589	83
1945	5000	425	438	85
1946	6100	809	474	67
1947	7400	644	1030	86
1948	6800	490	907	133
1949	9800	902	1308	92
1950	9500	874	1156	92
1951	12000	1032	1290	86
1952	11700	878	1229	75
1953	15300	1329	1794	87
1954	16000	1040	1404	65
1955	13200	1280	1536	97
1956	11000	880	968	80
1957	16300	1222	1344	75
1958	18800	1654	1985	88
1959	14800	1228	1474	83
1960	14600	1402	1472	96
1961	14500	1218	1401	84
1962	17200	1972	2403	115
1963	20400	2042	2622	100

Sources: United States Department of Agriculture, Agriculture Statistics(1944-1958). United States Department of Agriculture, Vegetables-Processing(1963); and United States Department of Agriculture-North Carolina Department of Agriculture, North Carolina Agricultural Statistics(1946 and 1963).

APPENDIX B

UNITED STATES ACREAGE, PRODUCTION, VALUE, AND YIELD OF PICKLE CUCUMBERS OF MAJOR PRODUCING STATES, 1963

STATE	ACRES	PRODUCTION 1000 BU.	VALUE $1000	YIELD BU. PER ACRE
Michigan	23900	5676	7329	238
North Carolina	20400	2042	2622	100
Wisconsin	15000	2063	3020	138
Texas	5900	1364	1624	231
California	3800	1979	2864	521
Virginia	3000	225	345	75
Maryland	2900	684	778	236
Ohio	1900	443	781	234
Colorado	1700	655	817	386
Washington	1500	441	628	294
Indiana	1000	254	262	254
Delaware	600	126	157	211
Other states	29360	3768	5662	129
Total United States	110960	19720	26899	177

Source: United States Department of Agriculture, Vegetables-Processing (1963).

APPENDIX C

NORTH CAROLINA PICKLE CUCUMBER ACREAGE BY PRODUCING AREA AND COUNTY, 1963

AREA AND COUNTY	ACRES
NORTHERN AREA	
Warren County	3,000
Nash County	950
Halifax County	600
Franklin County	400
Wake County	400
Vance County	325
Wilson County	300
Northern Edgecombe County	225
Northampton County	75
Granville County	60
AREA TOTAL	6,335
EASTERN AREA	
Pitt County	2,300
Martin County	600
Bertie County	350
Beaufort County	300
Greene County	300
Perquimans County	300
Craven County	250
Southern Edgecombe County	225
Lenior County	200
Washington County	75
Chowan County	60
Hyde County	57
Pamlico County	50
Pasquotank County	50
Jones County	50
Gates County	45
Hertford County	10
Onslow County	8
AREA TOTAL	5,230

APPENDIX C (Continued)

AREA AND COUNTY	ACRES
CENTRAL AREA	
Sampson County	3,000
Harnett County	600
Cumberland County	400
Duplin County	325
Wayne County	245
Johnston County	160
Pender County	75
Moore County	50
AREA TOTAL	4,855
SOUTHERN AREA	
Roberson County	3,000
Bladen County	312
Brunswick County	175
Anson County	155
Columbus County	135
Scotland County	100
Hoke County	100
AREA TOTAL	3,977
NORTH CAROLINA TOTAL	20,397

Based on estimates by county agricultural agents.

Donald Brooks Cates. THE PICKLE INDUSTRY OF NORTH CAROLINA. (Under the direction of Dr. Andrew D. Perejda) Department of Geography, August, 1963.

The purpose of this study is to provide a geographic description of the North Carolina pickle industry and pickle cucumber production and to determine the location factors of these activities. Further objectives are to evaluate North Carolina as a location for the pickle industry and pickle cucumber production, to determine the problems of these segments of the economy of the state, and to suggest solutions for these problems.

North Carolina ranked second in the United States in the acreage of pickle cucumbers and third in their production in 1963. The state also has an important pickle industry. The basic location factors of the pickle cucumber production in North Carolina are the favorable climatic conditions and soils, the ability to fulfill the large harvest labor requirement of the crop due to the dense rural-farm population in the tobacco-growing region of the eastern part of the state, and the strong market for the cucumbers in the form of the pickle factories of the state and of other states.

The pickle manufacturing industry of North Carolina exists basically because of the ability of the state to produce pickle cucumbers and the favorable location of the state, which enables the marketing of pickles in the populous northeastern United States as well as in the South. North Carolina is a favorable location for the pickle industry because of the production of pickle cucumbers in the state and the proximity of large populations constituting big markets. North Carolina is a favorable

location for the production of pickle cucumbers because of the favorable natural conditions, a farm economy in which pickle cucumbers find a definite role, and the big demand for the pickle cucumbers produced in the state.

The principal problem in the pickle industry and in the production of pickle cucumbers in North Carolina is the large harvest labor requirement of the pickle cucumbers, which results in low yield for the farmers and high cost of cucumber procurement for the pickle companies. The use of migrant labor and harvesting aids and the undertaking of developmental work on a mechanical harvester are suggested as ways of ameliorating or solving the problem of the harvest labor requirement.